Date Distributed: 12/20/2023

THE NATIONAL BOARD
OF BOILER AND PRESSURE VESSEL INSPECTORS

NATIONAL BOARD INSPECTION CODE SUBGROUP REPAIRS & ALTERATIONS

AGENDA

Meeting of January 9th, 2024
San Antonio, TX

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. Central Time. For those attending in person, the meeting will be held in Iberian A and B at the hotel.

2. **Roll call of Members and Introduction of Visitors**

3. **Check for a Quorum**

4. **Announcements**
   - This meeting marks the end of Cycle C for the 2025 NBIC edition. The committees will have until the end of the July 2024 NBIC meeting to approve items for inclusion in the 2025 NBIC.
   - The National Board will be hosting a reception on Wednesday evening from 5:30 p.m. to 7:30 p.m. in Veramendi (fourth level of the hotel).
   - The National Board will be hosting breakfast and lunch on Thursday in Veramendi for those attending the Main Committee meeting. Breakfast will be served from 7:00 a.m. to 8:00 a.m. and lunch will be served from 11:30 a.m. to 12:30 p.m.
   - Meeting schedules, meeting room layouts, and other helpful information can be found on the National Board website under the **NBIC** tab → NBIC Meeting Information.
   - Remember to add any attachments that you'd like to show during the meeting (proposals, reference documents, power points, etc.) to the NBIC file share site (nbfileshare.org) **prior to the meeting**.
     - Note that access to the NBIC file share site is limited to committee members only.
     - ALL power point attachments/presentations must be sent to the NBIC Secretary prior to the meeting for approval.
     - Contact Jonathan Ellis (*nbicsecretary@nbbi.org*) for any questions regarding NBIC file share access.
   - When possible, please submit proposals in Word format showing "strike through/underline". Project Managers: please ensure any proposals containing text from the 2021 NBIC are updated to contain text from the 2023 NBIC.
   - If you'd like to request a new Interpretation or Action item, this should be done 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*
     - 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 set up, etc. Please continue to use the online registration for each meeting. If you are here in person, and did not register, please visit the National Board website to register now. Registering will make sure we have an accurate count for the reception, breakfast, and lunch. It is also a good way to make sure we have the most up-to-date contact information.

5. **Awards and Special Recognitions**
   Mr. Mike Quisenberry – 5 Years on Subgroup R&A

6. **Adoption of the Agenda**

7. **Approval of the Minutes of the July 11, 2023, Meeting**
   The minutes are available for review on the National Board website, www.nationalboard.org.

8. **ASME/API Presentation**
   Presentation from Mr. Sowinski – Mr. Sowinski is a member of the ASME BPV VIII Standards committee and the Chair of BPV VIII Subgroup Design. Mr. Sowinski is also a member of BPV VIII Subgroup General Requirements and the Special Committee on Interpretations.

9. **Review of Rosters**
   a. **Membership Nominations**
      i. Mr. Mr. Mark Vogt (Users) 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 January 2024 NBIC meetings and wish to be reappointed to the SG R&A: Mr. Frank Johnson and Mr. Tom White.

   c. **Officer Nominations**

   d. **Resignations**
      i. Don Kinney will be stepping down form Subgroup R&A and Subcommittee R&A.
      ii. Kathy Moore will be letting her membership expire from Subgroup R&A
      iii. Brian Moorelock will be letting his membership expire from Subgroup R&A

10. **Action Items**

Item Number: A21-12	**NBIC Location: Part 3, 3.3.3, 3.4.4, Section 9**	**Attachment Page 2**
General Description: Clarify the definitions and examples of "Repair" and "Alteration" **Subgroup:** Repairs and Alterations **Task Group:** P. Becker (PM), K. Moore, R. Underwood, , T. Seime, P. Shanks **Explanation of Need:** Clarify the definitions of "Repair" and "Alteration" in the Glossary and revise the list of examples of each to better define the allowable scope of activities. **July 2023 Meeting Action:** P. Becker proposed a Rvw & Comment LB to SG R&A only. The proposal was UA.		

Item Number: A21-31	NBIC Location: NBIC Glossary	Attachment Page 5

General Description: Revise definition of "Field"

Subgroup: Repairs and Alterations

Task Group: R. Miletti (PM), P. Gilston, M. Toth, J. Walker

Explanation of Need: A "Field" site under the current definition could be multiple rented or leased spaces used for repairs/alterations, where there is no single or specific customer or job, but rather the locations(s) are used for conducting repair/alteration activities by personnel employed by the Certificate Holder on a continual basis.

July 2023 Meeting Action: P. Gilston presented that the NB-415 has been revised to add definitions of "Temporary Locations" so this proposal is being worked on**. This was a PR.**

Update – Passed SG LB (22-0-2) in Dec. 2023

Item Number: A21-43	NBIC Location: Part 3, Glossary	No Attachment

General Description: Defining and revising "Practicable" and "Practical" within the NBIC

Subgroup: Repairs and Alterations

Task Group: M. Toth (PM), B. Underwood

Explanation of Need: Defining and revising Practicable and Practical within the NBIC and revising where applicable

July 2023 Meeting Action: T. Hellman presented a PR.

Item Number: A21-44	NBIC Location: Part 3, Glossary	No Attachment

General Description: Defining "De-Rating" within Part 3

Subgroup: Repairs and Alterations

Task Group: M. Toth (PM), B. Underwood, B. Wielgoszinski

Explanation of Need: Defining de-rating within Part 3

July 2023 Meeting Action: T. Hellman presented a PR.

Item Number: A21-45 **NBIC Location: Part 3, Supplements** **Attachment Page 7**

General Description: Engineered Repairs and Alterations Supplement

Subgroup: Repairs and Alterations

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

Explanation of Need: : In an effort to simplify the main body of NBIC Part 3, we are proposing a new Supplement called Engineered Repairs and Alterations which will import some existing, more complex activities from the main body and then eventually add new repair and alteration activities that are not currently addressed in the Part 3.

July 2023 Meeting Action: B. Underwood presented the initial scope statement and plan for moving "engineered repairs" currently in the NBIC to the new supplement. The proposal in moving existing 'engineered repairs' to a new supplement was revised and UA.

Update – Passed SG LB (20-2-0) in Dec. 2023

Item Number: A21-53 **NBIC Location: Part 3, S8.5 a)** **No Attachment**

General Description: Post Repair Inspection of weld repairs to CSEF steels

Subgroup: Repairs and Alterations

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

Explanation of Need: The requirement for Inspector involvement in post-repair inspections to CSEF weld repairs is to ensure future safe operation of the boiler. This is a function of the inservice Authorized Inspection Agency, not the Repair Inspector, whose duties end with completion of repair documentation.

July 2023 Meeting Action: SG Inspection will be voting on this today. A. Triplett was added to TG. This was a PR.

Item Number: A21-67	NBIC Location: Part 3, 3.4.9	Attachment Page 29

General Description: Add welding requirements to plugging firetubes

Subgroup: Repairs and Alterations

Task Group: P. Gilston (PM), K. Moore, M. Quisenberry, T. Sieme

Explanation of Need: The current NBIC does not have enough direction or requirements for welding tube plugs in firetubes.

July 2023 Meeting Action: P. Gilston presented the revision made to the proposal based on Rvw & Comment LB comments received. This proposal has passed SG LB already and will be in SC R&A tomorrow.

Note that this item was approved by MC in July and then re-opened to address a comment from Mr. George Galanes. This updated proposal has been approved by the SG and SC.

Update – Passed SC LB (14-2-0) in Dec. 2023

Item Number: A22-18	NBIC Location: Part 3, Glossary	No Attachment

General Description: Definition 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 2023 Meeting Action: K. Moore presented a PR.

Item Number: A22-19	NBIC Location: Part 3, 5.2.2	No Attachment

General Description: R Certificate Holders with Design Only Scope

Subgroup: Repairs and Alterations

Task Group: J. Ferreira (PM), R. Valdez, G. Scribner, B. Schaefer, M. Schaser

Explanation of Need: To add new paragraphs 5.2.2 d) and 5.2.2 e) which will provide guidance for R Certificate Holders with "Design Only" on which activities they are permitted to perform and how they and the Inspectors shall complete the R-2 Form.

July 2023 Meeting Action: M. Schaser presented. UA as revised.

Update – Item has been revised and will be re-considered by SG and SC.

Item Number: A22-41 **NBIC Location: Part 3, 1.5** **No Attachment**

General Description: Reference NB-415 in Quality System

Subgroup: Repairs and Alterations

Task Group: P. Davis selected as PM. Added M. Carlson and J. Walker, L. Ponce

Explanation of Need: Requirements in the NB-415 should be included in the R Cert. Holder's QC Manual. Examples: a) Notifying the National Board when an organization changes scope, ownership, name, location, address, or Inspection Agreement and b) Return of the stamp.

July 2023 Meeting Action: K. Moore presented a PR.

Item Number: A23-13 **NBIC Location: Part 3, 3.3.3 s)** **Attachment Page 32**

General Description: Consistent addressing of the term for weld metal

Subgroup: Repairs and Alterations

Task Group: P. Gilston (PM), W. Sperko, J. Siefert, T. Melfi, F. Johnson

Explanation of Need: Item for addressing consistent addressing of the term for weld metal is being opened based on discussions on A21-82. Weld Metal vs Filler Metal vs Filler Material, etc.

July 2023 Meeting Action: P. Gilston presented. The proposal was UA.

Update – Passed LB in all SGs EXCEPT for Part 4.

Item Number: A23-14 **NBIC Location: Part 3, Table S9.2** **Attachment Page 33**

General Description: Extension Instructions for Reports of Repair

Subgroup: Repairs and Alterations

Task Group: M. Quisenberry (PM)

Explanation of Need: Additional text should be added to Instruction (29) of Table S9.2 of Supplement 9 (listing the "R" Cert. of Auth expiration date), to provide instructions on how to document if the "R" Cert. Holder is operating under an extension.

July 2023 Meeting Action: M. Quisenberry presented a PR.

Update – SG LB in progress till 12/29/23 – PM RESPONSE NEEDED

Item Number: A23-21 **NBIC Location: Part 3, 3.3.4.9** **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 2023 Meeting Action: K. Moore presented a PR. A. Triplett was added to the TG.

Item Number: A23-24 **NBIC Location: Part 3** **No Attachment**

General Description: Repairs 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 2023 Meeting Action: T. McBee presented a PR, as this item is being worked in collaboration with Part 2.

Item Number: A23-29 **NBIC Location: Part 3, 1.5.1 s)** **No Attachment**

General Description: Clarification of Intent

Subgroup: Repairs and Alterations

Task Group: A. Triplett (PM), P. Becker

Explanation of Need: The sentence is unclear as it currently reads. With the new wording it clarifies the intent.

July 2023 Meeting Action: New PM selected – Andrew Triplett, as Mr. Chestnut will not be continuing with SG membership. Added Pat Becker as TG member. This was a PR.

Item Number: A23-36 **NBIC Location: Part 3, 4.2 a) and 4.4 b)** **Attachment Page 40**

General Description: Clarifying Rules for Using Alternative NDE Methods

Subgroup: Repairs and Alterations

Task Group: Tom White (PM), P. Miller

Explanation of Need: It has been determined that there may be some confusion regarding allowable NDE methods for repairs and alterations. The existing language of 4.2 a) tells the reader that alternative NDE methods acceptable to the Inspector and, where required, the Jurisdiction, may be used provided the requirements of Section 4 are met. However, it is possible that the reader is not familiarizing themselves with all of the requirements of Section 4 prior to proposing an alternative NDE method. This change should help clarify and reinforce the requirements for alternative NDE methods for repairs and alterations.

July 2023 Meeting Action: T. White proposed to CLOSE W/NO ACTION as this is addressed under A23-24. The proposal to Close was UA. This motion to close w/ no action was later Disapproved by Main Committee.

Item Number: A23-38 **NBIC Location: Part 3, 1.1 a)** **Attachment Page 41**

General Description: Scope Clarification for Part 3

Subgroup: Repairs and Alterations

Task Group: M. Quisenberry (PM), R. Spuhl, P. Davis, T. Seime, A. Henson

Explanation of Need: The owner or user's need to return equipment to service must never compromise the operational safety of the equipment or the process by which the operational safety of the equipment is assured. There is an interpretation that supports this notion by describing subjects permitted to be considered when determining whether a repair or alteration activity is practicable.

July 2023 Meeting Action: M. Quisenberry presented a PR.

Item Number: A23-39 **NBIC Location: Part 3, 3.3.1** **Attachment Page 43**

General Description: Strengthening Prevention of Defect Recurrence

Subgroup: Repairs and Alterations

Task Group: M Quisenberry (PM), J. Walker, F. Johnson

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 2023 Meeting Action: M. Quisenberry presented a PR.

Item Number: A23-40 **NBIC Location: Part 3, 3.3.4.1** **Attachment Page 44**

General Description: Strengthening 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 2023 Meeting Action: L. Dutra selected as PM. This was a PR.

Item Number: A23-41 **NBIC Location: Part 3, 3.3.4.6 a) 2)** **Attachment Page 46**

General Description: Strengthening Requirements for Defect Removal When Patching

Subgroup: Repairs and Alterations

Task Group: A. Khssassi (PM), L. Dutra, A. Renaldo

Explanation of Need: The existing text requires the removal of defective material until sound material is reached but provides no requirements or guidance on means to employ to ensure complete removal of defective material. 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 2023 Meeting Action: New PM selected - A. Khssassi (PM). This was a PR.

Update – Failed SG LB (11-5-8) in Dec. 2023

New Action Items:

Item Number: A23-56	**NBIC Location: Part 3, 1.3.2**	**Attachment Page 48**

General Description: Alternate Repair Inspectors

Subgroup: Repairs and Alterations

Task Group: A. Triplett (PM), P. Lentzer

Explanation of Need: The 2023 Edition revision to 1.3.2.a makes the use of alternate Inspectors applicable only to AIAs. The language should be revised to include OUIOs and FIAs that perform repairs/alterations on their own equipment, as allowed by 1.3.b.

January 2024 Meeting Action:

Item Number: A23-59	**NBIC Location: Part 3, 4.2 a) and b)**	**Attachment Page 49**

General Description: NDE Personnel Certifications for Repairs and Alterations

Subgroup: Repairs and Alterations

Task Group: A. Triplett (PM), P. Lentzer

Explanation of Need: The 2023 Edition revision to 4.2.a, which revises language about codes to be used for NDE on repairs/alterations (i.e., to codes other than the original construction code), is not reflected in 4.2.b. This creates conflicting requirements between 4.2.a and 4.2.b; in a case where use of the construction code is practicable, but NDE personnel certification to another Code/standard is desirable, 4.2.a would allow this but 4.2.b would not.

January 2024 Meeting Action:

Item Number: A23-61	**NBIC Location: Part 3, S9.3**	**Attachment Page 50**

General Description: Revise 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.

January 2024 Meeting Action:

Item Number: A23-68 **NBIC Location: Part 3, 3.4.4 c) and d)** **Attachment Page 51**

General Description: Changes to Examples of Alterations

Subgroup: Repairs and Alterations

Task Group: M. Schaser (PM), T. McBee

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.

January 2024 Meeting Action:

Item Number: A23-69 **NBIC Location: Part 3, 9.1** **Attachment Page 52**

General Description: Update definitions of Field, Shop, and add definition for Temporary Locations

Subgroup: Repairs and Alterations

Task Group: R. Miletti (PM), E. Cutlip, M. Toth, J. Walker

Explanation of Need: This is a definition change to align with the latest NB-415 revision adding definitions for "Shop", "Field Site", and "Temporary Location".

Update - Failed SG LB (12-3-9) in Dec. 2023

January 2024 Meeting Action:

Item Number: A23-76 **NBIC Location: Part 3, 3.3.4.6 a)** **Attachment Page 54**

General Description: Revise paragraph 3.3.4.6 Patches for Clarity.

Subgroup: Repairs and Alterations

Task Group: None assigned.

Explanation of Need: Requirements do not include specific note to ensure sound metal meets minimum design thickness. Further the order of the rules is not logical, starts with finished weld, grinding and NDE, then addresses defect removal, preparation etc.

January 2024 Meeting Action: Combined W/A23-41 – CLOSE W/NO ACTION

Item Number: A23-77 **NBIC Location: Part 3, 4.2 a)** **Attachment Page 77**

General 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.

January 2024 Meeting Action:

Item Number: A23-78 **NBIC Location: Part 3, S8** **No Attachment**

General Description: Rev. NB-23 Part 3, Supplement 8 & Fig. S8.3-b

Subgroup: Repairs and Alterations

Task Group: P. Becker (PM)

Explanation of Need: Add 'Step 5' to FIGURE S8.3-b. (currently missing). Remove references to 'B9' and 'B87' weld filler metal including Notes A, B, and C in Table S8.2.1

January 2024 Meeting Action:

Item Number: A23-83 **NBIC Location: Part 3, New Engineered repairs and Alteration Supplement** **Attachment Page 58**

General Description: Relocating Existing Repairs to new Eng. Repair & Alteration Supplement

Subgroup: Repairs and Alterations

Task Group: R. Underwood (PM)

Explanation of Need: In an effort to simplify the main body of Part 3, we are proposing to relocate some of the more complex repair methods to the new Engineered Repair & Alterations supplement. This item proposes to relocate three existing repair methods.

Update - SG LB in Progress till 1/5/24

January 2024 Meeting Action:

Item Number: A23-86	NBIC Location: Part 3, S6.5 & S6.6	Attachment Page 65

General Description: Revision to Part 3 DOT Supplement re-write

Subgroup: Repairs and Alterations

Task Group: R. Underwood (PM)

Explanation of Need: There is a need to revise two sections of Item 20-67 (approved by Main Committee on 3/24/2023) to reflect DOT requirements and bring the sections in line with intent interpretation I23-55.

January 2024 Meeting Action:

11. Future Meetings

- July 15-18, 2024 – The Brown Hotel in Louisville, KY
- January 2025 – TBD

12. Adjournment

Respectfully submitted,

Terrence Hellman

Terrence Hellman

SG R&A Secretary

Subgroup Repairs/Alterations

Last Name	First Name	Interest Category	Role	Exp. Date
Underwood	Robert	Authorized Inspection Agencies	Chair	08/21/2026
McBee	Timothy	Authorized Inspection Agencies	Vice Chair	08/21/2026
Hellman	Terrence		Secretary	12/30/2099
Cutlip	Eric	National Board Certificate Holders	Member	01/30/2025
Davis	Paul	Manufacturers	Member	08/21/2026
Dutra	Louis	National Board Certificate Holders	Member	01/29/2026
Ferreira	Jonathan	Authorized Inspection Agencies	Member	10/23/2026
Frazier	Steven	Jurisdictional Authorities	Member	07/30/2024
Hopkins	Craig	National Board Certificate Holders	Member	01/30/2026
Johnson	Frank	Users	Member	01/30/2024
Khssassi	Aziz	Jurisdictional Authorities	Member	01/29/2026
Kinney	Donald	Jurisdictional Authorities	Member	01/30/2024
Moore	Kathy	National Board Certificate Holders	Member	01/30/2024
Morelock	Brian	Users	Member	01/30/2024
Quisenberry	Michael	National Board Certificate Holders	Member	07/30/2024
Schaefer	Benjamin	National Board Certificate Holders	Member	08/21/2026
Seime	Trevor	Jurisdictional Authorities	Member	08/21/2026
Sekely	James	General Interest	Member	07/30/2024
Siefert	John	General Interest	Member	07/30/2024
Sperko	Walter	General Interest	Member	01/30/2026
Spuhl	Raymond	Authorized Inspection Agencies	Member	01/30/2025
Toth	Marty	General Interest	Member	01/30/2026
Triplett	Andrew	National Board Certificate Holders	Member	08/21/2026
Valdez	Rick	Manufacturers	Member	08/21/2026
Walker	Jamie	National Board Certificate Holders	Member	07/30/2024
White	Tom	Users	Member	01/30/2024

PROPOSED REVISION OR ADDITION

Item No.

A 21-12

Subject/Title

Revision to modify Term 'Alteration' and to add Guidance on classifying a Repair vs Alteration

NBIC Location

Part: Repairs and Alterations; Section: Section 3

Project Manager and Task Group

P. Becker (PM), K. Moore, B. Underwood, P. Shanks, S. Chestnut, T. Seime

Source (Name/Email)

Pat Becker, pabecker@babcock.com

Statement of Need

Interpretations continue to be received based on confusion in current guidance given in Section 3, Part 3 of Repairs and Alterations. Of particular issue is the heavily relied upon 'List of Examples' of Repairs and Alterations. The lists are considered a 'shortcut' to understanding which activities should be classified as repairs and which should be alterations. However, the examples are not intended to be used without the understanding of the rest of the subject matter in Part 3, Section 3…nor are they all-inclusive or exclusive.

Experience levels can vary widely among all 'stakeholder' categories, i.e. Owner/User, Authorized Inspector, Certificate Holder, In-Service inspector, Jurisdictional Authority etc.

From the Forward: *The general philosophy underlying the NBIC is to parallel those provisions of the original code of construction, as they can be applied to post-construction activities. The NBIC does not contain rules to cover all details of post-construction activities. Where complete details are not given, it is intended that individuals or organizations, subject to the acceptance of the Inspector and Jurisdiction when applicable, provide details for post-construction activities that will be as safe as otherwise provided by the rules in the original code of construction.*

The Intent of any effort is to improve the user experience while being cognizant not to overly restrict. The task group is paying attention to industry concerns and suggestions including the potential impact of any changes to existing equipment and installations. Existing Interpretations are being 'walked thru' the decision tree and otherwise reviewed against the addition of any content. The goal is to provide clearer guidance with less conflicting or overlapping examples or information.

Background Information

Update of Part 3 Section 3 to improve User experience and clarify definition of 'Alteration'. Updated 'problematic' example lists to eliminate 'conflicting examples'.

Existing Text

PART 3, SECTION 3
REPAIRS AND ALTERATIONS — REQUIREMENTS FOR REPAIRS AND ALTERATIONS

3.1 SCOPE

This section provides requirements and guidelines for materials, replacement parts, and methods used when performing repairs and alterations to pressure-retaining items. Specific repair or alteration methods for other types of pressure equipment are in NBIC Part 3, Section 6.

3.2 GENERAL REQUIREMENTS FOR REPAIRS AND ALTERATIONS

(21) 3.2.1 MATERIAL REQUIREMENTS FOR REPAIRS AND ALTERATIONS

Proposed Text

PART 3, SECTION 3
REPAIRS AND ALTERATIONS — REQUIREMENTS FOR REPAIRS AND ALTERATIONS

3.0 INTRODUCTION

This Section provides information on the requirements for repairs and alterations to pressure retaining items. Information on how to classify, perform, verify, and document acceptable repair and alteration activities may be found throughout Part 3 Sections and Supplements (Refer to the Table of Contents for detail on the location of relevant information). It is the intent that this Section be used in cooperation with local jurisdictional authorities and with an understanding of the applicable pressure vessel code regulations relevant to the scope of repair or alteration activity. Note that the guidance herein and the examples given are not all inclusive and are intended to be representative of cases and activities commonly considered either a repair or alteration.

3.1 SCOPE

This section provides requirements and guidelines for materials and methods used when performing repairs and alterations to pressure-retaining items. Specific repair or alteration methods for other types of pressure equipment are in NBIC Part 3, Section 6.

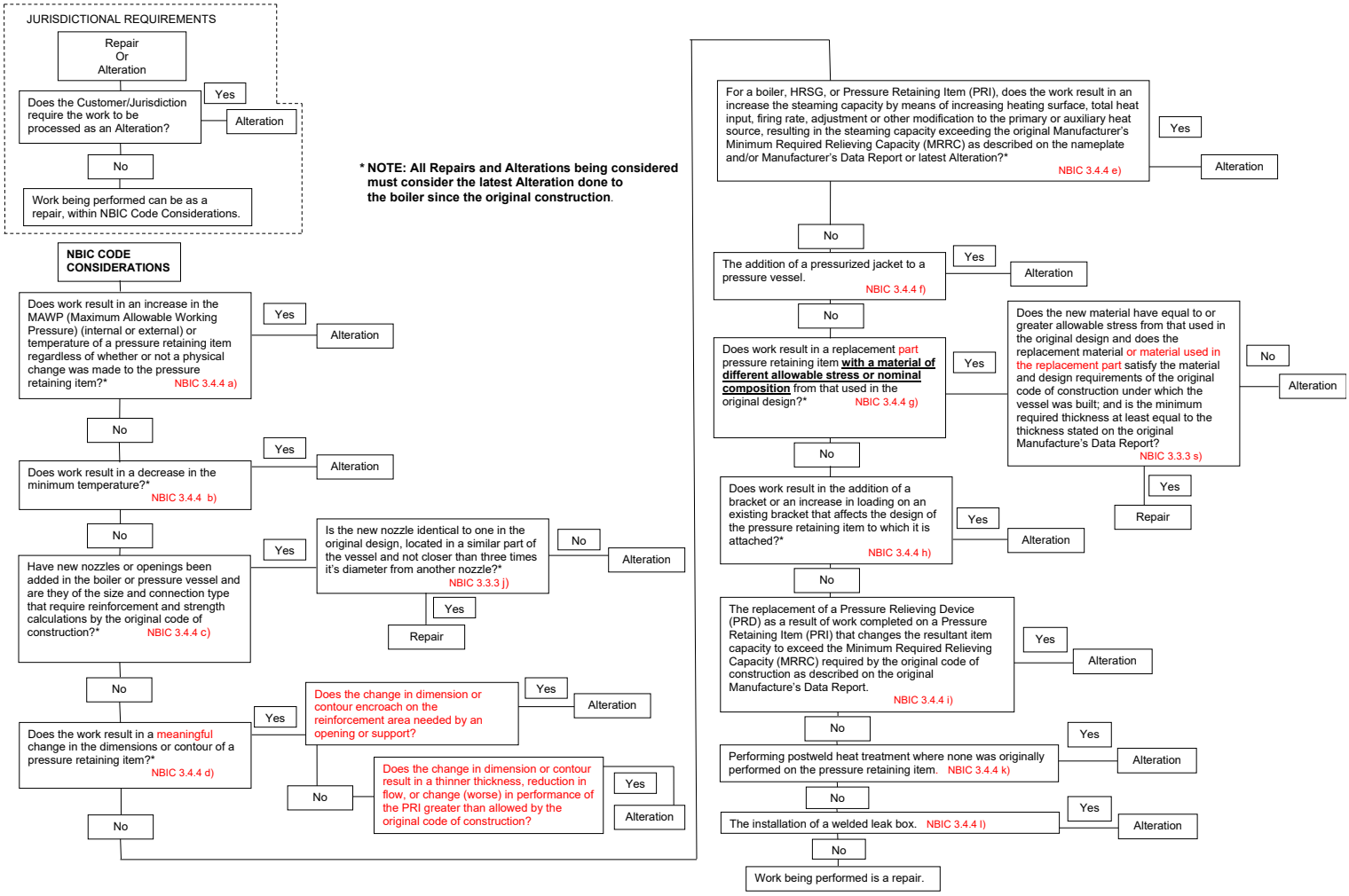
	3.1.1 CLASSIFICATION OF REPAIRS, ALTERATIONS AND REPLACEMENT PARTS When repairing, replacing, or altering existing pressure-retaining items, the activity classification (e.g. Repair vs. Alteration) shall be based on the scope of activity to be performed considering input from the Owner/User, Certificate Holder, AIA, and Jurisdictional Authority. When the scope of activity is complex or there is disagreement related to the classification, the Jurisdictional Authority in the location of the final installation of the repaired, altered or replaced equipment shall be considered the authority. Guidance on determining the activity classification may be found in: SUPPLEMENT X, *CLASSIFYING REPAIRS AND ALTERATIONS* and throughout this section. SUPPLEMENT X, FIGURE SX.1, *DECISION TREE (LOGIC DIAGRAM) FOR DETERMINING REPAIR OR ALTERATION ACTIVITY CLASSIFICATION* is based on the rules and guidance shown throughout Part 3, Section 3 and is provided to aid in determining the activity classification. References to relevant paragraphs may be found following the 'logic' questions throughout the diagram. Replacement Parts may be considered either a repair or alteration. Examples of replacement parts may be found in 3.2.2. Routine Repairs are limited to those listed in 3.3.2, e), 1) thru 5). Repair and Alteration activity examples may be found in 3.3.3 and 3.3.4. **The scope of the work to be performed will determine the classification type. Note that in all cases, the examples of Replacement parts, Routine Repairs, Repairs and Alterations are not all inclusive and should be used along with education, experience, and sound engineering judgment when determining classification type.** **3.2 GENERAL REQUIREMENTS FOR REPAIRS AND ALTERATIONS**
9.1 DEFINITIONS **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.	**9.1 DEFINITIONS** **Alteration —** A change in the item described on the original Manufacturer's Data Report which decreases 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, resulting in change of allowable stress of the material, or a reduction in minimum temperature of a pressure-retaining item shall be considered an alteration. **SUPPLEMENT X** **CLASSIFYING REPAIRS AND ALTERATIONS** **SX.1 SCOPE** **FIGURE SX.1** **DECISION TREE (LOGIC DIAGRAM) FOR DETERMINING REPAIR OR ALTERATION ACTIVITY CLASSIFICATION** **(See Below and Attachment)**

	VOTE:						
COMMITTEE	Approved	Disapproved	Abstained	Not Voting	Passed	Failed	Date

SUPPLEMENT X
CLASSIFYING REPAIRS AND ALTERATIONS

SX.1 SCOPE

FIGURE SX.1
DECISION TREE (LOGIC DIAGRAM) FOR DETERMINING REPAIR OR ALTERATION ACTIVITY CLASSIFICATION



THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS

PROPOSED REVISION OR ADDITION

Item No.

A 21-31 Rev 01

Subject/Title

Temporary Location

NBIC Location

Project Manager and Task Group

Ray Miletti (PM), Eric Cutlip, Marty Toth, Jamie Walker

Source (Name/email)

Statement of Need

"Field" site under the current definition could be multiple rented or leased spaces used for repairs/alterations, where there is no single or specific customer or job, but rather the locations(s) are used for conducting repair/alteration activities by personnel employed by the Certificate Holder on a continual basis.

Background Information

NB-415 has been revised and issued. Section 9.0 has added definitions for Shop Location, Temporary Location and Field Site. Shop Location and Field Site duplicate definitions already in Part 3, Temporary Location is a new definition.

Further Footnote 1 of section 2.2 in NB-415 states: '*A separate application is required for temporary locations (See Section 9.0 of this procedure) as permitted by National Board internal policies*.', and Section 6.4 requires requests for the use of temporary locations to be submitted to NB for approval, further the use of temporary locations not approved is prohibited.

This action proposes to add a new subparagraph h) in section 1.4.1 to provide guidance on making requests to NB for the use of a temporary location.

Existing Text	**Proposed Text**
1.4.1 ACCREDITATION PROCESS	**1.4.1 ACCREDITATION PROCESS**
a) The National Board administers accreditation programs for authorization of organizations performing repairs and alterations to pressure-retaining items in accordance with NB-415, *Accreditation of "R" Repair Organizations*.	a) The National Board administers accreditation programs for authorization of organizations performing repairs and alterations to pressure-retaining items in accordance with NB-415, *Accreditation of "R" Repair Organizations*.
b) Any organization may apply to the National Board to obtain a Certificate of Authorization for the requested scope of activities. A review shall be conducted to evaluate the organization's quality system. The individual assigned to conduct the evaluation shall meet the qualification requirements prescribed by the National Board. Upon completion of the evaluation, any deficiencies within the organization's quality system will be documented and a recommendation will be made to the National Board regarding issuance of a *Certificate of Authorization*.	b) Any organization may apply to the National Board to obtain a Certificate of Authorization for the requested scope of activities. A review shall be conducted to evaluate the organization's quality system. The individual assigned to conduct the evaluation shall meet the qualification requirements prescribed by the National Board. Upon completion of the evaluation, any deficiencies within the organization's quality system will be documented and a recommendation will be made to the National Board regarding issuance of a *Certificate of Authorization*.

c) As part of the accreditation process, an applicant's quality system is subject to a review. National Board procedures provide for the confidential review resulting in recommendations to issue or not issue a *Certificate of Authorization*. d) The accreditation programs provide requirements for organizations performing repairs and alterations to pressure-retaining items. e) The organization may perform repairs or alterations in its plants, shops, or in the field, provided such operations are described in the organization's Quality System. f) The Jurisdiction, as defined in Part 3, Section 9, may audit the Quality System and activities of an organization upon a valid request from an owner, user, inspection agency, or the National Board. g) The NBIC Committee may at any time change the rules for the issuance of Certificates of Authorization and use of the "R" Symbol Stamp. These rules shall become binding on all certificate holders. .	c) As part of the accreditation process, an applicant's quality system is subject to a review. National Board procedures provide for the confidential review resulting in recommendations to issue or not issue a *Certificate of Authorization*. d) The accreditation programs provide requirements for organizations performing repairs and alterations to pressure-retaining items. e) The organization may perform repairs or alterations in its plants, shops, or in the field, provided such operations are described in the organization's Quality System. f) The Jurisdiction, as defined in Part 3, Section 9, may audit the Quality System and activities of an organization upon a valid request from an owner, user, inspection agency, or the National Board. g) The NBIC Committee may at any time change the rules for the issuance of Certificates of Authorization and use of the "R" Symbol Stamp. These rules shall become binding on all certificate holders. h) **Temporary Locations** Per the requirements of NB-415 temporary locations shall not be used unless approved by the National Board. Request for authorization to use a temporary location shall be made to the National Board using Form NB-481. The organization shall describe the use and control of temporary location within the organization's quality management system (QMS). The activities of the Inspector shall be the same as for the Repair Organizations, plants, shops or field sites.

	VOTE						
Committee	**Approved**	**Disapproved**	**Abstained**	**Not Voting**	**Passed**	**Failed**	**Date**

Item 21-45

The purpose of this proposal is to relocate the **Bullseye PWHT** requirements in 2.5.2(c) and the **Alternative Welding Methods Without PWHT** in 2.5.3 to the new Engineered Repairs and Alterations Supplement, which has been approved by the Main Committee.

The below is relating to revisions to Part 3, Section 2.

2.5.2 POSTWELD HEAT TREATMENT (PWHT)
c) When it is impractical or detrimental to Postweld Heat Treat (PWHT) the entire item or band around the item, ~~the following~~ local PWHT methods as described in SXX may be used. ~~on spherical or cylindrical pressure-retaining items using the time and temperature parameters in the original code of construction and in accordance with a written procedure acceptable to the Inspector and, when required, by the Jurisdiction.~~
~~1) Heat a local area around the nozzle, welded attachment, or repair area such that the area is brought up uniformly to the required PWHT temperature. The application of local PWHT should be performed with controlled heating methods, such as induction or electric resistance heaters, and employing thermocouples to monitor PWHT temperature. The Soak Band (SB) shall extend tangentially and radially from the edge of the nozzle wall, or attachment weld or repair area equally by a minimum distance as defined by the thickness of the shell, t or 2 in. (50 mm), whichever is less. See Figure 2.5.2-b.~~ ~~Soak Band (SB) — this is the region on the spherical or cylindrical shell that will be heated uniformly to the required PWHT temperature. This band encompasses a circular region in the tangential and radial directions starting from the edge of a welded nozzle, or repair area or welded attachment that will be subjected to PWHT.~~ ~~2) The length of the Heating Band (HB) shall consist of the SB distance plus $4\sqrt{R*t}$. In no case shall the distance of the HB that extends beyond the edge of the nozzle weld, attachment weld or repair area be less than $2.5\sqrt{R*t}$.~~ ~~Heating Band (HB) – this is the region that encompasses the application of heat for PWHT and is defined in length by the equation, $SB+4\sqrt{R*t}$ where R is the outer radius of the spherical or cylindrical shell in inches (mm), and t is equal to the nominal thickness of the spherical or cylindrical shell in inches (mm).~~ ~~3) The Gradient Control Band (GCB) shall be kept as low as possible in all directions to avoid harmful temperature gradients adjacent to nozzles or geometric discontinuities.~~ ~~Gradient Control Band – this is the region that encompasses the SB, HB and extends beyond the edge of the HB.~~ ~~4) For PWHT of nozzle welds, repair welds, and external attachment welds on smooth spherical shells, heads, and cylindrical shells, the temperature differential within the GCB measured at the outside edge of the SB and the temperature measured at the outside edge of the HB shall not exceed one-half (1/2) of the peak soak PWHT temperature.~~ ~~5) The term t, as used above to determine SB, HB and GCB shall be the nominal thickness of either a full penetration weld, or the groove weld depth of a partial penetration repair weld. If a fillet weld is used in combination with a groove weld, the nominal thickness for PWHT shall be the depth of the groove weld.~~

Figure 2.5.2-a

LOCAL POSTWELD HEAT TREATMENT TEMPERATURE CONTROL BANDS BUTT WELD IN CYLINDER

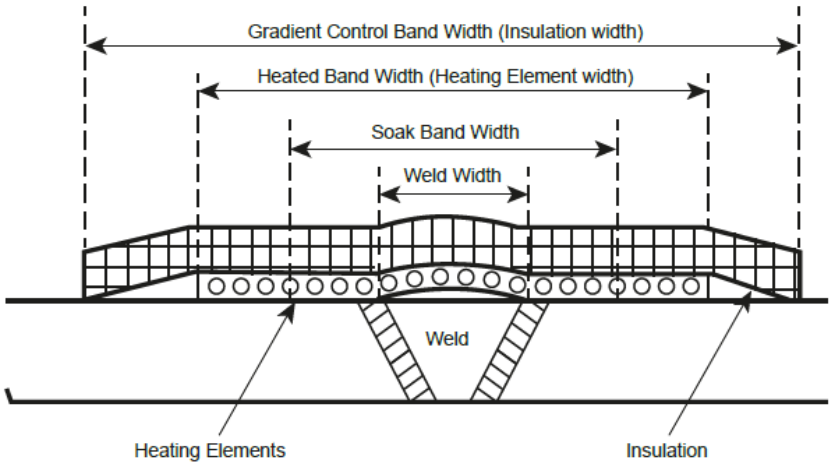
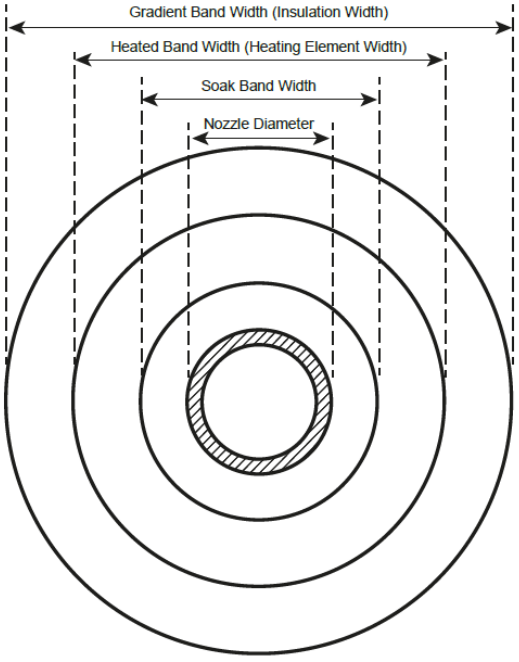


Figure 2.5.2-b

LOCAL POSTWELD HEAT TREATMENT TEMPERATURE CONTROL BANDS NOZZLE WELD OR ATTACHMENT TANGENTIAL DIRECTION HEATING BANDS



2.5.3 ALTERNATIVE WELDING METHODS WITHOUT POSTWELD HEAT TREATMENT

a) Under certain conditions, postweld heat treatment, in accordance with the original code of construction, may be inadvisable or impractical. In such instances, ~~the following~~ alternative methods as described in SXX may be used.~~.~~

~~b) Competent technical advice shall be obtained from the manufacturer of the pressure-retaining item or from another qualified source, such advice being especially necessary if the alternative is to be used in highly stressed areas, if service conditions are conducive to stress corrosion cracking, if materials are subject to hydrogen embrittlement, or are operating at temperatures in the creep range, or if the alternative is being considered for "on-stream" repairs or "hot tapping" on piping systems. Selection of the welding method used shall be based on the rules of the original code of construction together with the above mentioned advice concerning the adequacy of the weld in the as-welded condition at operating and pressure test conditions.~~

~~c) When reference is made in this section to materials by the ASME designation, P-Number and Group Number, the requirements of this section apply to the applicable materials of the original code of construction, either ASME or other, which conform by chemical composition and mechanical properties to the ASME P-Number and Group Number designations.~~

~~d) The detailed welding methods listed in the following subsections may be used as an alternative to postweld heat treatment (PWHT). NBIC Part 3, 2.5.3.1 is a method in which the welding procedure requires an elevation of the preheat temperature. In contrast, NBIC Part 3, 2.5.3.2 through 2.5.3.5, are methods in which the welding procedure requires the use of a temper-bead welding technique. Welding Method 6 as described in 2.5.3.6 requires use of a controlled fill technique. In 2.5.3.5 is a method in which the welding procedure used for joining dissimilar materials requires either an elevation of the preheat temperature or a temper-bead welding technique, depending on the chemical composition of the base metal that is joined to an austenitic steel. Temper-bead welding procedure nomenclature is defined in Section IX of the *ASME Boiler and Pressure Vessel Code*. Typically, this technique minimizes heat input of the initial beads, thus limiting heat beyond the weld heat-affected zone (HAZ) of the base metal. Heat input shall be increased for successive beads in accordance with the rules of QW-290 for temper bead welding in ASME Section IX. The Welding Procedure and Welder Performance Qualifications shall, in all cases, be in accordance with the requirements of the latest Edition of Section IX of the *ASME Boiler and Pressure Vessel Code*.~~

~~e) Nondestructive Examination of Welds~~

~~Prior to welding, the area prepared for welding shall be examined using either the Magnetic Particle (MT) or the Liquid Penetrant (PT) examination method to determine that no defects exist. After the finished weld has reached ambient temperature, and, when required by the specific welding method, the surface temper bead reinforcement layer has been removed substantially flush with the surface of the base metal, the weld shall be examined again by either of the above methods to determine that no defects exist using acceptance standards acceptable to the Inspector or original code of construction. In addition, welds greater than 3/8 in. (10 mm) deep or welds in a pressure retaining item that were originally required to be volumetrically examined by the rules of the original code of construction, shall be examined in accordance with paragraph NBIC Part 3, 4.2.~~

~~f) Methods that may be used as alternatives to postweld heat treatment are described in the following subsections.~~

~~2.5.3.1 WELDING METHOD 1~~

~~When using this method, the following is required:~~

~~a) This method may be used when the applicable rules of the original code of construction did not require notch toughness testing;~~

b) The materials shall be limited to P-No. 1, Groups 1, 2, and 3 and to P-No. 3, Groups 1 and 2 (excluding Mn-Mo steels in Group 2), as permitted for welded construction by the applicable rules of the original code of construction;

c) The welding shall be limited to the Shielded Metal-Arc welding (SMAW), Gas Metal-Arc Welding (GMAW), Flux Cored Arc Welding (FCAW), and Gas Tungsten-Arc Welding (GTAW) processes;

d) The Welders and Welding Operators, Welding Procedures Specifications shall be qualified in accordance with the applicable rules of the original code of construction, except that no postweld heat treatment shall be applied to the test coupon;

e) The weld area shall be preheated and maintained at a minimum temperature of 300˚F (149˚C) during welding. Alternatively, for P-No.1, Groups 1, 2 and 3 materials, the preheat may be reduced to 175˚F (79˚C) provided:

1) Provided the carbon equivalent of the base material to be welded is determined to be 0.40 or less.
2) The electrodes and filler metals are classified by the filler metal specification with a diffusible hydrogen designator of H4 or lower.
3) When shielding gas is used, it shall have a dew point that is -60˚F (-50˚C) or lower.

f) The preheat temperature shall be checked to assure that 4 in. (102 mm) of the material or four times the material thickness (whichever is greater) on each side of the groove (or full thickness of joint for a groove weld) is maintained at the preheat temperature during welding. When the weld does not penetrate through the full thickness of the material, the preheat need only be maintained at a distance of 4 in. (102 mm) or four times the depth of the repair weld, whichever is greater, on each side of the joint.

2.5.3.2 WELDING METHOD 2

When using this method, the following is required:

a) This method shall be used when the applicable rules of the original code of construction required notch toughness testing or shall be used when the applicable rules of the original code of construction did not require notch toughness testing provided the adequacy of the notch toughness of the weld, including the heat-affected zone, in the as-welded condition at operating and pressure test conditions is verified;

b) The materials shall be limited to carbon and low alloy steels permitted for welded construction by the applicable rules of the original code of construction, including those materials conforming to any of the following ASME P-No. designations: P-No. 1, Groups 1, 2, and 3; P-No. 3, Groups 1, 2, and 3; P-No. 4; P-No. 5A; P-No. 9A; P-No. 10A; P-No. 10B; P-No. 10C; P-No. 11A; or P-No. 11B;

c) The welding shall be limited to the Shielded Metal-Arc Welding (SMAW), Gas Metal-Arc Welding (GMAW), Flux Cored-Arc Welding (FCAW), and Gas Tungsten-Arc Welding (GTAW) processes;

d) The Welding Procedures Specifications shall be qualified in accordance with the temper bead procedure qualification requirements in QW-290 of ASME Section IX, and shall include the following additional requirements:

1) For P-No. 1 Groups 1, 2, and 3 and P-No. 3 Groups 1, 2, and 3, the minimum preheat temperature shall be 350°F (177°C), and the maximum interpass shall be 450°F (232°C).

2) For P-No. 9A, P-No. 10A, P-No. 10B, P-No. 10C, P-No. 11A, or P-No. 11B, the minimum preheat and interpass temperature requirements shall be in accordance with the guidelines in NBIC Part 3, 2.5.1.

3) For P-No. 4 and P-No. 5A materials, the minimum preheat, interpass temperature, and technique shall be in accordance with NBIC Part 3, 2.5.3.4. The repair depth for temper bead repairs to pressure retaining items of P-No. 4 and P-No. 5A materials is limited to welds not penetrating through full thickness.

4) Full thickness temper bead weld repairs are permitted to pressure retaining items of P-No 4 and P-No 5A materials under the following conditions:

a. ASME Section VIII, Division 2 pressure vessels, where application of PWHT on in-service vessels has been demonstrated to cause harm to vessel material.

b. For tube-to-header welds in steam service.

Full thickness weld repairs above shall be completed per NBIC Part 3, 3.3.5 with the following requirements:

a. The full thickness repair weld shall be verified as being the full penetration.

b. Volumetric examination of the full thickness weld shall be performed.

e. The test material for the welding procedure qualification shall be of the same material specification (including specification type, grade, class, and condition of heat treatment) as the material being repaired. In the event that the notch toughness of the material to be repaired is unknown, evidence from tests of that material or from another acceptable source (see NBIC Part 3, 2.5.3) may be used for the base metal notch toughness when qualifying the WPS as required in NBIC Part 3, 2.5.3.2 h). In the event that the original material specification is obsolete, the test material used should conform as closely as possible to the original material used for construction based on nominal composition and carbon equivalent (IIW Formula CE = C + Mn/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15; elements are expressed in Weight Percent Amounts), but in no case shall the material be lower in strength;

f. The qualification thickness for the test plates and repair groove depths shall be in accordance with ASME Section IX; for pressure retaining items repaired using this temper bead method, hardness test- ing and carbon equivalency requirements may be waived for ASME Section IX temper bead procedure qualification provided the pressure retaining item operates in steam service above 900°F (482°C);

g. The organization making the repair shall include, when qualifying its WPS, sufficient tests to deter- mine that the notch toughness of the weld metal and the heat-affected zone of the base metal in the "as-welded" condition is adequate at the minimum operating and pressure test temperatures (including start-up and shutdown). If for reasons of corrosion resistance, special hardness limits are necessary, such limits shall be included when qualifying the WPS;

h. Notch toughness shall be determined and evaluated by Charpy impact tests in accordance with the provisions of the original code of construction. Exemptions from impact testing described in the original code of construction are not applicable;

i. For the welding process in NBIC Part 3, 2.5.3.2 c), use of austenitic or ferritic filler metals is permitted. For ferritic filler metals, use only electrodes and filler metals that are classified by the filler metal specifi- cation with a diffusible-hydrogen designator of H8 or lower for the FCAW and SMAW processes. When shielding gases are used with a process, the gas shall exhibit a dew point that is below -60°F (-50°C). Surfaces on which welding will be done shall be maintained in a dry condition during welding and be free of rust, mill scale, and hydrogen producing contaminants such as oil, grease, and other organic materials;

j. After the weld has been deposited flush with the base metal, a surface temper reinforcing weld layer shall be applied;

k. For welds made by SMAW and FCAW, after completion of welding and without allowing the weldment to cool below the minimum preheat temperature, the temperature of the weldment shall be raised to
a temperature of 450°F (232°C) minimum for a minimum period of two hours. This hydrogen bake-out treatment may be omitted provided the electrode used is classified by the filler metal manufacturer with a diffusible-hydrogen designator of H4 (e.g., E7018-H4); and

l. After the finished repair weld has cooled to ambient temperature, the surface temper reinforcing layer shall be removed substantially flush with the surface of the base material.

2.5.3.3 WELDING METHOD 3

When using this method, the following is required:

a) This method may be used when the applicable rules of the original code of construction did not require notch toughness testing;

b) The materials shall be limited to any P-No. 1 or P-No. 3 material as permitted for welded construction by the applicable rules of the original code of construction;

c) The welding shall be limited to the SMAW, FCAW, and GTAW processes;

d) The test material for the welding procedure qualification shall be of the same P-No. and Group No. as the base material specification of the repair. In the event that the original material specification is obsolete, the test material used should conform to the nominal composition and carbon equivalent (IIW Formula CE = C + Mn/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15; elements are expressed in Weight Percent Amounts), as the material being repaired, but in no case shall the material be lower in strength;

e) If for reasons of corrosion resistance, special hardness limits are necessary, such limits shall be included when qualifying the WPS. For pressure retaining items repaired using this temper bead method, hardness testing and carbon equivalency requirements may be waived for ASME Section IX temper bead procedure qualification provided the pressure retaining item operates in steam service above 900°F (482°C);

f) The qualification thickness for the test plates and repair groove depths shall be in accordance with ASME Section IX; and

g) The WPS shall be qualified in accordance with the temper bead procedure qualification requirements in QW-290 of ASME Section IX, and shall include the following additional requirements:

1) The minimum preheat temperature for welding shall be 350°F (177°C) and the maximum interpass temperature shall be 450°F (232°C);

2) For the welding processes in NBIC Part 3, 2.5.3.3 c), use of austenitic or ferritic filler metal is permitted. For ferritic filler metals, use only electrodes or filler metals that are classified by the filler metal specification with a diffusible-hydrogen designator of H8 or lower for the FCAW and SMAW processes;

3) After completion of welding using SMAW and without allowing the weldment to cool below the mini- mum preheat temperature, the temperature of the weldment shall be raised to a temperature of 450°F (232°C) minimum for a minimum period of two hours. This hydrogen bake-out treatment may be omitted, provided the electrode used is classified by the filler metal manufacturer with a diffusible-hydrogen designator of H4 (e.g., E7018-H4); and

4) After the finished repair weld has cooled to ambient temperature, the final temper bead reinforcement layer shall be removed substantially flush with the surface of the base material.

2.5.3.4 WELDING METHOD 4

When using this method, the following is required:

a) This method is limited to repair welds in pressure retaining items for which the applicable rules of the original code of construction did not require notch toughness testing. The repair depth for temper bead repairs to pressure retaining items is limited to welds not penetrating though the full thickness.

Full thickness temper bead weld repairs are permitted under the following conditions:

1) ASME Section VIII, Division 2 pressure vessels, where application of PWHT on in-service vessels has been demonstrated to cause harm to vessel material.

2) For tube-to-header welds in steam service.

Full thickness weld repairs shall be completed per NBIC Part 3, 3.3.5 with the following requirements:

1) The full thickness repair shall be verified as being full penetration.

2) Volumetric examination of the full thickness weld shall be performed.

b) The materials shall be limited to P-No. 4, Groups 1 and 2, and P-No. 5A steels as permitted for welded
construction by the applicable rules of the original code of construction;

c) The welding shall be limited to the SMAW, FCAW, GMAW or GTAW processes using low-hydro- gen electrodes and filler metals classified by the filler metal specification with a diffusible-hydrogen designator of H8 or lower, and suitably controlled by maintenance procedures to avoid contamina- tion by hydrogen producing sources. The surface of the metal prepared for welding shall be free of contaminants;

d) The test material for the welding procedure qualification shall be of the same P-No. and Group No. as the base material specification of the repair. In the event that the original material specification is obsolete, the test material used should conform to the nominal composition and carbon equivalent (IIW Formula CE = C + Mn/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15; elements are expressed in Weight Percent Amounts), as the material being repaired, but in no case shall the material be lower in strength;

e) If for reasons of corrosion resistance, special hardness limits are necessary, such limits shall be included when qualifying the WPS;

f) The qualification thickness for the test plates and repair groove depths shall be in accordance with ASME Section IX. For pressure-retaining items repaired using this temper bead method, hardness test- ing and carbon equivalency requirements may be waived for ASME Section IX temper bead procedure qualification provided the pressure-retaining item operates in steam service above 900°F (482°C);

g) The welding procedures (WPS) shall be qualified in accordance with the temper bead procedure qualification requirements in QW-290 of ASME Section IX, and shall include the following additional requirements:

1) The minimum preheat temperature for welding shall be 300°F (150°C) for P-No. 4 material and 400°F (200 °C) for P-No. 5A material. The preheat temperature shall be checked to ensure that 4 in. (102 mm) of the material or four times the material thickness (whichever is greater) on each side of the

groove (or full thickness of joint for a groove weld) is maintained at the minimum temperature during welding. The interpass temperature shall not exceed 800°F (430°C). When the weld does not penetrate through the full thickness of the material, the minimum preheat and maximum interpass temperature need only be maintained for 4 in. (102 mm) or four times the depth of the repair weld (whichever is greater) on each side of the joint;

2) For the welding processes in NBIC Part 3, 2.5.3.4 c), use of austenitic or ferritic filler metal is permitted. For ferritic filler metals, use only electrodes or filler metals that are classified by the filler metal specification with a diffusible-hydrogen designator of H8 or lower for the FCAW and SMAW processes;

3) After the weld has been deposited flush with the base metal, a surface temper reinforcing weld layer shall be applied;

4) For welds made by the SMAW and FCAW processes, after completion of welding and without allowing the weldment to cool below the minimum preheat temperature, the temperature of the weldment shall be raised to 450°F (232°C) minimum for a minimum period of two hours. This hydrogen bake-out treatment may be omitted, provided the electrode used is classified by the filler metal manufacturer with a diffusible-hydrogen designator of H4 (e.g., E7018 H4); and

5) After the finished repair weld has cooled to ambient temperature, the surface temper reinforcing weld layer shall be removed substantially flush with the surface of the base metal (and for a fillet weld to the required size and suitable contour of the toes).

2.5.3.5 WELDING METHOD 5

When using this method, the following is required:

a) This welding method may be used when the applicable rules of the original code of construction or the construction standard or code selected permit joining dissimilar materials used in pressure-retaining items;

b) The materials shall be limited to ASME P-No. 1, Groups 1, 2, and 3, P-No. 3, Groups 1, 2, and 3, P-No. 4, P-No. 5A, P-No. 9A, P-No. 10A, P-No. 10B, P-No. 10C, P-No. 11A, P-No. 11B 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;

c) The welding shall be limited to the SMAW, FCAW, GMAW and machine or automatic GTAW processes. The filler metal used for joining the dissimilar materials shall be either A-No 8 or Nickel-Chrome alloy classification (F-No 43). When selecting a filler metal for dissimilar metal weld joints, determine if the weld joint will be exposed to elevated temperature service. A-No 8 filler metals exposed to service temperatures greater than 800°F (427°C) will exhibit reduced creep life along the fusion zone of the ferritic material due to carbon diffusion. Instead, a low hydrogen, Nickel-Chromium alloy classification filler metal shall be used for dissimilar weld joints exposed to service temperatures at or above 800°F (427°C);

d) The WPS shall be qualified in accordance with the temper bead rules of QW-290 in ASME Section IX. For pressure retaining items fabricated to ASME Section I and repaired using this temper bead method, hardness testing and carbon equivalency requirements may be waived for ASME Section IX temper bead procedure qualification provided the pressure retaining item operates in steam service above 900°F (482°C);

e) If the original code of construction did not require notch toughness testing, qualification of welding procedures (WPS) for joining ASME P-No. 1, P-No. 3 ferritic materials to either P-No. 8, P-No. 42, P-No. 43, or P-No. 45 materials shall be in accordance with requirements in either NBIC Part 3, 2.5.3.1, Welding Method 1 or in NBIC Part 3, 2.5.3.3, Welding Method 3;

f) If the original code of construction did not require notch toughness testing, qualification of welding pro- cedures (WPS) for joining ASME P-No. 4, P-No. 5A ferritic materials to either P-No. 8, P-No. 42, P-No. 43, P-No. 45 materials shall be in accordance with the requirements in NBIC Part 3, 2.5.3.4, Welding Method 4; and

g) If the original code of construction required notch toughness testing, qualification of welding procedures (WPS) for joining ferritic materials to either P-No. 8, P-No. 42, P-No. 43, or P-No. 45 materials shall be in accordance with the requirements in NBIC Part 3, 2.5.3.2, Welding Method 2.

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 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 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 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), UNS N08087;

e) 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; and

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.

2.5.3.7 WELDING METHOD 7

When using this welding method, the following applies:

a) This welding method may be used when the applicable rules of the original code of construction or the construction standard or code selected permit joining dissimilar materials.

b) The materials shall be limited to ASME P-No. 15E, Group 1 joined to either P-No. 5A or 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.

c) 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.

d) 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 and to non-pressure part welds for which the applicable rules of the original code of construction did not require notch toughness testing.

e) Application shall be limited to a location internal to the boiler setting.

f) 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.

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

h) The welding procedure qualification test coupon shall be ASME P-No. 15 E, Group 1, joined to either P-No. 5A, P-No. 8, P-No. 42, P-No. 43, or P-No. 45.

i) 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:

1) The minimum preheat for the GTAW process shall be 200°F (93°C). The minimum preheat for the SMAW process shall be 300°F (149°C). The maximum interpass temperature shall be 550°F (288°C).The preheat temperature shall be checked to ensure the minimum preheat temperature is maintained during welding and until welding is completed.

2) 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.

3) Regardless of the welding process, only the use of stringer beads shall be permitted.

~~4) For the joining of ASME P-No. 15E, Group 1 to P-No. 5A, the filler metal shall be limited to a mar- tensitic, iron-base filler metal to those assigned to F-No. 4 or F-No. 6 in ASME Section IX, QW-432 and limited to the following consumables: E8015-B8, E8018-B8 or ER80S-B8.~~

~~5) For the joining of ASME P-No. 15E, Group 1 to P-No. 8, P-No. 42, P-No. 43 or P-No. 45, the filler metal shall be limited to an austenitic, nickel-base filler metal to those assigned to F-No. 43 in ASME Section IX, QW-432 and limited to the following consumables: ERNiCr-3, ENiCrFe-3, ENi-CrFe-2, UNS N08087.~~

~~6)~~

The purpose of this proposal is to relocate the **Bullseye PWHT** requirements in 2.5.2(c) and the **Alternative Welding Methods Without PWHT** in 2.5.3 to the new Engineered Repairs and Alterations Supplement, which has been approved by the Main Committee.

The below is the approved Scope (SXX.1) and proposed relocated text from Part 3, Section 2. Any revisions to relocated or new text will be in red font/double underlined.

SUPPLEMENT XX – ENGINEERED REPAIRS AND ALTERATIONS

SXX.1 SCOPE

a) This supplement provides general and specific requirements for engineered repairs and alterations to pressure retaining items. These requirements shall be considered as supplemental requirements to those set forth in the main Parts of the NBIC.

b) Engineered repairs and alterations contained in this supplement will require acceptance by the Inspector and, when required, by the Jurisdiction. Procedures and methodologies established and proven in the industry are leveraged through references to published documents. Supplemental requirements are provided as necessary.

c) Implementation of engineered repairs and alterations will typically require specific inspection procedures, material identification and/or testing, a complete characterization of damage assessment, and knowledge of process conditions, etc. The remaining life and inservice monitoring requirements of any engineered repair or alteration should be established prior to implementation.

d) Careful consideration shall be given to repair or alteration of pressure-retaining items that have been fabricated of either creep strength enhanced ferritic steel materials or ferritic steel materials enhanced by heat treatment. The tensile and creep strength properties of these materials can be degraded by not following specific welding procedure specifications and heat treatment requirements. The user is cautioned to seek technical guidance for welding and heat treating requirements for these materials in accordance with the original code of construction.

e) A safety analysis may be necessary for certain engineered repairs and alteration activities to ensure safe operation of equipment and minimal risk to personnel.

SXX.2 WELDING

a) Welding, brazing and fusing shall be performed in accordance with the original code of construction, Part 3, Section 2, and this supplement.

b) Careful consideration shall be given to pressure-retaining items that have been fabricated of either creep strength enhanced ferritic steel materials or ferritic steel materials enhanced by heat treatment. The tensile and creep strength properties of these materials can be degraded by not following specific welding procedure specification and heat treatment requirements. The user is cautioned to seek technical guidance for welding and heat treating requirements for these materials in accordance with the original code of construction.

SXX.2.1 POSTWELD HEAT TREATMENT BULLSEYE METHOD

a) When it is impractical or detrimental to Postweld Heat Treat (PWHT) the entire item or band around the item, the following local PWHT method may be performed on spherical or cylindrical pressure-retaining items using the time and temperature parameters in the original code of construction and in

accordance with a written procedure acceptable to the Inspector and, when required, by the Jurisdiction:

1) Heat a local area around the nozzle, welded attachment, or repair area such that the area is brought up uniformly to the required PWHT temperature. The application of local PWHT should be performed with controlled heating methods, such as induction or electric resistance heaters, and employing thermocouples to monitor PWHT temperature. The Soak Band (SB) shall extend tangentially and radially from the edge of the nozzle wall, or attachment weld or repair area equally by a minimum distance as defined by the thickness of the shell, t or 2 in. (50 mm), whichever is less. See Figures SXX.2.1-a and S~~2.5.2~~XX.2.1-b.

Soak Band (SB) — this is the region on the spherical or cylindrical shell that will be heated uniformly to the required PWHT temperature. This band encompasses a circular region in the tangential and radial directions starting from the edge of a welded nozzle, or repair area or welded attachment that will be subjected to PWHT.

2) The length of the Heating Band (HB) shall consist of the SB distance plus 4 $\sqrt{R * t}$. In no case shall the distance of the HB that extends beyond the edge of the nozzle weld, attachment weld or repair area be less than $2.5\sqrt{R * t}$.

Heating Band (HB) – this is the region that encompasses the application of heat for PWHT and is defined in length by the equation, $SB + 4\sqrt{R * t}$ where R is the outer radius of the spherical or cylindrical shell in inches (mm), and t is equal to the nominal thickness of the spherical or cylindrical shell in inches (mm).

3) The Gradient Control Band (GCB) shall be kept as low as possible in all directions to avoid harmful temperature gradients adjacent to nozzles or geometric discontinuities.

Gradient Control Band – this is the region that encompasses the SB, HB and extends beyond the edge of the HB.

4) For PWHT of nozzle welds, repair welds, and external attachment welds on smooth spherical shells, heads, and cylindrical shells, the temperature differential within the GCB measured at the outside edge of the SB and the temperature measured at the outside edge of the HB shall not exceed one-half (1/2) of the peak soak PWHT temperature.

5) The term t, as used above to determine SB, HB and GCB shall be the nominal thickness of either a full penetration weld, or the groove weld depth of a partial penetration repair weld. If a fillet weld is used in combination with a groove weld, the nominal thickness for PWHT shall be the depth of the groove weld.

Figure SXX.2.1-a
LOCAL POSTWELD HEAT TREATMENT TEMPERATURE CONTROL BANDS BUTT WELD IN CYLINDER

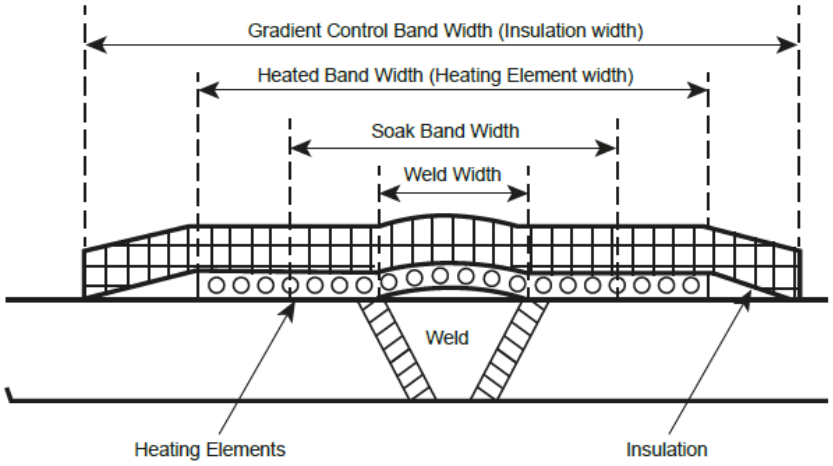
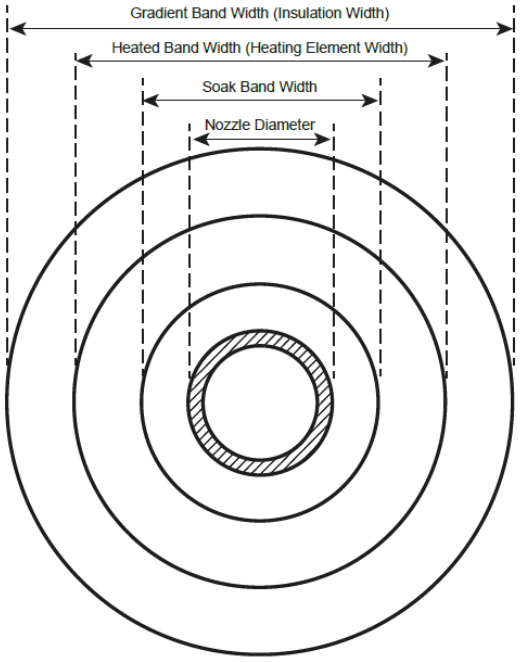


Figure SXX.2.1-b
LOCAL POSTWELD HEAT TREATMENT TEMPERATURE CONTROL BANDS NOZZLE WELD OR ATTACHMENT TANGENTIAL DIRECTION HEATING BANDS



SXX.2.2 ALTERNATIVE WELDING METHODS WITHOUT POSTWELD HEAT TREATMENT

a) Under certain conditions, postweld heat treatment, in accordance with the original code of construction, may be inadvisable or impractical. In such instances, the following alternative methods may be used.

b) Competent technical advice shall be obtained from the manufacturer of the pressure-retaining item or from another qualified source, such advice being especially necessary if the alternative is to be used in highly stressed areas, if service conditions are conducive to stress corrosion cracking, if materials are

subject to hydrogen embrittlement, or are operating at temperatures in the creep range, or if the alternative is being considered for “on-stream” repairs or “hot tapping” on piping systems. Selection of the welding method used shall be based on the rules of the original code of construction together with the above mentioned advice concerning the adequacy of the weld in the as-welded condition at operating and pressure test conditions.

c) When reference is made in this section to materials by the ASME designation, P-Number and Group Number, the requirements of this section apply to the applicable materials of the original code of construction, either ASME or other, which conform by chemical composition and mechanical properties to the ASME P-Number and Group Number designations.

d) The detailed welding methods listed in the following subsections may be used as an alternative to postweld heat treatment (PWHT). NBIC Part 3, ~~2.5.3.1~~ SXX.2.2.1 is a method in which the welding procedure requires an elevation of the preheat temperature. In contrast, NBIC Part 3, ~~2.5.3.2~~ SXX.2.2.2 through ~~2.5.3.5~~ SXX.2.2.5, are methods in which the welding procedure requires the use of a temper-bead welding technique. Welding Method 6 as described in ~~2.5.3.6~~ SXX.2.2.6 requires use of a controlled fill technique. ~~In 2.5.3.5~~ SXX.2.2.5 is a method in which
the welding procedure used for joining dissimilar materials requires either an elevation of the preheat temperature or a temper-bead welding technique, depending on the chemical composition of the base metal that is joined to an austenitic steel. Temper-bead welding procedure nomenclature is defined in Section IX of the *ASME Boiler and Pressure Vessel Code*. Typically, this technique minimizes heat input of the initial beads, thus limiting heat beyond the weld heat-affected zone (HAZ) of the base metal. Heat input shall be increased for successive beads in accordance with the rules of QW-290 for temper bead welding in ASME Section IX. The Welding Procedure and Welder Performance Qualifications shall, in all cases, be in accordance with the requirements of the latest Edition of Section IX of the *ASME Boiler and Pressure Vessel Code*.

e) Nondestructive Examination of Welds

Prior to welding, the area prepared for welding shall be examined using either the Magnetic Particle (MT) or the Liquid Penetrant (PT) examination method to determine that no defects exist. After the finished weld has reached ambient temperature, and, when required by the specific welding method, the surface temper bead reinforcement layer has been removed substantially flush with the surface of the base metal, the weld shall be examined again by either of the above methods to determine that no defects exist using acceptance standards acceptable to the Inspector or original code of construction. In addition, welds greater than 3/8 in. (10 mm) deep or welds in a pressure retaining item that were originally required to be volumetrically examined by the rules of the original code of construction, shall be examined in accordance with paragraph NBIC Part 3, 4.2.

f) Methods that may be used as alternatives to postweld heat treatment are described in the following subsections.

SXX.2.2.1 WELDING METHOD 1

When using this method, the following is required:

a) This method may be used when the applicable rules of the original code of construction did not require notch toughness testing;

b) The materials shall be limited to P-No. 1, Groups 1, 2, and 3 and to P-No. 3, Groups 1 and 2 (excluding Mn-Mo steels in Group 2), as permitted for welded construction by the applicable rules of the original code of construction;

c) The welding shall be limited to the Shielded Metal-Arc welding (SMAW), Gas Metal-Arc Welding (GMAW), Flux Cored Arc Welding (FCAW), and Gas Tungsten-Arc Welding (GTAW) processes;

d) The Welders and Welding Operators, Welding Procedures Specifications shall be qualified in accordance with the applicable rules of the original code of construction, except that no postweld heat treatment shall be applied to the test coupon;

e) The weld area shall be preheated and maintained at a minimum temperature of 300˚F (149˚C) during welding. Alternatively, for P-No.1, Groups 1, 2 and 3 materials, the preheat may be reduced to 175˚F (79˚C) provided:

1) Provided the carbon equivalent of the base material to be welded is determined to be 0.40 or less.
2) The electrodes and filler metals are classified by the filler metal specification with a diffusible hydrogen designator of H4 or lower.
3) When shielding gas is used, it shall have a dew point that is -60˚F (-50˚C) or lower.

f) The preheat temperature shall be checked to assure that 4 in. (102 mm) of the material or four times the material thickness (whichever is greater) on each side of the groove (or full thickness of joint for a groove weld) is maintained at the preheat temperature during welding. When the weld does not penetrate through the full thickness of the material, the preheat need only be maintained at a distance of 4 in. (102 mm) or four times the depth of the repair weld, whichever is greater, on each side of the joint.

SXX2.2.2 WELDING METHOD 2

When using this method, the following is required:

a) This method shall be used when the applicable rules of the original code of construction required notch toughness testing or shall be used when the applicable rules of the original code of construction did not require notch toughness testing provided the adequacy of the notch toughness of the weld, including the heat-affected zone, in the as-welded condition at operating and pressure test conditions is verified;

b) The materials shall be limited to carbon and low alloy steels permitted for welded construction by the applicable rules of the original code of construction, including those materials conforming to any of the following ASME P-No. designations: P-No. 1, Groups 1, 2, and 3; P-No. 3, Groups 1, 2, and 3; P-No. 4; P-No. 5A; P-No. 9A; P-No. 10A; P-No. 10B; P-No. 10C; P-No. 11A; or P-No. 11B;

c) The welding shall be limited to the Shielded Metal-Arc Welding (SMAW), Gas Metal-Arc Welding (GMAW), Flux Cored-Arc Welding (FCAW), and Gas Tungsten-Arc Welding (GTAW) processes;

d) The Welding Procedures Specifications shall be qualified in accordance with the temper bead procedure qualification requirements in QW-290 of ASME Section IX, and shall include the following additional requirements:

1) For P-No. 1 Groups 1, 2, and 3 and P-No. 3 Groups 1, 2, and 3, the minimum preheat temperature shall be 350°F (177°C), and the maximum interpass shall be 450°F (232°C).

2) For P-No. 9A, P-No. 10A, P-No. 10B, P-No. 10C, P-No. 11A, or P-No. 11B, the minimum preheat and interpass temperature requirements shall be in accordance with the guidelines in NBIC Part 3, 2.5.1.

3) For P-No. 4 and P-No. 5A materials, the minimum preheat, interpass temperature, and technique shall be in accordance with NBIC Part 3, ~~2.5.3.4~~ SXX.2.2.4. The repair depth for temper bead repairs to pressure retaining items of P-No. 4 and P-No. 5A materials is limited to welds not penetrating through full thickness.

4) Full thickness temper bead weld repairs are permitted to pressure retaining items of P-No 4 and P-No 5A materials under the following conditions:

a. ASME Section VIII, Division 2 pressure vessels, where application of PWHT on in-service vessels has been demonstrated to cause harm to vessel material.

b. For tube-to-header welds in steam service.

Full thickness weld repairs above shall be completed per NBIC Part 3, 3.3.5 with the following requirements:

a. The full thickness repair weld shall be verified as being the full penetration.

b. Volumetric examination of the full thickness weld shall be performed.

e. The test material for the welding procedure qualification shall be of the same material specification (including specification type, grade, class, and condition of heat treatment) as the material being repaired. In the event that the notch toughness of the material to be repaired is unknown, evidence from tests of that material or from another acceptable source (see NBIC Part 3, ~~2.5.3~~SXX.2.2) may be used for the base metal notch toughness when qualifying the WPS as required in NBIC Part 3, ~~2.5.3.2 h~~SXX.2.2.2 h). In the event that the original material specification is obsolete, the test material used should conform as closely as possible to the original material used for construction based on nominal composition and carbon equivalent (IIW Formula CE = C + Mn/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15; elements are expressed in Weight Percent Amounts), but in no case shall the material be lower in strength;

f. The qualification thickness for the test plates and repair groove depths shall be in accordance with ASME Section IX; for pressure retaining items repaired using this temper bead method, hardness test- ing and carbon equivalency requirements may be waived for ASME Section IX temper bead procedure qualification provided the pressure retaining item operates in steam service above 900°F (482°C);

g. The organization making the repair shall include, when qualifying its WPS, sufficient tests to determine that the notch toughness of the weld metal and the heat-affected zone of the base metal in the "as-welded" condition is adequate at the minimum operating and pressure test temperatures (including start-up and shutdown). If for reasons of corrosion resistance, special hardness limits are necessary, such limits shall be included when qualifying the WPS;

h. Notch toughness shall be determined and evaluated by Charpy impact tests in accordance with the provisions of the original code of construction. Exemptions from impact testing described in the original code of construction are not applicable;

i. For the welding process in NBIC Part 3, ~~2.5.3.2~~SXX.2.2.2-~~-~~c), use of austenitic or ferritic filler metals is permitted. For ferritic filler metals, use only electrodes and filler metals that are classified by the filler metal specifi- cation with a diffusible-hydrogen designator of H8 or lower for the FCAW and SMAW processes. When shielding gases are used with a process, the gas shall exhibit a dew point that is below -60°F (-50°C). Surfaces on which welding will be done shall be maintained in a dry condition during welding and be free of rust, mill scale, and hydrogen producing contaminants such as oil, grease, and other organic materials;

j. After the weld has been deposited flush with the base metal, a surface temper reinforcing weld layer shall be applied;

k. For welds made by SMAW and FCAW, after completion of welding and without allowing the weldment to cool below the minimum preheat temperature, the temperature of the weldment shall be raised to
a temperature of 450°F (232°C) minimum for a minimum period of two hours. This hydrogen bake-out treatment may be omitted provided the electrode used is classified by the filler metal manufacturer with a diffusible-hydrogen designator of H4 (e.g., E7018-H4); and

l. After the finished repair weld has cooled to ambient temperature, the surface temper reinforcing layer shall be removed substantially flush with the surface of the base material.

SXX2.2.3 WELDING METHOD 3

When using this method, the following is required:

a) This method may be used when the applicable rules of the original code of construction did not require notch toughness testing;

b) The materials shall be limited to any P-No. 1 or P-No. 3 material as permitted for welded construction by the applicable rules of the original code of construction;

c) The welding shall be limited to the SMAW, FCAW, and GTAW processes;

d) The test material for the welding procedure qualification shall be of the same P-No. and Group No. as the base material specification of the repair. In the event that the original material specification is obsolete, the test material used should conform to the nominal composition and carbon equivalent (IIW Formula CE = C + Mn/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15; elements are expressed in Weight Percent Amounts), as the material being repaired, but in no case shall the material be lower in strength;

e) If for reasons of corrosion resistance, special hardness limits are necessary, such limits shall be included when qualifying the WPS. For pressure retaining items repaired using this temper bead method, hardness testing and carbon equivalency requirements may be waived for ASME Section IX temper bead procedure qualification provided the pressure retaining item operates in steam service above 900°F (482°C);

f) The qualification thickness for the test plates and repair groove depths shall be in accordance with ASME Section IX; and

g) The WPS shall be qualified in accordance with the temper bead procedure qualification requirements in QW-290 of ASME Section IX, and shall include the following additional requirements:

   1) The minimum preheat temperature for welding shall be 350°F (177°C) and the maximum interpass temperature shall be 450°F (232°C);

   2) For the welding processes in NBIC Part 3, ~~2.5.3.3~~SXX.2.2.3 c), use of austenitic or ferritic filler metal is permitted. For ferritic filler metals, use only electrodes or filler metals that are classified by the filler metal specification with a diffusible-hydrogen designator of H8 or lower for the FCAW and SMAW processes;

   3) After completion of welding using SMAW and without allowing the weldment to cool below the mini- mum preheat temperature, the temperature of the weldment shall be raised to a temperature of 450°F (232°C) minimum for a minimum period of two hours. This hydrogen bake-out treatment may be omitted, provided the electrode used is classified by the filler metal manufacturer with a diffusible-hydrogen designator of H4 (e.g., E7018-H4); and

   4) After the finished repair weld has cooled to ambient temperature, the final temper bead reinforcement layer shall be removed substantially flush with the surface of the base material.

SXX2.2.4 WELDING METHOD 4

When using this method, the following is required:

a) This method is limited to repair welds in pressure retaining items for which the applicable rules of the original code of construction did not require notch toughness testing. The repair depth for temper bead repairs to pressure retaining items is limited to welds not penetrating though the full thickness.

Full thickness temper bead weld repairs are permitted under the following conditions:

1) ASME Section VIII, Division 2 pressure vessels, where application of PWHT on in-service vessels has been demonstrated to cause harm to vessel material.

2) For tube-to-header welds in steam service.

Full thickness weld repairs shall be completed per NBIC Part 3, 3.3.5 with the following requirements:

1) The full thickness repair shall be verified as being full penetration.

2) Volumetric examination of the full thickness weld shall be performed.

b) The materials shall be limited to P-No. 4, Groups 1 and 2, and P-No. 5A steels as permitted for welded construction by the applicable rules of the original code of construction;

c) The welding shall be limited to the SMAW, FCAW, GMAW or GTAW processes using low-hydro- gen electrodes and filler metals classified by the filler metal specification with a diffusible-hydrogen designator of H8 or lower, and suitably controlled by maintenance procedures to avoid contamina- tion by hydrogen producing sources. The surface of the metal prepared for welding shall be free of contaminants;

d) The test material for the welding procedure qualification shall be of the same P-No. and Group No. as the base material specification of the repair. In the event that the original material specification is obsolete, the test material used should conform to the nominal composition and carbon equivalent (IIW Formula CE = C + Mn/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15; elements are expressed in Weight Percent Amounts), as the material being repaired, but in no case shall the material be lower in strength;

e) If for reasons of corrosion resistance, special hardness limits are necessary, such limits shall be included when qualifying the WPS;

f) The qualification thickness for the test plates and repair groove depths shall be in accordance with ASME Section IX. For pressure-retaining items repaired using this temper bead method, hardness test- ing and carbon equivalency requirements may be waived for ASME Section IX temper bead procedure qualification provided the pressure-retaining item operates in steam service above 900°F (482°C);

g) The welding procedures (WPS) shall be qualified in accordance with the temper bead procedure qualification requirements in QW-290 of ASME Section IX, and shall include the following additional requirements:

1) The minimum preheat temperature for welding shall be 300°F (150°C) for P-No. 4 material and 400°F (200 °C) for P-No. 5A material. The preheat temperature shall be checked to ensure that 4 in. (102 mm) of the material or four times the material thickness (whichever is greater) on each side of the groove (or full thickness of joint for a groove weld) is maintained at the minimum temperature during welding. The interpass temperature shall not exceed 800°F (430°C). When the weld does not penetrate through the full thickness of the material, the minimum preheat and maximum interpass temperature need only be maintained for 4 in. (102 mm) or four times the depth of the repair weld (whichever is greater) on each side of the joint;

2) For the welding processes in NBIC Part 3, ~~2.5.3.4~~SXX.2.2.4 c), use of austenitic or ferritic filler metal is permitted. For ferritic filler metals, use only electrodes or filler metals that are classified by the filler metal specification with a diffusible-hydrogen designator of H8 or lower for the FCAW and SMAW processes;

3) After the weld has been deposited flush with the base metal, a surface temper reinforcing weld layer shall be applied;

4) For welds made by the SMAW and FCAW processes, after completion of welding and without allowing the weldment to cool below the minimum preheat temperature, the temperature of the weldment shall be raised to 450°F (232°C) minimum for a minimum period of two hours. This hydrogen bake-out treatment may be omitted, provided the electrode used is classified by the filler metal manufacturer with a diffusible-hydrogen designator of H4 (e.g., E7018 H4); and

5) After the finished repair weld has cooled to ambient temperature, the surface temper reinforcing weld layer shall be removed substantially flush with the surface of the base metal (and for a fillet weld to the required size and suitable contour of the toes).

SXX.2.2.5 WELDING METHOD 5

When using this method, the following is required:

a) This welding method may be used when the applicable rules of the original code of construction or the construction standard or code selected permit joining dissimilar materials used in pressure-retaining items;

b) The materials shall be limited to ASME P-No. 1, Groups 1, 2, and 3, P-No. 3, Groups 1, 2, and 3, P-No. 4, P-No. 5A, P-No. 9A, P-No. 10A, P-No. 10B, P-No. 10C, P-No. 11A, P-No. 11B 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;

c) The welding shall be limited to the SMAW, FCAW, GMAW and machine or automatic GTAW processes. The filler metal used for joining the dissimilar materials shall be either A-No 8 or Nickel-Chrome alloy classification (F-No 43). When selecting a filler metal for dissimilar metal weld joints, determine if the weld joint will be exposed to elevated temperature service. A-No 8 filler metals exposed to service temperatures greater than 800°F (427°C) will exhibit reduced creep life along the fusion zone of the ferritic material due to carbon diffusion. Instead, a low hydrogen, Nickel-Chromium alloy classification filler metal shall be used for dissimilar weld joints exposed to service temperatures at or above 800°F (427°C);

d) The WPS shall be qualified in accordance with the temper bead rules of QW-290 in ASME Section IX. For pressure retaining items fabricated to ASME Section I and repaired using this temper bead method, hardness testing and carbon equivalency requirements may be waived for ASME Section IX temper bead procedure qualification provided the pressure retaining item operates in steam service above 900°F (482°C);

e) If the original code of construction did not require notch toughness testing, qualification of welding procedures (WPS) for joining ASME P-No. 1, P-No. 3 ferritic materials to either P-No. 8, P-No. 42, P-No. 43, or P-No. 45 materials shall be in accordance with requirements in either NBIC Part 3, ~~2.5.3.1~~SXX.2.2.1, Welding Method 1 or in NBIC Part 3, ~~2.5.3~~SXX.2.2.3, Welding Method 3;

f) If the original code of construction did not require notch toughness testing, qualification of welding pro- cedures (WPS) for joining ASME P-No. 4, P-No. 5A ferritic materials to either P-No. 8, P-No. 42, P-No. 43, P-No. 45 materials shall be in accordance with the requirements in NBIC Part 3, ~~2.5.3~~SXX.2.2.4, Welding Method 4; and

g) If the original code of construction required notch toughness testing, qualification of welding procedures (WPS) for joining ferritic materials to either P-No. 8, P-No. 42, P-No. 43, or P-No. 45 materials shall be in accordance with the requirements in NBIC Part 3, ~~2.5.3~~SXX.2.2.2, Welding Method 2.

SXX.2.2.6 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 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 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 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), UNS N08087;

e) 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; and

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.

SXX.2.2.7 WELDING METHOD 7

When using this welding method, the following applies:

a) This welding method may be used when the applicable rules of the original code of construction or the construction standard or code selected permit joining dissimilar materials.

b) The materials shall be limited to ASME P-No. 15E, Group 1 joined to either P-No. 5A or 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.

c) 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.

d) 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 and to non-pressure part welds for which the applicable rules of the original code of construction did not require notch toughness testing.

e) Application shall be limited to a location internal to the boiler setting.

f) 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.

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

h) The welding procedure qualification test coupon shall be ASME P-No. 15 E, Group 1, joined to either P-No. 5A, P-No. 8, P-No. 42, P-No. 43, or P-No. 45.

i) 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:

1) The minimum preheat for the GTAW process shall be 200°F (93°C). The minimum preheat for the SMAW process shall be 300°F (149°C). The maximum interpass temperature shall be 550°F (288°C).The preheat temperature shall be checked to ensure the minimum preheat temperature is maintained during welding and until welding is completed.

2) 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.

3) Regardless of the welding process, only the use of stringer beads shall be permitted.

~~4)~~ For the joining of ASME P-No. 15E, Group 1 to P-No. 5A, the filler metal shall be limited to a mar- tensitic, iron-base filler metal to those assigned to F-No. 4 or F-No. 6 in ASME Section IX, QW-432 and limited to the following consumables: E8015-B8, E8018-B8 or ER80S-B8.

~~4)~~

5) For the joining of ASME P-No. 15E, Group 1 to P-No. 8, P-No. 42, P-No. 43 or P-No. 45, the filler metal shall be limited to an austenitic, nickel-base filler metal to those assigned to F-No. 43 in ASME Section IX, QW-432 and limited to the following consumables: ERNiCr-3, ENiCrFe-3, ENi-CrFe-2, UNS N08087.

THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS

PROPOSED REVISION OR ADDITION

Item No.

21-67

Subject/Title

Removal of reference to mechanical portion and add additional information for welding

NBIC Location

Part 3 Repairs and Alterations, Section 3, Paragraph 3.3.4.9

Project Manager and Task Group

PM – Philip Gilston

TG – Kathy Moore, Trevor Seime, Don Kinney and Steve Frazier

Source (Name/email)

Kathy Moore / kathymoore@joemoorecompany.com

Statement of Need

Removing the mechanical portion of the text. Many Jurisdictions are having a difficult time enforcing that part of the NBIC. Additionally, cracking of ligaments in welded plug is a common issue, the current NBIC does not have enough direction or requirements for welding tube plugs in firetube boiler.

Background Information

Mr. Kinney wrote on the Chief's Forum and asked the Chiefs what they thought of 3.3.4.9. They wanted the mechanical portion dropped.

Improper welding of tube plugs in firetubes often creates ligament cracks.

Originally the part addressing mechanical plugs was action item 21-71, the item has been combined here to make for a clean proposal

Revision 12 Notes, summary of changes, and actions addressing comments made in the ballot:

1. Second sentence of 'a' revised per Mr. Galanes comment. Highlighted below

Existing Text	**Proposed Text**
3.3.4.9 **TUBE PLUGGING IN FIRETUBE BOILERS** When the replacement of a tube in a firetube boiler is not practicable at the time the defective tube is detected, with the concurrence of the owner, Inspector, and when required, the Jurisdiction, the tube may be plugged using the following course of repair: a) The scope of work, type of plug and method of retention; whether welded or mechanical interface, shall be evaluated by the "R" Certificate Holder performing the repair and reviewed with the Inspector, and when	3.3.4.9 **TUBE PLUGGING BY WELDING IN FIRETUBE BOILERS** When the replacement of a tube in a firetube boiler is not practicable at the time the defective tube is detected, with the concurrence of the owner, Inspector, and when required, the Jurisdiction, the tube may be plugged ~~using the following course of repair:~~. ~~a) The scope of work, type of plug and method of retention; whether welded or mechanical~~

required, the Jurisdiction.

b) When the method of plugging is by welding, strength calculations for the size of the weld shall be in accordance with the original code of construction. The“R” Certificate Holder performing this repair shall weld the plug to the tube, or to the tube sheet, or a combination of both.

c) Plugging a tube in a firetube boiler is recognized as an alternative to the replacement of a firetube and may be further limited as a method of repair by the number of tubes plugged and their location; scattered or clustered. The operational effects on the waterside pressure boundary or membrane and the effects on the combustion process throughout the boiler should be considered prior to plugging.

d) The boiler may be returned to service for a period of time agreed upon by the owner, the Inspector, and when required, the Jurisdiction.

e) The Form R 1 shall be completed for the plugging of firetubes, identifying the means of plug retention; mechanical or by welding.

~~interface, shall be evaluated by the “R” Certificate Holder performing the repair and reviewed with the Inspector, and when required, the Jurisdiction.~~

~~b~~a) ~~Plugging a tube in a~~When installing a welded firetube plug, ~~boiler is recognized as an alternative to the replacement of a firetube and~~the repair may be ~~further~~ limited ~~as a method of repair~~ by the number of tubes plugged and their location~~; scattered or clustered~~. The operational effects on the waterside pressure boundary ~~or membrane~~ and reduced heat transfer (e.g. potential for over-heating of remaining tubes) ~~the effects on the combustion process throughout the boiler~~ should be considered prior to plugging. Competent technical advice should be obtained from the manufacturer of the pressure-retaining item or from another qualified source.

~~e~~b) Strength calculations for the size of the weld shall be in accordance with the original code of construction. The “R” Certificate Holder performing this repair shall weld the plug to the tube, or to the tube sheet, or a combination of both.

c) Cracking of ligaments due to the use of welded plugs is a common issue. To mitigate this possible occurrence the “R” Certificate Holder performing the repair shall consider actions including but not limited to the following:

1) For P-No. 1 and 3 materials, preheating to 200°F (95°C) minimum.

2) Limiting the maximum weld size to 3/8” (10 mm).

3) Limiting electrode size to 1/8” (3 mm) maximum diameter.

4) Using a stringer bead technique.

5) Using a minimum of two passes.

d) NDE in lieu of pressure testing is not permitted.

~~The boiler may be returned to service for a period of time agreed upon by the owner, the Inspector, and when required, the Jurisdiction.~~

~~e) The Form R 1 shall be completed for the plugging of firetubes, identifying the means of plug retention; mechanical or by welding.~~

For Information, Clean Copy of Proposed Text, *changes from Rev 11 only highlighted*

3.3.4.9 **TUBE PLUGGING BY WELDING IN FIRETUBE BOILERS**

When the replacement of a tube in a firetube boiler is not practicable at the time the defective tube is detected, with the concurrence of the owner, Inspector, and when required, the Jurisdiction, the tube may be plugged.

a) When installing a welded firetube plug, the repair may be limited by the number of tubes plugged and their location. The operational effects on the waterside pressure boundary and reduced heat transfer (e.g. potential for overheating of remaining tubes)~~the effects on the combustion process~~ should be considered prior to plugging. Competent technical advice should be obtained from the manufacturer of the pressure-retaining item or from another qualified source.

b) Strength calculations for the size of the weld shall be in accordance with the original code of construction. The

"R" Certificate Holder performing this repair shall weld the plug to the tube, or to the tube sheet, or a combination of both.

c) Cracking of ligaments due to the use of welded plugs is a common issue. To mitigate this possible occurrence the "R" Certificate Holder performing the repair shall consider actions including but not limited to the following:

1) For P-No. 1 and 3 materials, preheating to 200°F (95°C) minimum.

2) Limiting the maximum weld size to 3/8" (10 mm).

3) Limiting electrode size to 1/8" (3 mm) maximum diameter.

4) Using a stringer bead technique.

5) Using a minimum of two passes.

d) NDE in lieu of pressure testing is not permitted.

	VOTE						
Committee	**Approved**	**Disapproved**	**Abstained**	**Not Voting**	**Passed**	**Failed**	**Date**

THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS

PROPOSED REVISION OR ADDITION

Item No. A 23-13 Rev 02	
Subject/Title **Referencing for Weld Metal, Filler Metal etc.**	
NBIC Location	
Project Manager and Task Group P Gilston (PM), J. Siefert, W. Sperko, M. Vance, T Melfi, F Johnson	
Source (Name/email) January 2023, Sub-Committee Discussion	
Statement of Need Within Part 3, welding consumables are referred to in several different ways e.g., filler metal(s) (52 times), weld metal (11 times), consumable (14 times), welding electrode (once) etc. This item is to review these references, create definitions and bring consistency for reference descriptions.	
Background Information When discussing weld metal, references can be made to the weld consumable itself, or the deposited weld metal. Often we describe the 'nominal composition' for the weld, this is normally based on the actual weld metal deposited in a weld joint. Various factors can influence the chemistry of a deposited weld metal, including, but not limited to dilution with the base metal, protective fluxes, shielding gas etc.	
Existing Text None	**Proposed Text** **9.1 DEFINITIONS** **Weld -** A weld consists of weld metal and heat affected zones (HAZ) **Weld Metal** - Metal in a fusion weld consisting of that portion of the base metal and filler metal melted during welding. When no filler metal is added this is known as an autogenous weld. **Filler Metal** - The metal that is added during a welding, brazing or soldering operation. **Weld Consumable** - Electrodes, wires and fluxes that are melted during a welding operation.

S9.2 FORM R-1, REPORT OF REPAIR, NB-66

FIGURE S9.2.1
FORM R-1, PAGE 1 OF 2

THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS

NB-66, Rev. 16, (02/04/21)

FORM R-1 REPORT OF REPAIR
in accordance with provisions of the *National Board Inspection Code*

(1) (Authorized Rep. initials)
(2) (Inspectors initials)
(3) (Form "R" Registration no.)
(4) (P.O. no., job no., etc.)

1. WORK PERFORMED BY: (5) (name of repair organization)
(address)
2. OWNER: (6) (name)
(address)
3. LOCATION OF INSTALLATION: (7) (name)
(address)
4. ITEM IDENTIFICATION: (8) (boiler, pressure vessel, or piping) NAME OF ORIGINAL MANUFACTURER: (9)
5. IDENTIFYING NOS: (10) (mfg. serial no.) (11) (National Board no.) (12) (jurisdiction no.) (13) (other) (14) (year built)
6. NBIC EDITION/ADDENDA: (15) (edition) (addenda)
Original Code of Construction for Item: (16) (name / section / division) (edition / addenda)
Construction Code Used for Repair Performed: (17) (name / section / division) (edition / addenda)
7. REPAIR TYPE: (18) welded graphite pressure equipment FRP pressure equipment DOT
8. DESCRIPTION OF WORK: Form R-4, Report Supplement Sheet is attached FFSA Form (NB-403) is attached
(use Form R-4, if necessary)
(19)
(20) (Liquid, Pneumatic, Vacuum, Leak) Pressure Test, if applied (21) psi MAWP (22) psi
9. REPLACEMENT PARTS: (Attached are Manufacturer's Partial Data Reports or Form R-3's properly completed for the following items of this report):
(name of part, item number, data report type or Certificate of Compliance, mfg's. name and identifying stamp)
(23)
10. REMARKS: (24)

SUPPL. 9

FIGURE S9.2.2
FORM R-1, PAGE 2 OF 2

THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS

NB-66, Rev. 16, (02/04/21)

(25) (Form "R" Registration no.)

(26) (P.O. no., job no., etc.)

CERTIFICATE OFCOMPLIANCE

I, (27) , certify that to the best of my knowledge and belief the statements made in this report are correct and that all material, construction, and workmanship on this Repair conforms to the *National Board Inspection Code*. National Board "**R**" *Certificate of Authorization* No. (28) Expiration date: (29)

Repair Organization: (30)

Signed: (31)
(authorized representative)

Date: (32)

CERTIFICATE OF INSPECTION

I, (33) , holding a valid commission issued by The National Board of Boiler and Pressure Vessel Inspectors and certificate of competency, where required, issued by the Jurisdiction of (34) and employed by (35) of (36)

have inspected the work described in this report on (37), and state that to the best of my knowledge and belief, this work complies with the applicable requirements of the *National Board Inspection Code*. By signing this certificate, neither the undersigned nor my employer makes any warranty, expressed or implied, concerning the work described in this report. Furthermore, neither the undersigned nor my employer shall be liable in any manner for any personal injury, property damage, or loss of any kind arising from or connected with this inspection.

Commissions: (38)
(National Board and Jurisdiction no. including endorsement)

Signed: (39)
(Inspector)

Date: (40)

This form may be obtained from The National Board of Boiler and Pressure Vessel Inspectors, 1055 Crupper Avenue, Columbus, Ohio 43229-1183 Page 2 of 2

TABLE S9.2

GUIDE FOR COMPLETING FORM R-1, REPORT OF REPAIR, NB-66

Reference to Circled Numbers in the Form	Description
(1)	Initials of the authorized representative of the "R" Certificate Holder.
(2)	Initials of the Inspector reviewing the "R" Certificate Holders work.
(3)	When registering a Form R-1 Report with the National Board, this line is solely designated for a unique sequential number assigned by the "R" Certificate Holder. When the “R” Form is not to be registered, indicate so by “N/A”. As described in NBIC Part 3, 5.6, a log shall be maintained identifying sequentially, any Form “R” registered with the National Board.
(4)	If applicable, document the unique purchase order, job, or tracking number assigned by the organization performing the work.
(5)	The name and address of the National Board “R” Certificate Holder performing the work as it appears on the “*Certificate of Authorization*”.
(6)	Name and address of the owner of the pressure-retaining item.
(7)	Name and address of plant or facility where the pressure-retaining item is installed.
(8)	Description of the pressure-retaining item, such as boiler or pressure vessel, or piping. Include the applicable unit identification.
(9)	Name of the original manufacturer of the pressure-retaining item. If the original manufacturer is unknown, indicate by, “unknown.”
(10)	Document the serial number of the pressure-retaining item if assigned by the original manufacturer. If there is no serial number assigned or is unknown, indicate “unknown.”
(11)	When the pressure-retaining item is registered with the National Board, document the applicable registration number. If the pressure-retaining item is installed in Canada, indicate the Canadian design registration number (CRN), and list the drawing number under “other.” If the item is not registered, indicate, “none.”
(12)	Indicate the jurisdiction number assigned to the pressure retaining item, if available.
(13)	Indicate any other unique identifying nomenclature assigned to the pressure retaining item by the owner or user.
(14)	Identify the year in which fabrication/construction of the pressure retaining item was completed.
(15)	Indicate edition and addenda of the NBIC under which this work is being performed.
(16)	Indicate the name, section, division, edition, and addenda (if applicable) of the original code of construction for the pressure-retaining item.

TABLE S9.2 CONT'D

Reference to Circled Numbers in the Form	Description
(17)	Indicate the name, section, division, edition, and addenda (if applicable) of the construction code used for the work being performed. If code cases are used, they shall be identified in the "Remarks" section.
(18)	Check the repair type performed on the pressure retaining item.
(19)	Provide a detailed summary describing the scope of work that was completed to a pressure retaining item (PRI). The information to be considered when describing the scope of work should include such items as, the nature of the repair (i.e. welding, bonding, cementing), the specific location of the work performed to the PRI, the steps taken to remove a defect or as allowed by 3.3.4.8 to remain in place, the method of repair described as listed in the examples of Part 3, Section 3 or supplemental section if applicable, and the acceptance testing and or examination method used in accordance with the NBIC. When additional space is required to describe the scope of work, a Form R-4 shall be used and attached (check box). If a FITNESS FOR SERVICE Form (NB-403) is part of the Form R-1 repair package, check box and attach the form. Information determined to be of a proprietary nature need not be included, but shall be stated on the form.
(20)	Indicate type of pressure test applied (Liquid, Pneumatic, Vacuum, Leak). If no pressure test applied, indicate "none."
(21)	Indicate test pressure applied.
(22)	Indicate maximum allowable working pressure (MAWP) for the pressure retaining item, if known.
(23)	As applicable, identify what Replacement Parts manufactured by welding or bonding were introduced as needed to complete the scope of work. Indicate part, item number, manufacturer's name, stamped identification, and data report type or Certificate of Compliance.
(24)	Indicate any additional information pertaining to the work involved (e.g., routine repairs, code cases).
(25)	When registering a Form R-1 Report with the National Board, this line is solely designated for a unique sequential number assigned by the "R" Certificate Holder. When the "R" Form is not to be registered, indicate so by "N/A". As described in NBIC Part 3, 5.6, a log shall be maintained identifying sequentially, any Form "R" registered with the National Board.
(26)	If applicable, document the unique purchase order, job, or tracking number assigned by organization performing work.
(27)	Type or print name of authorized representative of the "R" Certificate Holder attesting to accuracy of the work described.
(28)	Indicate National Board "R" *Certificate of Authorization* number.
(29)	Indicate month, day, and year that the "R" *Certificate of Authorization* expires. If an Extension of your *Certificate of Authorization* has been granted by the National Board, and during the extension period, work is performed under your *Certificate of Authorization*, you must insert "Under Extension" after the Certificate expiration date on the "R" forms.

TABLE S9.2 CONT'D

Reference to Circled Numbers in the Form	Description
(30)	Record name of "R" Certificate Holder who performed the described work, using full name as shown on the *Certificate of Authorization* or an abbreviation acceptable to the National Board.
(31)	Signature of "R" Certificate Holder authorized representative.
(32)	Enter month, day, and year repair certified.
(33)	Type or print name of Inspector.
(34)	Indicate Inspector's Jurisdiction.
(35)	Indicate Inspector's employer.
(36)	Indicate address of Inspector's employer (city and state or province).
(37)	Indicate month, day, and year of final inspection by Inspector. For routine repairs this shall be the month, day, and year the Inspector reviews the completed routine repair package.
(38)	Inspector's National Board commission number and endorsement that qualifies the Inspector to sign this report, and when required by the Jurisdiction, the applicable State or Provincial numbers.
(38)	Signature of Inspector.
(40)	Indicate month, day, and year of Inspector signature

	VOTE						
Committee	Approved	Disapproved	Abstained	Not Voting	Passed	Failed	Date

PROPOSED REVISION OR ADDITION

Item No.

A 23-36

Subject/Title

Clarifying Rules for Using Alternative NDE Methods

NBIC Location

Part: Repairs and Alterations & Repairs and Alterations; Section: 4 & 4; Paragraph: 4.2 a) & 4.4 b)

Project Manager and Task Group

Source (Name/Email)

Gary Scribner / gscribner@nbbi.org

Statement of Need

It has been determined that there may be some confusion regarding allowable NDE methods for repairs and alterations. The existing language of 4.2 a) tells the reader that alternative NDE methods acceptable to the Inspector and, where required, the Jurisdiction, may be used provided the requirements of Section 4 are met. However, it is possible that a reader may not familiarize themselves with all of the requirements of Section 4 prior to proposing an alternative NDE method. This change will help clarify and reinforce the requirements for alternative NDE methods for repairs and alterations.

Background Information

This change is being proposed as a result of the U.S. Chemical Safety Bureau's investigation of the Loy Lange Box Company pressure vessel explosion.

Existing Text

4.2 NONDESTRUCTIVE EXAMINATION
a) 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, standard, or specification selected for the repair or alteration of the pressure-retaining item (see NBIC Part 3, 1.2). 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.

4.4 Examination and Test for Repairs and Alterations
a) The integrity of repairs, alterations, and replacement parts used in repairs and alterations shall be verified by examination or test;

b) Testing methods used shall be suitable for providing meaningful results to verify the integrity of the repair or alteration. Any insulation, coatings, or coverings that may inhibit or compromise a meaningful test method shall be removed, to the extent identified by the Inspector;

Proposed Text

4.2 NONDESTRUCTIVE EXAMINATION
a) 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, standard, or specification selected for the repair or alteration of the pressure-retaining item (see NBIC Part 3, 1.2). 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 the following requirements are met:~~provided that all other requirements of this section are met.~~
1) Testing methods used shall be suitable for providing meaningful results to verify the integrity of the repair or alteration;

2) Alternative NDE methods used for repairs shall be limited to those listed in Part 3, 4.4.1; and

3) Alternative NDE methods used for alterations shall be limited to those listed in Part 3, 4.4.2.

4.4 Examination and Test for Repairs and Alterations
a) The integrity of repairs, alterations, and replacement parts used in repairs and alterations shall be verified by examination or test;

b) ~~Testing methods used shall be suitable for providing meaningful results to verify the integrity of the repair or alteration.~~ Any insulation, coatings, or coverings that may inhibit or compromise a meaningful test method shall be removed, to the extent identified by the Inspector;

PROPOSED REVISION OR ADDITION

Item No.

A 23-38

Subject/Title

Scope Clarification for Part 3

NBIC Location

Part: Repairs and Alterations; Section: 1; Paragraph: 1.1(a)

Project Manager and Task Group

PM : Michael Quisenberry

Source (Name/Email)

Adam Henson / adam.henson@csb.gov

Statement of Need

The owner or user's need to return equipment to service must never compromise the operational safety of the equipment or the process by which the operational safety of the equipment is assured. There is an interpretation that supports this notion by describing subjects permitted to be considered when determining whether a repair or alteration activity is practicable.

Background Information

On April 3, 2017, an explosion occurred at the Loy-Lange Box Company in St. Louis, Missouri. The incident occurred when the bottom head of a pressure vessel called a semi-closed receiver (SCR), which was used in the company's steam generation system, catastrophically failed. The SCR was launched in the air as the result of the explosion and landed on a neighboring business. One employee of the Loy Lange Box Company and three members of the public were fatally injured. The U.S. Chemical Safety and Hazard Investigation Board (CSB) investigated this incident and learned during the investigation that the SCR was repaired by an R stamp organization in 2012 five years prior to the incident. During the repair a wasted area of the bottom head of the SCR was flush patched. The cause of the defect was determined to be oxygen pitting corrosion. Evidence gathered during the investigation suggests that the defects in the head were not fully removed during the repair activity. The R stamp organization stated during the investigation that Loy-Lange requested an "emergency repair" following the discovery of a leak from the SCR. The R stamp organization stated further that they interpreted this to mean the repair needed to be completed immediately, presumably so production could resume as normal. The full effect of the R stamp organization's understanding of an "emergency repair" and what bearing that had on the decision they made were not able to be established through the investigation. External pressure to work faster is however understood anecdotally to be determinantal to safety. Full details of the Loy-Lange Box Company Pressure Vessel Explosion are available at this link: https://www.csb.gov/loy-lange-box-company-pressure-vessel-explosion-/ INTERPRETATION 17-01 Subject: Application of Term "Practicable Edition: 2017 Question: May the desire to save time and/or expense be used solely in determining if a repair and/or alteration activity is practicable? Reply: No. The determination of "practicable" shall be based on technical consideration of the nature and scope of repair and/or alteration activities.

Existing Text	**Proposed Text**
This part provides requirements and guidelines that apply when performing repairs and alterations to pressure-retaining items.	This part provides requirements and guidelines that apply when performing repairs and alterations to pressure-retaining items. The financial and/or operational concerns of the owner or user associated with loss of use of equipment in need of repair or alteration must not compromise the integrity of the repair or safety of the owner/user.

	VOTE:						
COMMITTEE	Approved	Disapproved	Abstained	Not Voting	Passed	Failed	Date

Action Item 23-39 Proposed changes

Proposed changes for the 2025 Edition

3.3.1 DEFECT REPAIRS

~~Before a repair is made to a defect in a welded joint or base metal, care should be taken to investigate its cause and to determine its extent and likelihood of recurrence.~~ When determining the repair plan for repairing a defect in a welded joint or base metal, a condition assessment to determine the cause, extent, and likelihood of recurrence of the defect is required depending on the complexity of the defect. The owner or user of the pressure-retaining item is responsible for the selection and application of the condition assessment methodology that is performed. When a condition assessment is performed, it shall be documented on the applicable R-form.

Organizations or qualified individuals with experience in inspection, design, construction, repairs, or failure analysis of pressure-retaining items should be consulted to assist in identifying damage mechanisms and to evaluate the condition assessment results of the pressure-retaining item. NBIC Part 2, Section 4.4 should be used as a guide to aid in this assessment.

When a condition assessment results in an increase in the inspection intervals of the pressure-retaining item, the owner or user shall notify the Jurisdiction, where required, of the new inspection interval and the new inspection intervals shall be documented on the applicable R-form. The owner/user has the responsibility to ensure that all items found during the condition assessment are addressed.

PROPOSED REVISION OR ADDITION

Item No.

A 23-40

Subject/Title

Strengthening Requirements to Ensure Defect Removal

NBIC Location

Part: Repairs and Alterations; Section: 3; Paragraph: 3.3.4.1

Project Manager and Task Group

Source (Name/Email)

Adam Henson / adam.henson@csb.gov

Statement 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.

Background Information

On April 3, 2017, an explosion occurred at the Loy-Lange Box Company in St. Louis, Missouri. The incident occurred when the bottom head of a pressure vessel called a semi-closed receiver (SCR), which was used in the company's steam generation system, catastrophically failed. The SCR was launched in the air as the result of the explosion and landed on a neighboring business. One employee of the Loy Lange Box Company and three members of the public were fatally injured. The U.S. Chemical Safety and Hazard Investigation Board (CSB) investigated this incident and learned during the investigation that the SCR was repaired by an R stamp organization in 2012 five years prior to the incident. During the repair a wasted area of the bottom head of the SCR was flush patched. The cause of the defect was determined to be oxygen pitting corrosion. Evidence gathered during the investigation suggests that the defects in the head were not fully removed during the repair activity. The R stamp organization stated during the investigation that Loy-Lange requested an "emergency repair" following the discovery of a leak from the SCR. The R stamp organization stated further that they interpreted this to mean the repair needed to be completed immediately, presumably so production could resume as normal. To make the repair the R stamp organization cut the SCR shell from the bottom head, leaving the bottom head attached to the skirt. An employee who oversaw the repair stated that they observed pitting corrosion damage in the bottom head. They cut a hole in the center of the head where they believed the corrosion was isolated and applied a flush patch. They believed they removed all corrosion damage through this process. When asked what techniques they relied upon to determine the complete removal of defects the employee replied that they would have been able to see additional pitting and that with the hole cut in the head they were able to match up the patch with the existing metal to verify the thickness of the remaining metal of the head. Besides being able to see differences in the thickness of the patch and the remaining metal of the head, this employee also reported that they would have been able to feel the difference too. Another employee reported measuring the thicknesses of the two pieces with a tape measurer and verified the thickness of both pieces to be ¼ inch. The evidence the CSB gathered demonstrating the likeliness that repair did not remove all defective material from the SCR is discussed in Section 1.6 SCR Post-Failure Examination starting on page 26 of the report. Had all defective material been removed during this repair the incident may not have happened. Full details of the Loy-Lange Box Company Pressure Vessel Explosion are available at this link: https://www.csb.gov/loy-lange-box-company-pressure-vessel-explosion-/ INTERPRETATION 21-13 Subject: Repair of pressure-retaining items without complete removal of defect Edition: 2021 Question: If the characteristics of the defect cannot be fully established, would the provisions of NBIC Part 3, 3.3.4.8 be applicable? Reply: No.

Existing Text	Proposed Text
3.3.4.1 Except as provided in NBIC Part 3, 3.3.4.8, a repair of a defect in a welded joint or base material shall not be made until the defect has been removed. A suitable nondestructive examination (NDE) method, such as magnetic particle (MT) or liquid penetrant (PT), may be necessary to ensure complete removal of the defect. If the defect penetrates the full thickness of the material, the repair shall be made with a full penetration weld such as a double buttweld or single buttweld with or without backing. Where circumstances indicate that the defect is likely to recur, consideration should be given to removing the defective area and installing a flush patch or taking other corrective measures acceptable to the Inspector, and when required, by the Jurisdiction.	**3.3.4.1** Except as provided in NBIC Part 3, 3.3.4.8, a repair of a defect in a welded joint or base material shall not be made until the defect has been removed. A suitable nondestructive examination (NDE) method, such as magnetic particle (MT) or liquid penetrant (PT), may be necessary to ensure complete removal of the defect. After the defect has been removed, the thickness of the remaining base material shall be measured to confirm thickness complies with the original Code of construction. Measurement results shall be documented. If the defect penetrates the full thickness of the material, the repair shall be made with a full penetration weld such as a double buttweld or single buttweld with or without backing. Where circumstances indicate that the defect is likely to recur, consideration should be given to removing the defective area and installing a flush patch or taking other corrective measures acceptable to the Inspector, and when required, by the Jurisdiction.

	VOTE:						
COMMITTEE	Approved	Disapproved	Abstained	Not Voting	Passed	Failed	Date

THE NATIONAL BOARD
OF BOILER AND PRESSURE VESSEL INSPECTORS

PROPOSED REVISION OR ADDITION

Item No.

A 23-41

Subject/Title

Strengthening Requirements for Defect Removal When Patching

NBIC Location

Part: Repairs and Alterations; Section: 3; Paragraph: 3.3.4.6 a) 1) & 2)

Project Manager and Task Group

PM - Aziz Khssassi, B.Schaefer, C.Hopkins, P.Shanks, A.Henson, P.Gilston & L.Ponce

Source (Name/Email)

Adam Henson / adam.henson@csb.gov

Statement of Need

The existing text requires the removal of defective material until sound material is reached but provides no requirements or guidance on means to employ to ensure complete removal of defective material. 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.

Background Information

On April 3, 2017, an explosion occurred at the Loy-Lange Box Company in St. Louis, Missouri. The incident occurred when the bottom head of a pressure vessel called a semi-closed receiver (SCR), which was used in the company's steam generation system, catastrophically failed. The SCR was launched in the air as the result of the explosion and landed on a neighboring business. One employee of the Loy Lange Box Company and three members of the public were fatally injured. The U.S. Chemical Safety and Hazard Investigation Board (CSB) investigated this incident and learned during the investigation that the SCR was repaired by an R stamp organization in 2012 five years prior to the incident. During the repair a wasted area of the bottom head of the SCR was flush patched. The cause of the defect was determined to be oxygen pitting corrosion. Evidence gathered during the investigation suggests that the defects in the head were not fully removed during the repair activity. The R stamp organization stated during the investigation that Loy-Lange requested an "emergency repair" following the discovery of a leak from the SCR. The R stamp organization stated further that they interpreted this to mean the repair needed to be completed immediately, presumably so production could resume as normal. To make the repair the R stamp organization cut the SCR shell from the bottom head, leaving the bottom head attached to the skirt. An employee who oversaw the repair stated that they observed pitting corrosion damage in the bottom head. They cut a hole in the center of the head where they believed the corrosion was isolated and applied a flush patch. They believed they removed all corrosion damage through this process. When asked what techniques they relied upon to determine the complete removal of defects the employee replied that they would have been able to see additional pitting and that with the hole cut in the head they were able to match up the patch with the existing metal to verify the thickness of the remaining metal of the head. Besides being able to see differences in the thickness of the patch and the remaining metal of the head, this employee also reported that they would have been able to feel the difference too. Another employee reported measuring the thicknesses of the two pieces with a tape measurer and verified the thickness of both pieces to be ¼ inch. The evidence the CSB gathered demonstrating the likeliness that repair did not remove all defective material from the SCR is discussed in Section 1.6 SCR Post-Failure Examination starting on page 26 of the report. Had all defective material been removed during this repair the incident may not have happened. Full details of the Loy-Lange Box Company Pressure Vessel Explosion are available at this link: https://www.csb.gov/loy-lange-box-company-pressure-vessel-explosion-/ INTERPRETATION 21-13 Subject: Repair of pressure-retaining items without complete removal of defect Edition: 2021 Question: If the characteristics of the defect cannot be fully established, would the provisions of NBIC Part 3, 3.3.4.8 be applicable? Reply: No.

Existing Text	Proposed Text
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 welded flush patches are shown in NBIC Part 3, Figure 3.3.4.6-a. Nondestructive examination shall be performed in accordance with the requirements from NBIC Part 3, Section 4.2. 2) Before installing a flush patch, defective material shall be removed until sound material is reached. The patch shall be formed to the proper shape or curvature. The edges shall 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.	**3.3.4.6 PATCHES** a) Flush Patches 1) Examples of welded flush patches are shown in NBIC Part 3, Figure 3.3.4.6-a. 2) Defects should be evaluated in accordance with 3.3.1 & 3.3.4.1. 3) ~~Before installing a flush patch, defective material shall be removed until sound material is reached~~. The remaining material shall be free of corrosion and defects such as cracks and laminations and shall be verified through nondestructive examination suitable for providing meaningful results (e.g. MT or PT). The remaining material shall be measured to ensure it is at or above the required minimum thickness. 4) ~~Patches shall be made from a material whose composition and thickness meet the intended service.~~ 5) 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. 6) The patch shall be formed to the proper shape or curvature. 7) The edges of the opening and patch shall be prepared for welding to ensure full penetration welds. A suitable nondestructive examination shall be used to examine the weld preparation faces before assembly and welding. 8) The ~~edges~~ patch shall ~~align~~ be fitted and aligned without overlap. In stayed areas, the weld seams should come between staybolt rows or riveted seams. 9) 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~~. 10) Nondestructive examination shall be performed in accordance with the requirements from NBIC Part 3, Section 4.2. 11) The completed welds shall meet the requirements of the original code of construction.

Commented [LP10]: The goal of this proposal is to provide a means to better understand 3.3.4.6 by:
-separating the paragraph into specific numbered items,
-reordering for a more logical flow,
-adding new item 6) for welding prep and MT/PT requirements, and
-adding an evaluation of existing sound metal for required thickness.

Commented [LP1]: Item 9) on in proposed text

Commented [LP2]: Item 1) in proposed text

Commented [LP3]: Item 10) in proposed text

Commented [LP4]: New item 3) in proposed text. This new item also includes an evaluation of sound metal to ensure tmin is maintained.

Commented [LP5]: New item 7) in proposed text.

Commented [LP6]: New item 8) in proposed text.

Commented [LP7]: New item 4) in proposed text.

Commented [LP8]: New item 5) in proposed text.

Commented [LP9]: New item 11) in proposed text.

	VOTE:						
COMMITTEE	Approved	Disapproved	Abstained	Not Voting	Passed	Failed	Date

PROPOSED REVISION OR ADDITION

Item No.

A 23-56

Subject/Title

Alternate Repair Inspectors

NBIC Location

Part: Repairs and Alterations & Repairs and Alterations; Section: 1 & 1; Paragraph: 1.3.2.a & 1.3.b

Project Manager and Task Group

Source (Name/Email)

Andrew Triplett / triplettal@ornl.gov

Statement of Need

The 2023 Edition revision to 1.3.2.a makes the use of alternate Inspectors applicable only to AIAs. The language should be revised to include OUIOs and FIAs that perform repairs/alterations on their own equipment, as allowed by 1.3.b.

Background Information

The 2023 Edition revision to 1.3.2.a makes the use of alternate Inspectors applicable only to AIAs. The language should be revised to include OUIOs and FIAs that perform repairs/alterations on their own equipment, as allowed by 1.3.b.

Existing Text

Inspections and NBIC Form R Report certifications shall be performed by the same Inspector who authorized the repair or alteration activity. Where this is not possible or practicable, another Inspector may perform these duties; however, in all cases, duties associated within the same scope of work shall be performed by Inspectors employed by the same Authorized Inspection
Agency.

Proposed Text

Inspections and NBIC Form R Report certifications shall be performed by the same Inspector who authorized the repair or alteration activity. Where this is not possible or practicable, another Inspector may perform these duties; however, in all cases, duties associated within the same scope of work shall be performed by Inspectors employed by the same Authorized Inspection Agency, Owner-User Inspection Organization, or Federal Inspection Agency.

	VOTE:						
COMMITTEE	Approved	Disapproved	Abstained	Not Voting	Passed	Failed	Date

PROPOSED REVISION OR ADDITION

Item No.

A 23-59

Subject/Title

NDE Personnel Certifications for Repairs and Alterations

NBIC Location

Part: Repairs and Alterations & Repairs and Alterations; Section: 4 & 4; Paragraph: 4.2.b & 4.2.a

Project Manager and Task Group

Source (Name/Email)

Andrew Triplett / triplettal@ornl.gov

Statement of Need

The 2023 Edition revision to 4.2.a, which revises language about codes to be used for NDE on repairs/alterations (i.e., to codes other than the original construction code), is not reflected in 4.2.b. This creates conflicting requirements between 4.2.a and 4.2.b; in a case where use of the construction code is practicable, but NDE personnel certification to another Code/standard is desirable, 4.2.a would allow this but 4.2.b would not.

Background Information

The 2023 Edition revision to 4.2.a, which revises language about codes to be used for NDE on repairs/alterations (i.e., to codes other than the original construction code), is not reflected in 4.2.b. This creates conflicting requirements between 4.2.a and 4.2.b; in a case where use of the construction code is practicable, but NDE personnel certification to another Code/standard is desirable, 4.2.a would allow this but 4.2.b would not.

Existing Text	**Proposed Text**
NDE personnel shall be qualified and certified in accordance with the requirements of the original code of construction.	NDE personnel shall be qualified and certified in accordance with the requirements of the original code of construction, standard, or specification selected for the repair or alteration of the pressure-retaining item (see NBIC Part 3, 1.2).

	VOTE:						
COMMITTEE	Approved	Disapproved	Abstained	Not Voting	Passed	Failed	Date

PROPOSED REVISION OR ADDITION

Item No.

A 23-61

Subject/Title

Revise NBIC R-2 Report and guide

NBIC Location

Part: Repairs and Alterations & Repairs and Alterations; Section: S9.3; Paragraph: Figure 9.3.1

Project Manager and Task Group

Source (Name/Email)

Benjamin Schaefer / bschaefer@aep.com

Statement of Need

Updates to the R-2 Report and the guide for completing R Report.

Background Information

As directed from the July 2023 R&A meeting. This action is to update the R-2 Report and accompanying guideline to include the following changes. Various staff change requests and to include the work associated with A23-22 (Design only changes).

Existing Text	**Proposed Text**
R-2 Report Form	R-2 Report Form

	VOTE:						
COMMITTEE	Approved	Disapproved	Abstained	Not Voting	Passed	Failed	Date

PROPOSED REVISION OR ADDITION

Item No.

A 23-68

Subject/Title

Changes to Examples of Alterations

NBIC Location

Part: Repairs and Alterations; Section: 3 & 3; Paragraph: 3.4.4.c & 3.4.4.d

Project Manager and Task Group

Source (Name/Email)

Matt Schaser / mschaser@e2g.com

Statement 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.

Background Information

A recent interpretation request (I23-63) has identified a potential for unintended use of paragraph 3.4.4.d (2023). Current wording suggests major changes (changing the type of head) to a vessel design may be viewed as a repair rather than an alteration. It is believed that this is not the intent of the recent (2023) revisions to 3.4.4.d. Updates are required to both 3.4.4.c and 3.4.4.d to limit the scope of 3.4.4.d. The resolution of this action item will be used to justify the response to interpretation I23-63. These 2 items should be move forward together through the committees.

Existing Text

3.4.4.c The addition of new nozzles or openings in a boiler or pressure vessel except those classified as repairs; 3.4.4.d A change in the dimensions or contour of a pressure-retaining item that decreases its pressure retaining
capability;

Proposed Text

3.4.4.c The addition of new openings or components (nozzle, head, flange, etc.) in a boiler or pressure vessel that were not considered in its original design analysis, except those classified as repairs; 3.4.4.d A change in the dimensions of a pressure-retaining item that decreases its pressure retaining capability;

	VOTE:						
COMMITTEE	Approved	Disapproved	Abstained	Not Voting	Passed	Failed	Date

THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS

PROPOSED REVISION OR ADDITION

Item No.

A 23-69

Subject/Title

Temporary Location

NBIC Location

Project Manager and Task Group

Ray Miletti (PM), Eric Cutlip, Marty Toth, Jamie Walker

Source (Name/email)

Statement of Need

"Field" site under the current definition could be multiple rented or leased spaces used for repairs/alterations, where there is no single or specific customer or job, but rather the locations(s) are used for conducting repair/alteration activities by personnel employed by the Certificate Holder on a continual basis.

Background Information

NB-415 has been revised and issued. Section 9.0 has added definitions for Shop Location, Temporary Location and Field Site. Shop Location and Field Site duplicate definitions already in Part 3, Temporary Location is a new definition.

Further Footnote 1 of section 2.2 in NB-415 states: '*A separate application is required for temporary locations (See Section 9.0 of this procedure) as permitted by National Board internal policies*.', and Section 6.4 requires requests for the use of temporary locations to be submitted to NB for approval, further the use of temporary locations not approved is prohibited.

This action proposes to revise the entries for the definitions of Field and Shop in Section 9.1 and add a new entry for Temporary Location. The definitions will reference NB-415 Section 9.

This action will require balloting for Parts 1, 2, 3 and 4.

Existing Text	**Proposed Text**
9.1 DEFINITIONS	**9.1 DEFINITIONS**
Field - A temporary location, under the control of the Certificate Holder, that is used for repairs and/or alterations to pressure-retaining items at an address different from that shown on the Certificate Holder's *Certificate of Authorization.*	**Field** - See NB-415, Accreditation of "R" Repair Organizations, Section 9.0.~~A temporary location, under the control of the Certificate Holder, that is used for repairs and/or alterations to pressure-retaining items at an address different from that shown on the Certificate Holder's *Certificate of Authorization.*~~
Shop - A permanent location, the address that is shown on the *Certificate of Authorization*, from which a Certificate Holder controls the repair and/or alteration of pressure-retaining items.	**Shop** - See NB-415, Accreditation of "R" Repair Organizations, Section 9.0.~~A permanent location, the address that is shown on the *Certificate of Authorization*, from which a Certificate Holder controls the repair and/or alteration of pressure-retaining items~~.
	Temporary Location - See NB-415, Accreditation of "R" Repair Organizations, Section 9.0.

	VOTE						
Committee	Approved	Disapproved	Abstained	Not Voting	Passed	Failed	Date

PROPOSED REVISION OR ADDITION

Item No.

A 23-76

Subject/Title

Revise paragraph 3.3.4.6 Patches for Clarity.

NBIC Location

Part: Repairs and Alterations; Section: 3; Paragraph: 3.3.4.6 a)

Project Manager and Task Group

Source (Name/Email)

Luis Ponce / lponce@nationalboard.org

Statement of Need

Requirements do not include specific note to ensure sound metal meets minimum design thickness. Further the order of the rules is not logical, starts with finished weld, grinding and NDE, then addresses defect removal, preparation etc.

Background Information

The reason for this change came to light because of the CSB's report at the July 2023 NBIC Meeting in St. Louis, MO and the need to ensure the method for flush patch repairs are clearer for repair organizations and inspectors.

Existing Text

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 welded flush patches are shown in NBIC Part 3, Figure 3.3.4.6-a. Nondestructive examination shall be performed in accordance with the requirements from NBIC Part 3, Section 4.2. 2) Before installing a flush patch, defective material shall be removed until sound material is reached. The patch shall be formed to the proper shape or curvature. The edges shall 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.

Proposed Text

a) Flush Patches 1) Examples of welded flush patches are shown in NBIC Part 3, Figure 3.3.4.6-a. 2) Defects should be evaluated in accordance with 3.3.1. 3) Before installing a flush patch, defective material shall be removed until sound material is reached. The sound material shall be evaluated to ensure minimum design thickness is maintained. Sound material is that which is free of corrosion and defects, such as cracks and laminations. 4) Patches shall be made from a material whose composition and thickness meet the intended service. 5) 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. 6) The edges of the opening and patch shall be prepared for welding to ensure full penetration welds. A suitable nondestructive examination (NDE) method, such as magnetic particle (MT) or liquid penetrant (PT) shall be used to examine the weld preparation faces before assembly and welding. 7) The patch shall be formed to the proper shape or curvature. 8) The patch shall be fitted and aligned without overlap. In stayed areas, the weld seams should come between staybolt rows or riveted seams. 9) The weld around a flush patch shall be a full penetration weld. After welding the accessible surfaces shall be ground flush where required by the applicable original code of construction. 10) Nondestructive examination shall be performed in accordance with the requirements from NBIC Part 3, Section 4.2. 11) The completed welds shall meet the requirements of the original code of construction.

	VOTE:						
COMMITTEE	Approved	Disapproved	Abstained	Not Voting	Passed	Failed	Date

PROPOSED REVISION OR ADDITION

Item No.

A 23-77

Subject/Title

Performance of Original NDE During Repairs and Alterations

NBIC Location

Part: Repairs and Alterations; Section: 4; Paragraph: 4.2.a

Project Manager and Task Group

PM – Andrew Triplett, R. Collins, S. Frazier, J. Walker

Source (Name/Email)

Andrew Triplett / triplettal@ornl.gov

Statement 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.

Background Information

The exact NDE performed on every weld for ASME boilers and pressure vessels is not a required piece of information on most Manufacturer's Data Reports, which is often the only piece of paper available to describe what the Manufacturer did. While some forms, such as the U-1/U-1A, ask for radiography information about specific welds (such as the shell and head longitudinal or circumferential welds), the NDE conducted on other welds (such as nozzles, couplings, attachment welds, etc.) is not mandatory information, as well as non-RT NDE conducted anywhere on the vessel. In addition, the term "requirements" in 4.2.a could easily be read as applying to not only the required NDE from the code, but also whatever additional/alternative NDE was performed under the Manufacturer's quality program. For instance, some Manufacturers elect to perform extra NDE (such as progressive surface NDE on thicker or more complex welds) to ensure the work is progressing as expected, and to preclude rework; this could easily be considered "required" NDE based on what the Manufacturer decided to do during construction, whether called for by the construction code or not.

Existing Text	Proposed Text
4.2 NONDESTRUCTIVE EXAMINATION a) 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, standard, or specification selected for the repair or alteration of the pressure-retaining item (see NBIC Part 3, 1.2). 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.	**4.2 NONDESTRUCTIVE EXAMINATION** a) 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, standard, or specification selected for the repair or alteration of the pressure-retaining item (see NBIC Part 3, 1.2). Weld repairs and alterations shall be subjected to the same nondestructive examination ~~requirements~~ as the original welds, as determined by the code of construction for the pressure-retaining item, the Manufacturer's Data Report, and any other available documentation. Where this is not possible or practicable, or where there is not enough information available to determine the original NDE, alternative NDE ~~methods~~ acceptable to the Inspector and the Jurisdiction ~~where the pressure-retaining item is installed~~, when required, may be used~~,~~ provided that all other requirements of this section are met.

	VOTE:						
COMMITTEE	Approved	Disapproved	Abstained	Not Voting	Passed	Failed	Date

Item 23-83

This item proposes to **relocate** three **existing** repair methods and two existing alteration methods to the new Engineered Repairs and Alterations Supplement which was approved by the Main Committee last August.

3.3.4.3 WASTED AREAS

~~e) External Weld Metal Buildup~~

All text in 3.3.4.3(e), including Figure 3.3.4.3-c, will be relocated to paragraph SXX.3.1 of the new Engineered Repairs and Alteration Supplement as indicated on page 2 of this proposal.

~~**3.3.4.8 REPAIR OF PRESSURE-RETAINING ITEMS WITHOUT COMPLETE REMOVAL OF DEFECTS**~~

All text in 3.3.4.8 will be relocated to paragraph SXX.3.2 of the new Engineered Repairs and Alteration Supplement as indicated on page 2 of this proposal.

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

All text in 3.3.5 will be relocated to paragraph SXX.3.3 of the new Engineered Repairs and Alteration Supplement as indicated on page 2 of this proposal.

~~**3.4.3 ENCAPSULATION**~~

All text in 3.4.3 will be relocated to paragraph SXX.4.1 of the new Engineered Repairs and Alteration Supplement as indicated on page 2 of this proposal.

~~**3.4.5 ALTERATION OF ASME CODE SECTION VIII, DIVISION 2 OR 3, PRESSURE VESSELS**~~

All text in 3.4.5 will be relocated to paragraph SXX.4.2 of the new Engineered Repairs and Alteration Supplement as indicated on page 2 of this proposal.

SXX.3 Engineered Repair Methods

SXX.3.1 EXTERNAL WELD METAL BUILDUP

a) Pressure-retaining items that have localized internal thinning due to erosion and/or corrosion and where the internal surface is not readily accessible may be weld repaired by depositing weld metal on the external surface of the item as shown in NBIC Part 3, Figure SXX.3.1-a. This method of repair is subject to approval by the Inspector and the Jurisdiction, where required.

b) All of the following conditions shall apply for this repair method to be permitted:

1) The component to be repaired shall be a ferrous material;

2) The maximum design temperature of the repaired component shall not exceed 650°F (340°C), and the minimum design temperature shall not be less than -20°F (-29°C);

3) The pressure-retaining item shall be volumetrically examined for cracks in the area to be weld repaired. If cracks are detected, this repair method shall NOT be used;

4) The WPS followed shall be qualified for weld metal buildup in accordance with ASME Section IX. The nominal chemical analysis of the deposited weld metal shall be equivalent to the base material that is to be repaired. In addition, the nominal tensile strength of the deposited weld metal shall be equal to or exceed the specified minimum tensile strength and shall be based on the requirements of the welding consumable. If butt welds in the component being overlaid required postweld heat treatment by the code of construction, the WPS followed for the weld buildup shall be qualified with PWHT;

5) The pressure-retaining item shall be taken out of service prior to performing the weld metal buildup. The owner of the pressure-retaining item shall evaluate the flammability, volatility, or potential reaction of the contents that were in the vessel to ensure safe working conditions during weld repair. When required by the results of this evaluation, the pressure-retaining item shall be drained of its contents to the extent necessary to make the repair;

6) This method may be used more than once in the same areas to repair locally thinned areas; however, the cumulative weld buildup for all repairs shall not exceed the thickness (t) of the component at any point; and

7) Repairs using this method shall not cover more than 25% of the circumference of the component.

c) External weld buildup shall be applied in accordance with the following requirements:

1) The area to be repaired shall be ultrasonically scanned for wall thickness, and the location and size of the thinned region shall be mapped;

2) The area requiring repairs and the boundaries of the weld buildup shall be marked on the external surface of the component;

3) The general design of the external weld buildup shall be in accordance with NBIC Part 3, Figure SXX.3.1-a. The finished weld buildup shall be circular, oval, or rectangular in shape;

4) The weld buildup shall extend, at full thickness, a minimum distance B in each direction beyond the boundaries of the thinned base metal area.

a. $B = 3/4 \sqrt{(Rt_{nom})}$

b. R = outer radius of the component, or D/2

c. t_{nom} = nominal wall thickness of the component

The thickness shall be sufficient to maintain the predicted life of the repair. Any corrosion allowance that is determined to be necessary shall be added to the value of B.

5) All edges of the weld buildup shall be tapered to the existing contour of the component, at a maximum angle (a) of 45°;

6) The thickness of the weld buildup shall be uniform except along tapered edges as welded surfaces are acceptable, provided they are free of coarse ridges and valleys and are suitable for any required nondestructive examinations;

7) All corners of the weld buildup shall have a minimum radius (r), not less than the overlay thickness;

8) Any corrosion allowance that is determined to be necessary shall be added to the thickness of the weld buildup;

9) The thickness (W) of the weld deposit plus the remaining wall thickness in the affected area (μ) of the component at its thinnest point shall not exceed the nominal wall thickness (t) of the component. This shall be verified by ultrasonic methods;

10) Final dimension and contour of the weld buildup may be achieved by grinding or machining. This work may be done before or after any PWHT;

11) The weld buildup shall be examined by liquid penetrant inspection or wet fluorescent magnetic particle inspection. If the buttwelds in the component being built up were required to be volumetrically examined during the original construction, the built-up area shall be similarly volumetrically examined;

12) 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 the component or 8 in. (200 mm). The length of a rectangular patch is not limited; and

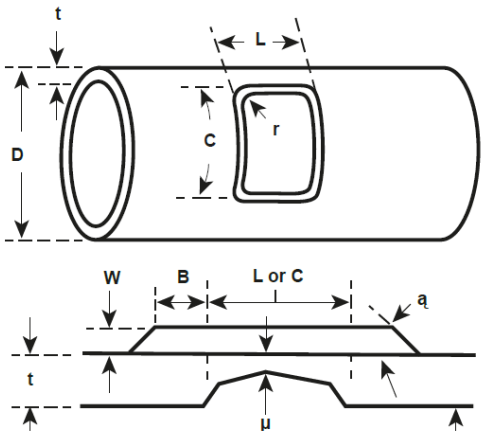
13) The distance between the weld toes of the multiple weld buildup regions on a component's outer diameter surface area shall not be less than 3/4 $\sqrt{}$(Rt).

14) Test and examination methods shall be in accordance with Part 3, Section 4.

15) Documentation and distribution requirements shall be in accordance with Part 3, Section 5.

FIGURE SXX.3.1-a

EXTERNAL OVERLAY TERMS AND DEFINITIONS



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

SXX.3.2 REPAIR OF PRESSURE-RETAINING ITEMS WITHOUT THE COMPLETE REMOVAL OF DEFECTS

a) There may be cases where removal of a defect in a pressure-retaining item is not practical at the time the defect is found. In such cases, with approval of the Inspector and, when required, the Jurisdiction, an engineering evaluation shall be performed to determine the scope of the repair and impact to safety prior to returning the pressure-retaining item to service for a specified period of time. The engineering evaluation shall be performed by an organization with demonstrated competency in defect (and flaw) characterization of pressure-retaining items. The method of defect evaluation and time interval for returning the pressure-retaining item back to service shall be as agreed upon by the Inspector, and when required, the Jurisdiction. The specified period of time the defect can remain in service after weld repair shall be based on no measureable defect growth during subsequent inspections, or a period of time as specified by the Jurisdiction, if applicable. This repair method is not permitted for vessels used in lethal service, vessels designed for high-cycle operation or fatigue service, compressed air storage, and in cases where high stress concentration cannot be reduced by weld repair. This repair method is not permitted for DOT vessels.

b) One or more fitness-for-service engineering evaluation methods as described in NBIC Part 2, 4.4 shall be used to determine whether the defect may remain, either in part or in whole, in the pressure-retaining item. If it is determined that the defect can remain in the item, a risk-based inspection program shall be developed as described in NBIC Part 2, 4.5 to assure inspection of the defect and monitoring of defect growth over time. This program shall be a controlled and documented inspection program that specifies inspection intervals as agreed upon with the Inspector and, when required, the Jurisdiction, and shall be maintained until the defect can be completely removed and the item repaired.

c) The following requirements shall apply to the weld repair of pressure-retaining items without complete removal of defects:

   1) Engineering evaluation of the defect in the pressure-retaining item shall be conducted using one or more fitness-for-service condition assessment method(s) as described in NBIC Part 2, 4.4. Engineering evaluation of the condition assessment results shall be performed by an organization that has demonstrated industry experience in evaluating pressure-retaining items, if the fitness-for-ser- vice engineering evaluation requires finite element analysis (FEA), the requirements in NBIC Part 2, 4.6 and NBIC Part 2, Supplement 11 shall be met.

   2) If engineering evaluation indicates a defect can remain in the pressure-retaining item, a risk-based inspection program shall be developed and implemented based on review and acceptance by the Inspector and, when required, the Jurisdiction. The risk-based inspection program shall be in accordance with the requirements in NBIC, Part 2, 4.4.

   3) The fitness-for-service condition assessment and risk-based inspection programs shall remain in effect for the pressure-retaining item until such time that the defect can be completely removed and the item repaired. The fitness-for-service condition assessment method, results of assessment, and method of weld repair, if applicable, shall be documented on a Report of Fitness for Service Assessment (FFSA) Form as described in NBIC Part 2, 4.4.1 and shall be filed with the Jurisdiction, when required.

   4) When weld repairs are performed without complete removal of the defect(s), this shall be noted on the Form R-1 in the description of the work. The “R” Stamp Holder performing the weld repairs shall provide detailed information on the Form R-1, describing the method, extent, and include the specific location of the weld repair on the item.

   5) The interval to re-inspect or remove the item from service or perform weld repair shall be deter- mined based on a risk-based inspection program developed and implemented as required by

NBIC Part 2, 4.5. The inspection interval shall not exceed the remaining life of the item, and shall be documented on the Form NB-403 and in the Remarks section of the Form R-1. The Form NB-403 shall be affixed to the Form R-1. A National Board Commissioned Inspector holding an "R" endorsement as described in NB-263, RCI-1 shall sign both the Form R-1 and the attached Form NB-403.

6) A copy of the completed Form R-1 with the completed Form NB-403 attached may be registered with the National Board, and when required, filed with the Jurisdiction where the item was installed.

SXX.3.3 REPAIR OF ASME SECTION VIII, DIVISION 2 OR DIVISION 3 PRESSURE VESSELS

a) 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.

b) Repair Plan

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

1) 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 Data 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 Data 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 certified during initial construction.

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

2) 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.

SXX.4 ENGINEERED ALTERATION METHODS

SXX.4.1 ENCAPSULATION

Encapsulation is a method used to maintain the pressure retaining capability of piping and valves (with the exception of firetube boilers) by fabricating a new pressure containing boundary over the item in the form of a "welded leak box" as described by ASME PCC-2, Article 204.

a) Except as required in SXX.4.1 c) 1), ASME PCC-2 should be used as a guideline for the design of the welded leak box and fabrication shall be in accordance with the original code of construction, when practicable. Design of the encapsulation shall consider original design conditions, taking into account current service conditions and damage mechanisms. Use of this method shall be acceptable to the inspector and when required, the jurisdiction.

b) The “R” Certificate Holder responsible for the design of the encapsulation shall ensure a Fitness for Service Assessment (FFSA) has been performed on the portion of the item being encapsulated in accordance with NBIC Part 2, 4.4.1, supporting the continued service of the item. The leak box shall not remain in place beyond the calculated remaining life of the encapsulated portion of the pressure retaining item.

1) The remaining life of the encapsulated pressure retaining item shall be documented on the Report of FFSA in the Remarks section. The Report of FFSA Form shall be affixed to the Form R-2 and identified in the Remarks section.

2) The leak box shall fully encapsulate the thinned or leaking area, as specified in the FFSA, to the distance where the minimum required metal thickness is verified. Wall thickness shall be verified in the area to be welded.

3) A welded leak box shall not be used to encapsulate a crack unless it has been removed and repaired in accordance with Part 3, Paragraph 3.3.4.2 a).

c) Hazards associated with welding on degraded components should be addressed with the Owner-User by the use of engineering controls, administrative controls, and personal protective equipment.

1) When the pressure retaining item will remain in service while implementing this method, the requirements and limitations described within ASME PCC-2, Part-1 shall be used in conjunction with the Welded Leak Box Repair article in ASME PCC-2, Part-2, Article 210.

2) API RP-2201, “Safe Hot Tapping Practices in the Petroleum and Petrochemical Industries” may be used as a guideline for identifying hazards associated with welding to a component that is under pressure, including service restrictions.

d) Visual examination shall be in accordance with the NBIC Part 3, 4.4.1 e).

e) Completion of the Form R-2 shall follow the requirements for preparation, distribution, and registration as described in Part 3, Section 5.

SXX.4.2 ALTERATION OF ASME SECTION VIII, DIVISION 2 OR 3, PRESSURE VESSELS

a) Alteration Plan

1) Engineer Review and Certification

a. 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.

b. 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 Manufacturer’s Design Report to be certified 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.

2) User’s Design Specification

If the alteration is such that the work is not compatible with, or changes one or more requirement(s) of the original user’s design specification, the user’s design specification shall be revised by the user with the new parameters or changes. The revisions shall be 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.

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

3) Manufacturer's Design Report

   a. The "R" Certificate Holder shall prepare, or cause to have prepared a supplement to the Manufacturer's Design Report to reconcile the new parameters or changes with the User's Design Specification.

   b. The supplement to the Manufacturer's Design Report shall be 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.

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

4) Authorized Inspection Agency Acceptance

   Following review and certification, the alteration 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-2.

PROPOSED REVISION OR ADDITION

Item No.

A 23-86

Subject/Title

Revision to Part 3 DOT Supplement re-write

NBIC Location

Part: Repairs and Alterations; Section: 6; Paragraph: S6.5 and S6.6

Project Manager and Task Group

Source (Name/Email)

Robert Underwood / robert_underwood@hsb.com

Statement of Need

There is a need to revise two sections of Item 20-67 (approved by Main Committee on 3/24/2023) to reflect DOT requirements and bring the sections in line with intent interpretation I23-55.

Background Information

This item relates to the intent interpretation item 23-55.

Existing Text	Proposed Text
S6.5 Authorization The Inspector's authorization to perform a repair, alteration, or modification shall be obtained prior to initiation of the work to be performed on a transport tank. When required by the Competent Authority the Inspector providing the authorization shall be a Registered Inspector. Additional requirements are specified in NBIC Part 3, 1.3.1 and 1.3.2. S6.6 Inspection Inspection and certification shall be made by an Inspector holding an appropriate National Board Commission as required by NBIC Part 3, 1.3.	S6.5 Authorization The Inspector's authorization to perform a repair, alteration, or modification shall be obtained prior to initiation of the work to be performed on a transport tank. Additional requirements are specified in NBIC Part 3, 1.3.1 and 1.3.2. S6.6 Inspection Inspection and certification shall be made by an Inspector holding an appropriate National Board Commission as required by NBIC Part 3, 1.3, and when required by the Competent Authority the Inspector providing the authorization shall be a Registered Inspector.

	VOTE:						
COMMITTEE	Approved	Disapproved	Abstained	Not Voting	Passed	Failed	Date