Date Distributed:



THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS

NATIONAL BOARD INSPECTION CODE SUBGROUP REPAIRS & ALTERATIONS

AGENDA

Meeting of January 14th, 2025 Charleston, SC

The National Board of Boiler & Pressure Vessel Inspectors 1055 Crupper Avenue Columbus, Ohio 43229-1183 Phone: (614)888-8320 FAX: (614)847-1828

1. Call to Order

The Chair will call the meeting to order at 8:00 a.m. Eastern Time. For those attending in person, the meeting will be held in Grand Magnolia B on the second floor of the hotel.

2. Roll call of Members and Introduction of Visitors

3. Check for a Quorum

4. Announcements

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- This meeting marks the end of Cycle A for the 2027 NBIC edition.
- The National Board will be hosting a reception on Wednesday evening from 5:30 p.m. to 7:30 p.m. at the Hyatt Place rooftop bar, the Pour Taproom.
- The National Board will be hosting breakfast and lunch on Thursday for those attending the Main Committee meeting. Breakfast will be served from 7:00 a.m. to 8:00 a.m. in Grand Magnolia Foyer, and lunch will be served from 11:30 a.m. to 12:30 p.m. in Sterling Hall Foyer.
- Meeting schedules, meeting room layouts, and other helpful information can be found on the National Board website under the NBIC tab → NBIC Meeting Information.
- The NBIC Committee has transitioned from NB File Share to SharePoint. Remember to add any attachments that you'd like to show during the meeting (proposals, reference documents, powerpoints, etc.) to the NBIC SharePoint site (nationalboard.sharepoint.com/sites/NBIC) **prior to the meeting**.
 - Note that access to the NBIC SharePoint site is limited to <u>committee members only</u>.
 - ALL powerpoint attachments/presentations <u>must be sent to the NBIC Secretary for</u> <u>approval prior to the meeting</u>.
 - Contact Jonathan Ellis (*nbicsecretary@nbbi.org*) for any questions regarding NBIC SharePoint access.
- When possible, please submit proposals in Word format showing "strike through/underline." Project Managers: please ensure any proposals containing text from previous NBIC editions are updated with text from the most current edition.
- If you'd like to request a new Interpretation or Action item, do so on the National Board Business Center.
 - Anyone, member or not, can request a new item.
 - As a reminder, anyone who would like to become a member of a group or committee:
 - Should attend at least two meetings prior to being put on the agenda for membership consideration. The nominee will be on the agenda for voting during their third meeting.
 - The nominee must submit the formal request along with their resume to the NBIC Secretary **PRIOR TO** the meeting. *nbicsecretary@nbbi.org*
 - \circ $\,$ If needed, we can also create a ballot for voting on a new member between meetings.
- Thank you to everyone who registered online for this meeting. The online registration is very helpful for planning our reception, meals, room setup, etc. It is also a good way to make sure we have the most up-to-date contact information. Please continue to use the online registration for each meeting.

5. Awards and Special Recognitions

6. Adoption of the Agenda

7. Approval of the Minutes of the July 16, 2024, Meeting

The minutes are available for review on the National Board website, <u>www.nationalboard.org</u>.

8. Review of Rosters (Attachment Page 1)

a. Membership Nominations

Mr. Lane Baker is interested in becoming a member of the subgroup.

b. Membership Reappointments

i. The following Subgroup R&A memberships are set to expire prior to the July 2025 NBIC meetings: Mr. Eric Cutlip and Mr. Ray Spuhl.

c. Officer Nominations

d. Resignations

9. Action Items

| Item Number: A21-45 | NBIC Location: Part 3, Supplements | No Attachment |
|---|---|----------------------|
| General Description: Eng | gineered Repairs and Alterations Supplement | |
| Subgroup: Repairs and A Task Group: M. Schaser | lterations (PM), B. Boseo, B. Ray, D. Marek, R. Underwood, J | . Siefert, P. Becker |
| new Supplement called Er | an effort to simplify the main body of NBIC Part 3, ngineered Repairs and Alterations which will import s he main body and then eventually add new repair and essed in the Part 3. | some existing, more |

July 2024 Meeting Action: R. Underwood presented a PR; this proposal is ready for SC.

| Item Number: A21-53 | NBIC Location: Part 3, S8.5 a) | No Attachment |
|----------------------------|---|-------------------|
| General Description: Pos | t Repair Inspection of weld repairs to CSEF ste | eels |
| Subgroup: Repairs and A | Iterations | |
| Task Group: P. Gilston (l | PM), E. Cutlip, A. Triplett | |
| CSEF weld repairs is to er | e requirement for Inspector involvement in pos- nsure future safe operation of the boiler. This is ection Agency, not the Repair Inspector, whose mentation. | a function of the |
| July 2024 Meeting Actio | n: P. Gilston presented a PR. | |

| Item Number: A22-18 | NBIC Location: Part 3, Glossary | No Attachment |
|-------------------------|----------------------------------|---------------|
| General Description: De | finition of blowdown and blowoff | |

Subgroup: Repairs and Alterations

Task Group: K. Moore (PM). M. Quisenberry, G. Scribner, M. Wadkinson

Explanation of Need: These terms are not consistently used throughout the industry. This is to provide guidance to use the correct term when addressing the equipment or the action.

July 2024 Meeting Action: K. Moore presented a PR.

| Item Number: A23-09 | NBIC Location: Part 3, New | Attachment Page 2 |
|---------------------|----------------------------|-------------------|
| | Supplement | |

General Description: Scope and Rules for use of Additive Manufacturing Pressure Parts

Subgroup: Repairs and Alterations

Task Group: G. Galanes (PM), J. Siefert, B. Schaefer, W. Sperko, J. Ferreira, J. Getter, T. Seime, M. Wadkinson

Explanation of Need: Developing rules for the use of additive manufacturing pressure parts in alterations.

July 2024 Meeting Action: G. Galanes presented revisions to the proposal based on the Rvw & Comment LB. This will go to SG R&A for LB Vote.

NOTE: This item was approved by the Subgroup via letter ballot on September 27, 2024.

Item Number: A23-21 NBIC Location: Part 3, 3.3.4.9

No Attachment

No Attachment

General Description: Boiler tube plug guidelines and inclusion or watertube boilers

Subgroup: Repairs and Alterations

Task Group: E. Cutlip (PM), P. Gilston, K. Moore, A. Triplett

Explanation of Need: Currently both firetube and watertube boilers require a boiler tube be plugged when replacement of a tube is not practicable at the time the defective tube is detected.

July 2024 Meeting Action: P. Gilston presented a proposal for a vote. The item passed with 4 negatives and 3 abstentions. (Neg. votes = M. Quisenberry, T. McBee, L. Dutra, C. Hopkins; Abstentions = B. Schaefer, J. Ferreira, T. Seime)

NOTE: This item failed to pass through Subcommittee R&A.

| Item Number: A23-24 | NBIC Location: Part 3 | No Attachment |
|--------------------------|-----------------------------------|---------------|
| General Description: Rep | pairs to quick actuating closures | |

Subgroup: Repairs and Alterations

Task Group: T. McBee (PM), C. Becker, M. Schaser, A. Khssassi, R. Smith

Explanation of Need: Put safe guidelines for repairs to quick actuating closures.

July 2024 Meeting Action: T. McBee presented a proposal which was UA.

NOTE: This proposal is currently being balloted to Main Committee.

Item Number: A23-35 NBIC Location: All Parts, 9.1

General Description: Definition of "non-load bearing attachment" (All Parts)

Subgroup: Repairs and Alterations

Task Group: T. White (PM), A. Khssassi

Explanation of Need: The term "nonload bearing attachment" is used as a basis for determining a routine repair but is not defined in the NBIC.

July 2024 Meeting Action: T. White presented a PR.

Item Number: A23-39 NBIC Location: Part 3, 3.3.1

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General Description: Strengthening Prevention of Defect Recurrence

Subgroup: Repairs and Alterations

Task Group: J. Ferreira (PM), J. Walker, F. Johnson, P. Gilston, A. Henson, G. Galanes, B. Hrubala

Explanation of Need: The existing text recommends, but does not require an investigation of the cause, extent, and likelihood of recurrence of defects. The existing text also has no requirement for anyone to act to prevent the recurrence of defects. Where root and/or proximate causes of defects are known, or could be determined, someone needs to act to prevent catastrophic failure of equipment.

July 2024 Meeting Action: J. Ferreira presented a proposal which was UA by both Subgroup and Subcommittee. During the Main Committee meeting, discussion was held on the applicability of the guidance given in the proposal and the overall wording of the proposal. The Committee asked that the proposal go back to subgroup and subcommittee for additional work.

| Item Number: A23-40 | NBIC Location: Part 3, 3.3.4.1 | No Attachment |
|-------------------------|---|---------------|
| General Description: St | rengthening Requirements to Ensure Defect Removal | |

Subgroup: Repairs and Alterations

Task Group: L. Dutra (PM), E. Cutlip, A. Renaldo, R. Valdez, T. McBee, A. Henson

Explanation of Need: The existing text alludes to the potential need for nondestructive examination (NDE) to ensure complete removal of defects but does not require it. The means to ensure defects have been removed must be understood by all to ensure safety. There is an interpretation of the 2021 NBIC that compounds this issue permitting repair organizations to not follow the requirements of NBIC Part 3, 3.3.4.8 even when the characteristics of the defect cannot be fully established.

July 2024 Meeting Action: L. Dutra presented a PR.

| Item Number: A23-61 | NBIC Location: Part 3, 89.3 | No Attachment |
|--------------------------|--------------------------------|---------------|
| General Description: Rev | vise NBIC R-2 Report and guide | |

Subgroup: Repairs and Alterations

Task Group: B. Schaefer (PM), T. LeBeau

Explanation of Need: Updates to the R-2 Report and the guide for completing R Report.

July 2024 Meeting Action: B. Schaefer presented a PR.

| Item Number: A | 23-68 NBIC Location: Part 3, 3.4.4 c) and | d) No Attachment |
|-----------------|---|------------------|
| General Descrip | tion: Changes to Examples of Alterations | |

Subgroup: Repairs and Alterations

Task Group: M. Schaser (PM), T. McBee, P. Becker, L. Baker

Explanation of Need: The current wording of 3.4.4.d (2023) is open ended and may result in allowing significant design changes to a pressure vessel under the guise of a repair when an alteration is a more appropriate classification. Rewording is required to limit the scope of potential design changes.

July 2024 Meeting Action: M. Schaser presented a PR.

Item Number: A23-77NBIC Location: Part 3, 4.2 a)No AttachmentGeneral Description: Performance of Original NDE During Repairs and Alterations

Subgroup: Repairs and Alterations

Task Group: A. Triplett (PM), S. Frazier, J. Walker, R. Collins, P. Becker

Explanation of Need: The existing language in Part 3, Section 4, Paragraph 4.2.a does not provide enough guidance or flexibility for Repair Organizations and owners to prescribe appropriate NDE for repairs/alterations to existing welds. Based on the limited, often non-specific documentation typically available to these entities during NBIC repairs and alterations, additional allowances and direction should be provided.

July 2024 Meeting Action: A. Triplett presented a Rvw & Comment LB to SG R&A.

Item Number: A24-11 NBIC Location: Part 3, S9 No Attachment

General Description: Addition of a section on the R-1 Form for "Unresolved Issues"

Subgroup: Repairs and Alterations

Task Group: M. Quisenberry (PM), T. Seime, T. McBee

Explanation of Need: There have been multiple instances discussed during NBIC meetings of Certificate Holders having to leave known defects unrepaired because of the owner/user not wanting to make the repair. This field would allow AIA and Jurisdictional Authorities to be made aware of known and identified issues with a pressure retaining item that were not corrected. Additionally, this provides cover for the Certificate Holder that they identified the defect, brought it to everyone's attention, and the owner/user decided to leave it.

July 2024 Meeting Action: No action was taken on this item.

Item Number: A24-17 NBIC Location: Part 3, 5.7.5 b) No Attachment

General Description: Specific Requirements For Stamping And Nameplates

Subgroup: Repairs and Alterations

Task Group: E. Cutlip (PM), B. Schaefer, A. Khssassi

Explanation of Need: 2023 ASME Section VIII-Div 1 UG-119(c)(5) has been revised to allow for the use of mechanical etching or laser annealing on nameplates.

July 2024 Meeting Action: B. Schaefer presented a PR.

Item Number: A24-18 **NBIC Location: Part 3, 9.1** **Attachment Page 12**

General Description: Definition of Controlled Fill

Subgroup: Repairs and Alterations

Task Group: P. Gilston (PM), A. Triplett, R. Collins, F. Johnson

Explanation of Need: Interpretation item I 23-79 addresses the use of the term 'controlled fill' in relation to welding method 6. The term is used in 2.5.3 d in relation to welding method 6 and more specifically in Supplement 8. Supplement 8 gives a lot of detail in schematics about a controlled fill in terms of weld bead placement, its use in controlling heat input etc., but in Welding Method 6 the term is not specifically used, but direction for welding is given, typically preheats are specified, electrode size for SMAW, and the use of stringer beads only.

July 2024 Meeting Action: P. Gilston presented a proposal which was UA by SG. This will need to be voted on by Parts 1, 2, and 4.

No Attachment Item Number: A24-20 **NBIC Location: Part 3, 9.1** General Description: Define "Engineered Repairs" and "Engineered Alterations"

Subgroup: Repairs and Alterations

Task Group: M. Schaser (PM), B. Ray, R. Underwood, B. Boseo, D. Marek, J. Siefert, P. Becker

Explanation of Need: The new supplement dealing with "Engineered Repairs and Alterations" (A21-45) will impact Part 3 Section 1, the NB-415, QRRs, the application process for Certificate Holders, and other documents to be determined. Defining "Engineered Repairs" and "Engineered Alterations" clarify the intent for these new scopes.

July 2024 Meeting Action: M. Schaser presented a PR.

Item Number: A24-21NBIC Location: Part 3, 9.1No Attachment

General Description: Engineered Repairs and Alterations - Section 1 Scope and Manual reqs

Subgroup: Repairs and Alterations

Task Group: M. Schaser (PM), B. Ray, R. Underwood, B. Boseo, D. Marek, J. Siefert, P. Becker

Explanation of Need: The scope of "Engineered Repairs and Alterations" (A21-45)needs to be clarified in 1.4.1 d) and reflected in the scope statement requirements for manuals in 1.5.1 a).

July 2024 Meeting Action: M. Schaser presented a PR.

| Item Number: A24-60 NBIC Location: Part 3, 3.3.5.2 a) and | | No Attachment |
|---|---------|---------------|
| | 3.4.5.1 | |

General Description: Revise the repair and alteration Sect VIII Div 2 and 3 paragraphs

Subgroup: Repairs and Alterations

Task Group: R. Collins (PM)

Explanation of Need: A revision of Part 3, 3.3.5.2 a) and 3.4.5.1 a), b), and c) are needed to reconcile the NBIC to Divisions 2 and 3 of ASME Section VIII. The attached proposal includes the complete revision draft.

July 2024 Meeting Action: R. Collins presented a PR.

Item Number: A24-61 NBIC Location: Part 3, 2.5.3 e) and 4.2

No Attachment

General Description: Relocate Volumetric NDE requirement for Weld Repair Greater than 3/8-inch

Subgroup: Repairs and Alterations

Task Group: M. Schaser (PM), M. Quisenberry, K. Derrik, and B. Schaefer

Explanation of Need: Relocate the volumetric NDE requirement for weld repairs of 3/8-inch depth or greater from paragraph 2.5.3.e to paragraph 4.2.

July 2024 Meeting Action: M. Schaser presented a PR. M. Quisenberry, K. Derrik, and B. Schaefer were added to the TG.

New Action Items:

| Item Number: A24-85 | NBIC Location: Part 3, 3.4.4 m) | Attachment Page |
|--|--|-------------------------|
| General Description: E | xample of alterations to include requalification of cycl | e life |
| Subgroup: Repairs and | Alterations | |
| Task Group: None assi | gned. | |
| documentation. This puts | Currently vessels above 10,000 psi are being "requali a conflict between the ASME data report limitation pleted without inspector involvement. | |
| January 2025 Meeting | Action: | |
| | | |
| Item Number: A24-93 | NBIC Location: Part 3, Supplement 8 | Attachment Page |
| | | 8 |
| | | |
| General Description: C | hanging Part 3 supplement 8's title for clarity | |
| General Description: C Subgroup: Repairs and | | |
| * | Alterations | |
| Subgroup: Repairs and Task Group: P. Shanks Explanation of Need: U | Alterations | and has cause confusion |
| Subgroup: Repairs and Task Group: P. Shanks Explanation of Need: U | Alterations (PM) Use of pressure equipment is unusual within NB-23 a ne applicability for Supplement 8. | and has cause confusion |
| Subgroup: Repairs and Task Group: P. Shanks Explanation of Need: U within the industry as to the | Alterations (PM) Use of pressure equipment is unusual within NB-23 a ne applicability for Supplement 8. | and has cause confusion |

General Description: Add examples of repairs and alterations specific to Electrochemical Stacks

Subgroup: Repairs and Alterations

Task Group: A. Triplett (PM)

Explanation of Need: With inclusion and initial deployments of electrochemical stacks as U Stamped pressure vessels under ASME BPVC Section VIII Division 1 and Code Case 3078, these stacks are starting to be shipped and registered with the National Board. Some basic examples of allowed repairs are needed to help guide an understanding of limitations for electrochemical stacks.

January 2025 Meeting Action:

Item Number: A24-98 NBIC Location: Part 3, 2.5.2

Attachment Page 16

General Description: Review and revise the PWHT Requirements in 2.5.2

Subgroup: Repairs and Alterations

Task Group: P. Gilston (PM)

Explanation of Need: Simplify PWHT requirements in 2.5.2.

January 2025 Meeting Action:

10. Future Meetings

- July 7-10, 2025 Cincinnati, OH
- January 12-15, 2026 New Orleans, LA

11. Adjournment

Respectfully submitted,

Terrence Hellman

Terrence Hellman SG R&A Secretary

Subgroup Repairs/Alterations

| Last Name | First Name | Interest Category | Role | Exp. Date | More |
|-------------|------------|------------------------------------|------------|------------|---------|
| Underwood | Robert | Authorized Inspection Agencies | Chair | 08/22/2026 | Details |
| Davis | Paul | Manufacturers | Vice Chair | 04/03/2027 | Details |
| Hellman | Terrence | | Secretary | 12/31/2099 | Details |
| Collins | Riley | Users | Member | 01/31/2027 | Details |
| Cutlip | Eric | National Board Certificate Holders | Member | 01/31/2025 | Details |
| Dutra | Louis | National Board Certificate Holders | Member | 01/30/2026 | Details |
| Ferreira | Jonathan | Authorized Inspection Agencies | Member | 10/24/2026 | Details |
| Frazier | Steven | Jurisdictional Authorities | Member | 08/19/2027 | Details |
| Hopkins | Craig | National Board Certificate Holders | Member | 01/31/2026 | Details |
| Johnson | Frank | Users | Member | 01/31/2027 | Details |
| Khssassi | Aziz | Jurisdictional Authorities | Member | 01/30/2026 | Details |
| LeBeau | Timothy | National Board Certificate Holders | Member | 08/19/2027 | Details |
| McBee | Timothy | Authorized Inspection Agencies | Member | 08/22/2026 | Details |
| McGuire | Robert | Manufacturers | Member | 08/19/2027 | Details |
| Quisenberry | Michael | National Board Certificate Holders | Member | 08/19/2027 | Details |
| Schaefer | Benjamin | National Board Certificate Holders | Member | 08/22/2026 | Details |
| Schaser | Matt | National Board Certificate Holders | Member | 01/31/2027 | Details |
| Seime | Trevor | Jurisdictional Authorities | Member | 08/22/2026 | Details |
| Sekely | James | General Interest | Member | 08/19/2027 | Details |
| Siefert | John | General Interest | Member | 08/19/2027 | Details |
| Sperko | Walter | General Interest | Member | 01/31/2026 | Details |
| Spuhl | Raymond | Authorized Inspection Agencies | Member | 01/31/2025 | Details |
| Toth | Marty | General Interest | Member | 01/31/2026 | Details |
| Triplett | Andrew | National Board Certificate Holders | Member | 08/22/2026 | Details |
| Valdez | Rick | Manufacturers | Member | 08/22/2026 | Details |
| Vogt | Mark | Users | Member | 01/31/2027 | Details |
| White | Tom | Users | Member | 01/31/2027 | Details |

Engineered Alterations

NB23-09 Rev 5964

Supplement SXX??

Pressure Retaining Parts fabricated using Additively Manufactured Material

Section XX.1 Scope

Additively Manufactured (AM) pressure <u>retaining containing</u> parts are parts that have been fabricated using material made by the direct energy deposition (DED) process. The method of welding using DED shall be limited to the <u>gas metal arc welding (GMAW)</u> process<u>and are referred to as AM parts</u>. AM parts replicate pressure retaining parts that were previously made using wrought<u>forged</u> or cast product forms. The requirements listed <u>under Section XX.2</u> for installation of AM parts are based on references to other known international Codes and Standards (e.g., ASME Boiler and Pressure Vessel Code).

Section XX.2 Installation of AM Pressure Retaining Parts

AM parts manufactured by the DED process that are being installed by a <u>National Board</u> R-Certificate holder shall be considered an alteration and shall require a Form R-2. AM parts that are installed shall be limited to service temperatures below the creep range (e.g. where time independent properties govern).

In addition to the requirements for an alteration, the following documents shal information shall be provided for the AM part and attached to the NBIC Form R-2;

(a) copy of the Additive Manufacturing Specification (AMS).

As a minimum the following information shall be included in the AMS:

a 1) The governing original code of construction Construction Code for the AM component.

<u>a</u>2) File names with current revision for all model data describing the geometry and build strategy needed to <u>fabricate build</u> the physical component.

<u>a</u>3) The applicable Material Specification listed in <u>the original code of construction for the</u> pressure retaining item ASME BPVC Section II, Part A or Part B.

<u>a</u>4) The applicable Filler Metal Specification and AWS Classification listed in <u>the original code of</u> <u>constructionASME BPVC Section II, Part C</u>.

<u>a</u>5) Allowable ranges of process variables from <u>the original code of construction ASME BPVC</u> <u>Section IX, Part QW, Article VI,</u> "Material Manufacturing using Wire Additive Welding". <u>a</u>6) The nondestructive evaluation and testing requirements being applied to the AM Material

_____from the applicable <u>original code of construction</u>

<u>a</u>7) Supplemental examination requirements identified by the Additive Manufacturer or the User.

<u>a</u>8) Post-processing requirements identified by the Additive Manufacturer or the User.

<u>a</u>9) Thermal treatment requirements for the AM Material identified by the Additive Manufacturer _____or the User.

<u>a</u>10) Supplemental requirements identified by the Additive Manufacturer or the User (e.g., _corrosion testing).

a(11) Prior to fabrication, tThe AMS Additive Manufacturing Specification shall be reviewed and accepted by the Inspector, and the Jurisdiction, where applicable required.

(b) <u>A</u>copy of the design calculations for the AM pressure part which shall be based on the original code of construction.

(c) <u>A</u>copy of the <u>original code of construction</u> <u>ASME Section IX</u> qualified welding procedure specification(s) that was followed <u>for AM pressure part fabrication</u> and weld/<u>welder</u> qualification record(s).

(d) <u>A</u> copy of the Additive Material Manufacturing Qualification Build Test Report.

As a minimum the following information shall be included in the AM Qualification Build Test Report:

d(1)(1) The Additive Manufacturer shall complete qualification builds prior to starting ____production _builds.

d(2) One qualification build is required for each F-Number (e.g., ASME BPVC Section IX, Table _____QW- 432) that captures the geometric features for the production components.

<u>d3(a)</u> A specific component geometry being built for production.

- <u>d3(</u>b) A generic component geometry containing geometric features that capture the bounding heat inputs and interpass temperature for multiple production components. Examples of geometric features can include but are not limited to thick wall sections, thin wall sections, tilted wall sections, nozzle sections, thickness transitions, and required joints (e.g., tees or cruciform).
- <u>d3</u>(c) Additional qualification builds are not required for a F-Number unless the geometric features for the qualification build in <u>d)3 paragraph 7(c)</u> do not bound the heat inputs and interpass temperatures for additional production builds.
- <u>d(4)</u>____Sufficient AM <u>product Material</u> for qualification testing shall be produced to complete _____all required material <u>qualification</u> testing.

<u>d(5)</u>—Test specimens shall be extracted from the AM <u>product Material</u> produced during the qualification builds at bounding heat inputs and interpass temperatures (e.g., thick wall

| | sections, thin wall sections, tilted wall sections, thickness transitions, and required joints , etc.). | |
|--|--|--|
| <u>d</u> (6) | Test specimens shall be extracted from multiple locations as needed to define the bounding value of the material property of interest (i.e., the tensile strength and toughness may not be at a minimum at the same location). | |
| <u></u> (7) | If the test specimen population is < 15, then a statistical analysis shall be performed in accordance with ASTM E2586 to verify that the material properties of an extrapolated population meet or exceed the minimum specifications of the properties based on a 95% confidence interval. If verified, then the product properties are deemed acceptable. | Commented [MS1]: I think bullet 7 and 8 should be applicable for all mechanical properties, not just tensile. Therefore, I've written this in more general terms. |
| analy are in | n 15 test specimens are produced the Additive Manufacturer shall complete a statistical sis to support with 95% confidence that 99% of the produced material tensile properties a coordance with the material specification. | |
| <u>excee</u> prope If 15 or m | test specimen population is ≥ 15, and testing indicates that all the material properties ad the minimum specifications then no statistical analyses are required and the product erties are deemed acceptable. ore specimens are produced, and all the tensile properties meet the requirements of the rial specification, the material is acceptable, and a statistical analysis is not required. | |
| <u>d(9</u> 10) "Mat | rial specification, the material is acceptable, and a statistical analysis is not required. —The tensile data generated for the ASME BPVC Section IX, Part QW, Article VI Additive reial _Manufacturing Procedure Qualification Requirements" (Section c 6) may be included ecalculation of the total number of test specimens. | |
| <u>d (101)</u> | <u>Elemental Chemical</u> composition testing shall be performed <u>and included in the AM</u> <u>Qualification Build Test Report</u> in accordance with the requirements in Section <u>f</u> (g). | |
| <u>d(112)</u> | Mechanical property testing shall be performed <u>and included in the AM</u> <u>Qualification Build Test Report</u> in accordance with the requirements of Section (<u>g and</u> <u>hg</u>). | |
| <u>d(12</u> 3) | Metallographic testing shall be performed <u>and included in the AM</u> <u>Qualification Build Test Report</u> in accordance with the requirements of Section (k)h) . | |
| (e) copy of Pr | oduction (witness specimen) Test Report s . | |

The following information shall be provided in the AM Production Test Report:

AM product witness specimens shall be manufactured and tested from each production <u>e</u>(1) build to document material integrity and stability of the manufacturing process.

Commented [MS2]: Is this the best word to use? Are we extracting these from a product or are these manufactured separately? Should we say, "obtained and tested"?

Commented [MS3]: Need to define specifically. Batch, lot, or every product item?

AM Material witness specimens shall be manufactured and tested for each production build to measure and verify on going process stability.

- e(2) At least one AM product Material witness tension test specimen shall be manufactured and tested fromer each production build.
- e(3) When toughness testing is required by the Construction Code, at least one AM product Material witness toughness test specimen shall be manufactured and tested fromer each production build.
- e(4) The AM product witness toughness test sample shall be of sufficient size to produce the required number of replicate specimens required by the original code of construction.
- The AM Material witness toughness test specimen shall be of sufficient size to produce the number of toughness test specimens required by the Construction Code.
- e(5) When a production component requires the use of multiple heats of filler metal AM product Material witness specimens for tension and toughness testing shall be manufactured and tested from each heat of filler metal.
- <u>e</u>(6) The witness specimens shall be extracted from the AM <u>product Material</u> manufactured using bounding heat inputs and interpass temperatures that provides limiting values for tensile and toughness properties as determined by the Additive Manufacturer.
- $\underline{e}(7)$ The witness specimens shall be manufactured either immediately before, during, or immediately after each production build.
- $\underline{e}(8)$ All tension and toughness testing shall be performed in accordance with the requirements of Sections <u>g</u>),<u>h</u>), and <u>j</u>).
- <u>e</u>(9) Following any production test non-compliance, components fabricated during the build shall be dispositioned using the Additive Manufacturers Quality Control Program.
- $\underline{e}(10)$ The results of the required witness specimen testing shall be documented in a Production Test Report certified by the Additive Manufacturer.
- <u>e(11)</u> The Production Test Report shall be included in the Additive Manufacturer's Construction Records.

(f) _____f). Elemental Composition TestingHEMICAL COMPOSITION TESTING

- (<u>f11</u>) One AM <u>productMaterial</u> specimen from the qualification build shall be provided for <u>elemental chemical</u> composition testing at a location determined by the Additive Manufacturer.
- (<u>f22</u>) The analytical method for <u>elemental chemical</u> composition testing shall be in accordance with the Material Specification.

(<u>f3</u>-) The <u>elementalchemical</u> composition of the specimens shall conform to the ASME filler metal specification identified in the <u>AM_Additive Manufacturing</u> Specification.

(g) -----g). Mechanical Property Test Locations MECHANICAL PROPERTY TESTING

- (g11) The build x, y, and z axes are defined in Figure 1.
- (g22) The z axis is defined as normal to deposition layers (Parallel to Build Direction) as shown in Figure 1.
- h). Tension Testing Requirements
 - (h11) All AM product Material testing shall be performed on specimens in the final heattreated condition identified in the <u>AM</u>-Additive Manufacturing Specification.
 - (h22) Tension test specimens shall be constructed with their long direction parallel to the zaxis as shown in Figure 1.
 - <u>(h3</u>-2) All room temperature tension testing shall be in accordance with ASTM E8 (see Appendix A and B)
 - <u>(h44</u>) All elevated temperature tension testing shall be in accordance with ASTM E21 (see Appendix A and B).

i). Hardness Testing Requirements

- (i11) Hardness testing shall be performed on the AM product from the qualification build when required by the Material Specification, the code of construction, or the AMS.
- Hardness testing shall be performed on AM Material extracted from the qualification build when required by the Material Specification, the Construction Code, or the Additive Manufacturing Specification.
- <u>(i22</u>) The hardness testing shall be performed on the AM <u>productMaterial</u> specimen in regions of the highest tensile strength.
- (i3-3) Hardness testing shall comply with ASTM E10, ASTM E18 or ASTM E92.
- <u>(i44)</u> The hardness values for the AM <u>product material</u> shall comply with the Material ______Specification.

—_j).—____Toughness Testing <u>Requirements</u>

- <u>(j11)</u> Toughness testing shall be performed when required by the Material Specification, Construction Code or the Additive Manufacturing Specification AMS.
- <u>(j2</u>2) When toughness testing is required, toughness testing shall be performed on AM product Material extracted from the qualification build and the witness specimens.
- <u>(j3</u>) Toughness testing shall be performed in the AM <u>product Material</u> specimen orientation as shown in Figure 1.

Commented [MS4]: Do you need to extract material to perform the test, or do you perform the test on the finished product?

Commented [GG5R4]: Both can be used. Depends on location and function.

(<u>i44</u>) The acceptance criteria for toughness testing shall be as specified by the applicable original code of constructionConstruction Code.

(h) k). MMetallographic Examination RequirementsETALLOGRAPHIC EVALUATIONS

- (<u>k1</u>) Metallographic specimens shall be extracted from the AM <u>product Material</u> produced during the qualification builds at bounding location of heat inputs and interpass temperatures as determined by the Additive Manufacturer.
- (k22) Metallographic specimens shall be prepared using methods prescribed in ASTM E3, Standard Guide for Preparation of Metallographic Specimens and ASTM E407, Standard Practice for Microetching Metals and Alloys.
- (k33) The microstructure shall be examined at magnifications ranging from 50X to 200X at locations selected by the AM to ensure the desired microstructure has been achieved.
 - (k44) The microstructure shall be reasonably uniform and free of cracks and lack of fusion dDefects at the selected locations in section k) 3.
- I). (i) A ceopy of nondestructive test reports as required by the original code of construction and Owner/User<u>-contract specification</u> requirements, if applicable.
- m). Test results from sections f),h), i), j) and k) shall be documented in a certified test report.
- <u>n). (j)</u><u>R</u>results of the hydrostatic test as performed in accordance with the rules of the original ______code of _Construction_
- o). Certification of AM pressure parts shall be documented on the NBIC Form R-3.

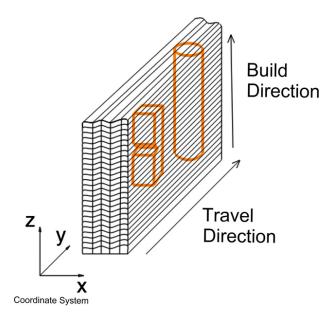


Figure 1 Material Manufacturing Coordinate System and Material Test Specimen Orientation

| Point | Temperature | Strength | Description | Criteria | | |
|-------|-------------|----------|--|---|--|--|
| | | - | • | Specified Minimum Tensile Strength from the | | |
| C1 | C1 Room TS | | Specified Minimum Tensile Strength | Material Specification | | |
| | | | | Specified Minimum Elongation from the | | |
| | | | The measured elongation from the | Material Specification. | | |
| C2 | Room | TS | tensile specimen is equal to the | Note: If the elongation in all the tensile | | |
| C2 | ROOM | 13 | specified minimum elongation value in | specimens exceeds the specified minimum | | |
| | | | the Material Specification. | elongation it is not required that Control | | |
| | | | | Point C2 be determined. | | |
| C3 | Design | TS | Value from Table U at Design | Tensile Strength from ASME BPVC Section II, | | |
| | | - | Temperature | Part D, Table U at Design Temperature | | |
| 64 | | тс | Minimum Acceptable Value of Tensile | Point C3/1.1 (See Paragraph 6(e)(3)) Value | | |
| C4 | Design | TS | Strength for High Temperature Test | from Table U at Design Temperature Divided | | |
| | | | | by 1.1 Specified Minimum Yield Strength from the | | |
| C5 | Room | YS | Specified Minimum Yield Strength | Material Specification | | |
| | | | | Specified Minimum Elongation from the | | |
| | | | The measured elongation from the | Material Specification. | | |
| 66 | Daam | VC | tensile specimen is equal to the | Note: If the elongation in all the tensile | | |
| C6 | Room | YS | specified minimum elongation value in | specimens exceeds the specified minimum | | |
| | | | the Material Specification. | elongation it is not required that Control | | |
| | | | | Point C6 be determined. | | |
| C7 | Design | YS | Minimum Acceptable Value of Yield | Yield Strength from ASME BPVC Section II | | |
| 0. | 2 60.8.1 | | Strength for High Temperature Test | Part D Table Y-1 at Design Temperature | | |
| | | | | Tensile strength and elongation from the | | |
| | | | | ASME BPVC Section IX, Part QW, Article VI | | |
| | | | Minimum value of tensile strength | tension tests shall equal or exceed the specified minimum values in the Material | | |
| D1 | Room | TS | from ASME BPVC Section IX, Part QW, | Specification (Point C1) | | |
| | | | Article VI tension test data | The elongation from the tension tests shall | | |
| | | | | exceed the specified minimum elongation in | | |
| | | | | the Material Specification | | |
| | | | | Tensile strength value from ASME BPVC | | |
| D2 | Design | TS | Tensile strength value from elevated | Section IX, Part QW, Article VI tension test | | |
| 02 | Design | 15 | temperature tension test. | shall equal or exceed value calculated for | | |
| | | | | Point C4 | | |
| | | | | Yield strength and elongation from the ASME | | |
| | | | | BPVC Section IX, Part QW, Article VI tension | | |
| D3 | Room | YS | Minimum value of yield strength from | tests shall equal or exceed the specified | | |
| | | | ASME BPVC Section IX, Part QW, Article VI tension test data | minimum values in the Material Specification (Point C5) | | |
| | | | | The elongation from the tension tests shall | | |
| | | | | exceed the specified minimum elongation in | | |
| | | | | the Material Specification | | |
| | | | Viold strongth value from high | Yield strength value from ASME BPVC Section | | |
| D4 | Design | YS | Yield strength value from high | IX, Part QW, Article VI tension test shall equal | | |
| | - | | temperature tension test | or exceed value for Point C7 | | |

Appendix A Control Points and Data Point Definitions and Nomenclature

Appendix B Example Section IX, Part QW, Article VI Data Analysis

Given the test data shown below determined from a QW -600 bracketed weld qualification testing, calculate the allowable minimum yield and tensile strength values to be used for acceptance of the tensile test specimens for qualification and production witness specimens.

Target Material Specification - ASME SA-403 Grade 316L Filler Material Specification - ER316LSi

Control Points - Example Data SA 403 Grade 316L (ksi)

| C1 | C2 | C3 | C4 | C5 | C6 | C7 |
|----|------------|------|---------------|----|------------|------|
| 70 | Elongation | 59.7 | 59.7/1.1=54.3 | 25 | Elongation | 14.1 |
| | Controlled | | | | Controlled | |

Example 1 Data Point D1 = 74 ksi Data Point D2 = Control Point C4 = 54.3 ksi Data Point D3 = 30 ksi Data Point D4 = Control Point C7= 14.1 ksi

Calculate the Minimum Allowable Tensile Strength and Yield Strength for the Qualification Build Specimen and the Production Witness Specimens Builds Specimen using Equation 1 and 2.

AMTS_{Minimum} = Max [C1, D1 x C4/D2] = Max [70, 74 x 54.3/54.3] = 74 ksi

AMYS_{Minimum}= Max [C5, D3 x C7/D4] = Max [25, 30 x 14.1/14.1] = 30 ksi

Example 2 Data Point D1 = 74 ksi Data Point D2 = Control Point C3 = 59.7 ksi Data Point D3 = 30 Ksi Data Point D4 = 17 ksi Calculate the Minimum Allowable Tensile Strength and Yield Strength for the Qualification Puild Specimen and the Production Witness Specimens Puilds Specimen using Fourtien 1

Build Specimen and the Production Witness Specimens Builds Specimen using Equation 1 and 2.

AMTS_{Minimum} = Max [C1, D1 x C4/D2] = Max [70, 74 x 54.3/59.7] = 70 ksi

AMYS_{Minimum}= Max [C5, D3 x C7/D4] = Max [25, 30 x 14.1/17] = 25 ksi



PROPOSED REVISION OR ADDITION

Item No.

A 24-18 Rev 01

Subject/Title

Controlled Fill Definition

NBIC Location

All Parts, Section 9, Glossary of Terms

Project Manager and Task Group

Philip Gilston (PM), A. Triplett

Source (Name/email)

Philip Gilston (philip_gilston@hsb.com)

Statement of Need

There is no definition of the term 'controlled fill'.

Background Information

Interpretation item I 23-79 addresses the use of the term 'controlled fill' in NBIC Part 3, 2.5.3 d in relation to Welding Method 6 for Grade 91 material.

While the term 'controlled fill' is not specifically used in the text of Welding Method 6 (2.5.3.6), directions are given for such variables as typical preheats, electrode size for SMAW, and the use of stringer beads only. The term is used explicitly in Supplement 8 for CSEF repairs, where S8.3.b says that "To control heat input the weld repair shall be performed using a "controlled fill" technique"; details are also given on such items as preheats, electrode size, required fill pass overlap, etc., and a lot of detail is provided in schematics including specifics on weld bead placement.

| Existing Text | Proposed Text | Clean Copy |
|---------------|--|---|
| None | Changes form Rev 00 shown Controlled Fill – requirements specified_control of weld technique for a permitted weld-repair process in order to manage heat input to ensure satisfactory weld properties by controlling distortion, promoting tempering and minimizing the risk of cracking by addressing variables including but not limited to heat input, such as preheat and interpass temperature, weld consumable type and diametersize, weld technique (string or weave), and bead placement-etc. | Controlled Fill – control of weld technique for a repair process to ensure satisfactory weld properties by controlling distortion, promoting tempering and minimizing the risk of cracking by addressing variables including but not limited to heat input, preheat and interpass temperature, weld consumable type and size, weld technique (string or weave) and bead placement. |

| | VOTE | | | | | | |
|-----------|----------|-------------|-----------|------------|--------|--------|------|
| Committee | Approved | Disapproved | Abstained | Not Voting | Passed | Failed | Date |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

NBIC Action Item A24-85 Submitted by Craig Bierl (cbierl@chubb.com) January 6, 2025



THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS

| Subject: | Example of alterations to include requalification of cycle life |
|----------------------------|---|
| NBIC Location: | 2023 NBIC, Part 3, 3.4.4 |
| Statement of Need: | Currently vessels above 10,000 psi are being "requalified" without any code documentation. This puts a conflict between the ASME data report limitations and the actual installation. This practice is being completed without inspector involvement. |
| Background Information: | I have requested a change to the wording in Part 2 in conjunction with this request in order to clarify what the inspector involvement and process should be (conforming to the NB Alteration process). |

Proposed Text:

3.4.4 Examples of Alterations

m) Any change in a vessels design cycle life or requalification of a vessel beyond the original designed cycle life.

NBIC Action Item A24-93 Submitted by Paul Shanks (paul.shanks@tuvsud.com) November 1, 2024



THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS

| Subject: | Changing Part 3 supplement 8's title for clarity |
|----------------------------|--|
| NBIC Location: | 2023 NBIC, Part 3, Supplement 8 |
| Statement of Need: | Use of pressure equipment is unusual within NB-23 and has cause confusion within the industry as to the applicability for supplement 8. |
| Background Information: | The first sentence of s8.1 a) talks to PRI's and the final sentence talks about situations not covered under weld methods 6 or 7 which are limited to boiler only. |

Proposed Text:

SUPPLEMENT 8 WELD AND POST REPAIR INSPECTION OF CREEP STRENGTH ENHANCED FERRITIC STEEL PRESSURE<u>-RETAINING ITEMS</u>-EQUIPMENT

NBIC Action Item A24-96 Submitted by Matthew Sweetland (msweetland@plugpower.com) November 1, 2024



THE NATIONAL BOARD

| Subject: | Add examples of repairs and alterations specific to Electrochemical Stacks |
|----------------------------|---|
| NBIC Location: | 2023 NBIC, Part 3, 3.3.3 and 3.4.4 |
| Statement of Need: | With inclusion and initial deployments of electrochemical stacks as U Stamped pressure vessels under ASME BPVC Section VIII Division 1 and Code Case 3078, these stacks are starting to be shipped and registered with the National Board. Some basic examples of allowed repairs and alterations are needed to help guide an understanding of limitations for electrochemical stacks. |
| Background Information: | Plug Power has an Authorization to Register from the National Board as well as an issued R stamp for stack repair specific to Electrochemical stacks built per ASME BPVC Section VIII and Code Case 3078 rules.Stacks are being built and registered by Plug Power with the National Board under an issued Authorization to Register. Once deployed, if some stack alteration is required by the end user, having an example list of alterations will help guide decisions by AHJ's, local inspectors and stack producers. |

Proposed Text:

3.3.3 EXAMPLES OF REPAIRS

v) Repairs to Electrochemical Stacks are limited to the following:

1) In kind replacement of end plates;

2) Replacement of any failed connection or frame bolting, representing the replacement parts described in part 3, 3.2.2 a) with no change of materials or grade as described on the Manufacturer's Data Report (MDR) or Original Equipment Manufacturers (OEM) drawing;

3) The addition or repair of load bearing attachments (e.g., welded supports, base or lifting lugs) to the end plates;

4) Replacement of parts bearing certification or manufacturer's stamping with nochange in material allowed as described on the MDR or verifiable OEM drawing. NBIC Action Item A24-96 Submitted by Matthew Sweetland (msweetland@plugpower.com) November 1, 2024

5) Replacement of active cells components (e.g., MEA, cell frames, cell components, separator plates) to address electrical or electrochemical performance issues; and

6) Replacement of electrical interface components (e.g., current collectors, insulator plates, fluid isolators).

3.4.4 EXAMPLES OF ALTERATIONS

m) For Electrochemical stacks, 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:

 Any change in material whether described at 3.3.3 s) or as described at 3.4.4. g);
<u>a.</u> A change in connection bolt or frame compression bolt diameter or material grade;
<u>b.</u> A change in material grade or nominal dimensions of any end plates or nozzles;

2) For active cell components

<u>a.</u> A change in material grade or nominal thickness for separator plates or cell frames;

b. A reduction in number of cells below any minimum, or when no minimum is specified;

c. An increase in number of cells above any maximum, or when no maximum is specified;

d. A change in cathode cell compliant structure thickness or stiffness;

e. A change in material grade or nominal thickness for current collectors or insulator plates;

NBIC Action Item A24-99 Submitted by Robert Underwood (robert_underwood@hsb.com) November 1, 2024



THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS

| Subject: | Review and revise the PWHT Requirements in 2.5.2 |
|----------------------------|---|
| NBIC Location: | 2023 NBIC, Part 3, 2.5.2 |
| Statement of Need: | Simplify PWHT requirements in 2.5.2. |
| Background Information: | Many sub-paragraphs in paragraph 2.5.2 are confusing, specifically the ones relating to measuring the Soak and Heat Bands. The purpose of this proposal is to review the current requirements and simplify where appropriate. |

Proposed Text:

To be determined by task group.