



**THE NATIONAL BOARD
OF BOILER AND PRESSURE VESSEL INSPECTORS**

NATIONAL BOARD INSPECTION CODE SUBGROUP REPAIRS & ALTERATIONS

Minutes

**Meeting of January 13, 2026
New Orleans, LA**

These minutes are subject to approval and are for committee use only. They are not to be duplicated or quoted for other than committee use.

The National Board of Boiler & Pressure
Vessel Inspectors 1055 Crupper Avenue
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1. Call to Order

The meeting was called to order at 8:00 a.m. Central Time in Lafitte AB on the 1st floor of the hotel by Chair Underwood.

2. Roll call of Members and Introduction of Visitors

Secretary Hellman took roll of members and visitors. ([Attachment 1](#))

3. Check for a Quorum

A quorum was established with all 23 of the SG R&A members present.

4. Announcements

- This meeting marks the end of Cycle C for the 2027 NBIC edition.
 - Last cycle for LBs.
- The National Board will be hosting a reception on Wednesday evening from 5:30 p.m. to 7:30 p.m. at The Hard Rock Café on Bourbon Street.
- The National Board will be hosting breakfast and lunch on Thursday for those attending the Main Committee meeting. Breakfast will be served from 7:00 a.m. to 8:00 a.m. in the Atrium on the 2nd floor of the hotel, and lunch will be served at the same location 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, powerpoints, etc.) to the NBIC SharePoint site (nationalboard.sharepoint.com/sites/NBIC) **prior to the meeting**.
 - Note that access to the NBIC SharePoint site is limited to committee members only.
 - ALL powerpoint attachments/presentations must be sent to the NBIC Secretary for approval prior to the meeting.
 - Contact Jonathan Ellis (nbicsecretary@nbbi.org) for any questions regarding NBIC SharePoint access.
- When possible, please submit proposals in Word format showing “strike through/underline.” Project Managers: please ensure any proposals containing text from previous NBIC editions are updated with text from the most current edition.
- If you'd like to request a new Interpretation or Action item, do so on the National Board Business Center.
 - Anyone, member or not, can request a new item.
- As a reminder, anyone who would like to be considered for membership of a group or committee:
 - Should attend at least two meetings prior to being put on the agenda for membership consideration. The nominee may be placed on the agenda for voting during their third meeting, pending the Chair's approval.
 - The nominee must submit the formal request along with their resume to the NBIC Secretary **PRIOR TO** the meeting. nbicsecretary@nbbi.org
 - If elected by the membership, the member will serve a term of three years.
- Thank you to everyone who registered online for this meeting. The online registration is very helpful for planning our reception, meals, room setup, etc. It is also a good way to make sure we have the most up-to-date contact information. Please continue to use the online registration for each meeting.
- NBBI Committee Code of Conduct requirements review.

5. Awards and Special Recognitions - None

6. **Adoption of the Agenda** – The Agenda was UA with the added revisions listed below:
 - **Added** Update from NR TG
 - **Added** consideration of new Member, Mr. J. Bates (Labor)
 - o **NOTE: Other** Interest Categories not being considered at this time, however the SG currently does not have representation by the “Labor” interest category.
 - **Added** Officer Nomination – Ben Schafer (NB Cert. Holder) for consideration as Vice Chair
 - **Added Items: A25-83** (Edits to NBIC Part 3, 2.5.3.4 Welding Method 4), **A25-84** (Edits to NBIC Part 3, 2.5.3), and **A25-85** (Inclusion of Grade 92 into 2.5.3.6 and Supplement 8)
 - **Added Discussion Item** A25-23 from Part 2 SG
7. **Approval of the Minutes of the July 2025 Meeting**

A motion was made and seconded to adopt the agenda and was unanimously approved (UA).
8. **Review of Rosters**
 - a. **Membership Nominations**

Jonathan Bates (Labor) was voted to become a member of the SG R&A and was UA.
 - b. **Membership Reappointments**

The following Subgroup memberships were UA for reappointment: Mr. Louis Dutra, Mr. Aziz Khssassi, and Mr. Walt Sperko.
 - c. **Officer Nominations**

Mr. Ben Schaefer (NBIC Cert. Holder) was UA for Vice Chair.
 - d. **Resignations**

The following Subgroup members resigned from SG R&A: Mr. Craig Hopkins, Mr. Marty Toth, Mr. Tom White.
9. **NR TG Update** – L. Ponce and R. Spuhl provided an update of NR TG activities.

10. Action Items

Item Number: A21-53	NBIC Location: Part 3, S8.5 a)	Attachment 2
<p>General Description: Post Repair Inspection of weld repairs to CSEF steels</p> <p>Subgroup: Repairs and Alterations</p> <p>Task Group: P. Gilston (PM), E. Cutlip, A. Triplett</p> <p>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.</p> <p>SG R&A July 2025 Meeting Action: P. Gilston presented Rev. 4 of the proposal. Slight revisions were made, and the proposal was UA as revised.</p> <p>SC R&A July 2025 Meeting Action: P. Gilston presented a proposal that was revised by the SC. This was UA to be sent to SC LB for a vote.</p> <p>UPDATE: Failed SC R&A LB 1/9/26 - (No Quorum)</p> <p>SG R&A Jan. 2026 Meeting Action: P. Gilston presented Rev 6 of the proposal. Slight editorial changes were made and the item was UA as revised.</p>		

Item Number: A23-21	NBIC Location: Part 3, 3.3.4.9	No Attachment
<p>General Description: Boiler tube plug guidelines and inclusion or watertube boilers</p> <p>Subgroup: Repairs and Alterations</p> <p>Task Group: S. Lombardo (PM), P. Gilston, A. Triplett T. White, J. Ferriera, L. Dutra</p> <p>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.</p> <p>SG R&A July 2025 Meeting Action: P. Gilston presented a PR.</p> <p>SG R&A Jan. 2026 Meeting Action: P. Gilston presented a PR. L. Dutra added to the TG</p>		

Item Number: A23-35	NBIC Location: All Parts, 9.1	Attachment 3
<p>General Description: Definition of "non-load bearing attachment" (All Parts)</p> <p>Subgroup: Repairs and Alterations</p> <p>Task Group: T. White (PM), A. Khssassi , J. Walker, P. Lentzer</p> <p>Explanation of Need: The term "nonload bearing attachment" is used as a basis for determining a routine repair but is not defined in the NBIC.</p> <p>SG R&A July 2025 Meeting Action: T. White presented a PR.</p> <p>SG R&A Jan. 2026 Meeting Action: A. Khssassi presented a proposal with changes to 3.3.2 e) 2) to add a description of “non-load bearing attachments”. Sect. VIII Div. 2 defines this term already and P. Shanks asked if this definition can be used. A. Khssassi revised the proposal (Rev 5) and after much discussion and revisions, the item was Approved with 2 negs (J. Siefert, B. Schaefer)</p>		

Item Number: A23-61	NBIC Location: Part 3, S9.3	No Attachment
<p>General Description: Revise NBIC R-2 Report and guide</p> <p>Subgroup: Repairs and Alterations</p> <p>Task Group: B. Schaefer (PM), T. LeBeau, S. Marks</p> <p>Explanation of Need: Updates to the R-2 Report and the guide for completing R Report.</p> <p>SG R&A July 2025 Meeting Action: B. Schaefer presented a PR. A proposal that was revised based on discussion. Additional revisions will be made with the intention of sending them to SG LB.</p> <p>SG R&A Jan. 2026 Meeting Action: B. Schaefer presented a PR. Additional changes to the R Form and Guide are being made and will be presented later.</p>		

Item Number: A23-77	NBIC Location: Part 3, 4.2 a)	Attachment 4
<p>General Description: Performance of Original NDE During Repairs and Alterations</p> <p>Subgroup: Repairs and Alterations</p> <p>Task Group: T. White (PM), S. Frazier, J. Walker, R. Collins, P. Becker, P. Lentzer, A. Triplett</p> <p>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.</p> <p>SG R&A July 2025 Meeting Action: T. White presented a PR.</p> <p>SG R&A Jan. 2026 Meeting Action: A. Triplett presented a proposal that combined A23-36, A23-59, and A23-77 and the current 2025 NBIC text. Specific changes regarding not having RI prior approval was removed and additional editorial changes were made. The proposal was UA as revised.</p>		

Item Number: A24-17	NBIC Location: Part 3, 5.7.5 b)	Attachment 5
<p>General Description: Specific Requirements For Stamping And Nameplates</p> <p>Subgroup: Repairs and Alterations</p> <p>Task Group: S. Marks (PM), A. Khssassi, J. Ferreira and T. LeBeau</p> <p>Explanation of Need: 2023 ASME Section VIII-Div 1 UG-119(c)(5) has been revised to allow for the use of mechanical etching or laser annealing on nameplates.</p> <p>SG R&A July 2025 Meeting Action: B. Schaefer presented a proposal that was revised and UA by the SG.</p> <p>SC R&A July 2025 Meeting Action: B. Schaefer presented a proposal that was revised and Approved w/1 Neg (K. Moore)</p> <p>MC July 2025 Meeting Action: To be LB to MC.</p> <p>UPDATE: Failed MC LB (4-11-1)</p> <p>SG R&A Jan. 2026 Meeting Action: B. Schaefer presented. Stacy Marks discussed another item (A25-51) addresses some of this in the 1.5 of Part 3. Instead of combining these items into a single proposal, Stacy Marks was made the PM for both items to ensure they are compatible and meet the intent of the NBIC. B. Shaefer (newly elected VC this meeting) was removed from the TG as the PM. After revisions, the proposal was Approved UA.</p>		

Item Number: A24-18	NBIC Location: Part 3, 9.1	Attachment 6
<p>General Description: Definition of Controlled Fill</p> <p>Subgroup: Repairs and Alterations</p> <p>Task Group: P. Gilston (PM), A. Triplett, R. Collins, F. Johnson</p> <p>Explanation of Need: Interpretation item I 23-79 addresses the use of the term ‘controlled fill’ in relation to welding method 6. The term is used in 2.5.3 d in relation to welding method 6 and more specifically in Supplement 8. Supplement 8 gives a lot of detail in schematics about a controlled fill in terms of weld bead placement, its use in controlling heat input etc., but in Welding Method 6 the term is not specifically used, but direction for welding is given, typically preheats are specified, electrode size for SMAW, and the use of stringer beads only.</p> <p>SG R&A July 2025 Meeting Action: P. Gilston presented a previous proposal that was revised based on discussion and was UA by the SG. This is a definition (all Parts), so a LB will go to Parts 1, 2, and 4.</p> <p>Update: A revised proposal will be presented to all four SGs during the Jan. 2026 meeting.</p> <p>SG R&A Jan. 2026 Meeting Action: P. Gilston presented a proposal that was UA by the SG. This will go to All SG’s via LB. (Parts 1, 2, 4)</p>		

Item Number: A24-20	NBIC Location: Part 3, 9.1	No Attachment
<p>General Description: Define "Engineered Repairs" and "Engineered Alterations"</p> <p>Subgroup: Repairs and Alterations</p> <p>Task Group: M. Schaser (PM), B. Ray, R. Underwood, B. Boseo, D. Marek, J. Siefert, P. Becker</p> <p>Explanation of Need: The new supplement dealing with "Engineered Repairs and Alterations" (A21-45) will impact Part 3 Section 1, the NB-415, QRRs, the application process for Certificate Holders, and other documents to be determined. Defining "Engineered Repairs" and "Engineered Alterations" clarify the intent for these new scopes.</p> <p>SG R&A July 2025 Meeting Action: M. Schaser presented a PR, new “Advanced Repairs” items can now move forward.</p> <p>SG R&A Jan 2026 Meeting Action: M. Schaser presented a motion to Close w/No Action. - UA</p>		

Item Number: A24-21	NBIC Location: Part 3, 9.1	Attachment 7
<p>General Description: Engineered Repairs and Alterations - Section 1 Scope and Manual reqs</p> <p>Subgroup: Repairs and Alterations</p> <p>Task Group: M. Schaser (PM), B. Ray, R. Underwood, B. Boseo, D. Marek, J. Siefert, P. Becker</p> <p>Explanation of Need: The scope of "Engineered Repairs and Alterations" (A21-45) needs to be clarified in 1.4.1 d) and reflected in the scope statement requirements for manuals in 1.5.1 a).</p> <p>SG R&A July 2025 Meeting Action: M. Schaser presented a PR.</p> <p>SG R&A Jan. 2026 Meeting Action: M. Schaser presented a proposal that was discussed regarding defining “Advanced Repairs” vs “Basic Repairs”. After lengthy discussion on S11 and how current Cert. Holders would receive this change, the proposal was ultimately voted on. The proposal was Approved with 2 Negs (T. Seime and L. Dutra).</p>		

Item Number: A24-96	NBIC Location: Part 3, 5.5 a)	Attachment 8
<p>General Description: Add examples of repairs and alterations specific to Electrochemical Stacks</p> <p>Subgroup: Repairs and Alterations</p> <p>Task Group: A. Triplett (PM), R. Collins, R. Miletti</p> <p>Explanation of Need: With inclusion and initial deployments of electrochemical stacks as U Stamped pressure vessels under ASME BPVC Section VIII Division 1 and Code Case 3078, these stacks are starting to be shipped and registered with the National Board. Some basic examples of allowed repairs are needed to help guide an understanding of limitations for electrochemical stacks.</p> <p>SG R&A July 2025 Meeting Action: A. Triplett presented, and this will be sent to SG LB once the proposal can be reviewed by an ECS subject matter expert. This was a PR.</p> <p>UPDATE: READY FOR SC - Passed SG R&A LB 10/31/25 (18-0-0)</p> <p>SG R&A Jan. 2026 Meeting Action: A. Triplett presented a proposal that was revised and UA.</p>		

Item Number: A24-98	NBIC Location: Part 3, 2.5.2	No Attachment
<p>General Description: Review and revise the PWHT Requirements in 2.5.2</p> <p>Subgroup: Repairs and Alterations</p> <p>Task Group: P. Gilston (PM), M. Schaser, W. Sperko</p> <p>Explanation of Need: Simplify PWHT requirements in 2.5.2.</p> <p>July 2025 Meeting Action: P. Gilston presented a PR.</p> <p>Update: SC R&A Rvw & LB closed 12/31/25 w/ 2 comments.</p> <p>SG R&A Jan. 2026 Meeting Action: P. Gilston presented that revisions based on the comments will be discussed at SC.</p>		

Item Number: A25-18	NBIC Location: Part 3, 5.7.5	No Attachment
<p>General Description: Requirements for Stamping and Nameplates</p> <p>Subgroup: Repairs and Alterations</p> <p>Task Group: B. McGuire (PM), L. Baker</p> <p>Explanation of Need: which contains critical identification information. However, HRSG boilers differ in that they have multiple master nameplates for different sections (e.g., HP, LP, economizer), all located on the outer casing of the boiler. Currently, NBIC repair nameplates do not provide a way to indicate which specific section was repaired. This limitation creates confusion for future inspections and maintenance, as there is no clear indication of which section underwent repairs. Adding a requirement for repair nameplates to include the specific HRSG boiler section being repaired will enhance clarity and traceability.</p> <p>July 2025 Meeting Action: B. McGuire presented a proposal that was revised based on discussion, however the proposal Failed the SC vote (20 members present – only 12 approvals obtained – 14 needed). Added Lane Baker to the task group.</p> <p>SG R&A Jan. 2026 Meeting Action: B. McGuire presented a PR</p>		

Item Number: A25-20	NBIC Location: Part 3, 3.3.4.6	Attachment 9
<p>General Description: Adoption of reinforcement/fillet welded patches from PCC-2</p> <p>Subgroup: Repairs and Alterations</p> <p>Task Group: M. Schaser (PM), B. Boseo, D. Marek, B. Ray, P. Becker, G. Galanes</p> <p>Explanation of Need: Oil refineries are scant on shutdown opportunities and vital to the fuel needs of the community. At times inspection departments will detect corrosion on an in-service piece of equipment and be unable to clean it up for internal entry without a planned outage. Fillet welded patches are a safer alternative to external weld metal build up, or fitness for service.</p> <p>July 2025 Meeting Action: M. Schaser presented a PR. Brent Ray and Stacy Marks (on ASME Committees) both offered to supply PCC and other ASME references if the SC needs to review the material proposals will be referencing.</p> <p>SG R&A Jan. 2026 Meeting Action: M. Schaser presented a PR. Discussion on adding “external” to the ‘welded lap patch’ term to clarify these are lap patches holding pressure via a fillet weld was had. “Encapsulation” was referenced as a type of “lap patch” and that OUIO’s use this PCC-2 type of activity regularly. This will be LB to the SG.</p>		

Item Number: A25-21	NBIC Location: Part 3, S11.2.3 and S11.3.2	No Attachment
<p>General Description: Synchronize/Revise Repairs & Alterations of VIII-2, VIII-3 PRIs</p> <p>Subgroup: Repairs and Alterations</p> <p>Task Group: R. Collins (PM)</p> <p>Explanation of Need: Mr. Tim Gardner, NBBI Senior Staff Engineer/Training Instructor, plans to create an online course for repairs of ASME Sect VIII-2 and VIII-3 PRIs but the current requirements in S11.2.3 and S11.3.2 (formerly 3.3.5 and 3.4.5) do not seem to be in agreement.</p> <p>July 2025 Meeting Action: R. Collins presented a PR.</p> <p>UPDATE: Failed SC LB – No Quorum (12-1-0)</p> <p>SG R&A Jan. 2026 Meeting Action: R. Collins presented an update that this will be presented for a vote at the SC R&A Meeting.</p>		

Item Number: A25-22	NBIC Location: Part 3, Table 2.5.1	Attachment 10
<p>General Description: Revise Part 3, Table 2.5.1</p> <p>Subgroup: Repairs and Alterations</p> <p>Task Group: L. Dutra (PM), G. Galanes</p> <p>Explanation of Need: There have been changes to materials in the ASME Code that have made a review/revision of Table 2.5.1 necessary. If anything, the obsolete group numbers should be deleted. It will be up to the committee to decide whether to add the missing P/group numbers and the associated temperatures.</p> <p>July 2025 Meeting Action: L. Dutra presented a PR.</p> <p>SG R&A Jan. 2026 Meeting Action: L. Dutra presented a proposal deleting Table 2.5.1 and revising text to clarify the min. temp. for pre-heat shall be IAW the OCC or the Alt Weld Methods shall be IAW Part 3, 2.5.3. The proposal was revised and UA.</p>		

Item Number: A25-23	NBIC Location: Part 2, 3.4.8	No Attachment
<p>General Description: Add guidance for tube sag allowance</p> <p>Subgroup: Inspection</p> <p>Task Group: J. Jessick (PM), B. Ray, J. Sowinski, T. Bolden, PART 3 TG MEMBER: Hagan Fee</p> <p>Submitted by: V. Scarcella</p> <p>Explanation of Need: Inspectors were asking for clarification and better guidance. Item needs a working group to consider language.</p> <p>INSTALLATION SG - July 2025 Meeting Action: The group reviewed this item and assigned a TG.</p> <p>SG R&A Jan. 2026 Meeting Action: Part 2 has requested someone from Part 3 to join the TG on this item. Hagan Fee was added to the TG for this Part 2 Action Item.</p>		

Item Number: A25-25	NBIC Location: Part 3, S11.2.2	Attachment 11
<p>General Description: Repair of PRIs Without Complete Removal of Defect</p> <p>Subgroup: Repairs and Alterations</p> <p>Task Group: T. LeBeau (PM), M. Schaser, R. Collins, J. Hayes, K. Derrick</p> <p>Explanation of Need: To clarify this repair activity can be used for welded or non-welded repairs. This proposal will remove reference to welded repairs in S11.2.2 and only refer to "repair."</p> <p>July 2025 Meeting Action: T. LeBeau presented a PR; M. Schaser, R. Collins, J. Hayes, K. Derrick were added to the TG.</p> <p>SG R&A Jan. 2026 Meeting Action: T. LeBeau presented a proposal that was UA</p>		

Item Number: A25-26	NBIC Location: Part 3, 3.2.2 and 5.7.4	No Attachment
<p>General Description: Stamping of non-ASME Parts and Distribution of Form R-3</p> <p>Subgroup: Repairs and Alterations</p> <p>Task Group: P. Gilston (PM)</p> <p>Explanation of Need: Part 3 does not address the distribution of the R-3 and provides no specific details on how to stamp non-ASME parts fabricated by the R Certificate Holder.</p> <p>SC July 2025 Meeting Action: P. Gilston presented a proposal that was UA.</p> <p>UPDATE: Passed MC LB 1/7/26 (18-0-0)</p>		

Item Number: A25-29	NBIC Location: Part 3, 2.5.3 and 3.3	Attachment 12
<p>General Description: Referencing for Weld Metal, Filler Metal etc.</p> <p>Subgroup: Repairs and Alterations</p> <p>Task Group: P. Gilston (PM), J. Siefert, W. Sperko, T. Melfi</p> <p>Explanation of Need: Within Part 3, welding consumables are referred to in several different ways e.g., filler metal, weld metal etc. This item is to review these references and identify if a single reference description is beneficial for users of the Code.</p> <p>July 2025 Meeting Action: P. Gilston presented a PR.</p> <p>UPDATE: SG R&A Rvw & Cmt LB closed 12/31/25 w/ 4 comments.</p> <p>SG R&A Jan. 2026 Meeting Action: P. Gilston presented a proposal that was revised based on the LB Comments. The Proposal was UA.</p>		

New Action Items:

Item Number: A25-43	NBIC Location: Part 3, New Supplement	No Attachment
<p>General Description: General Requirements for Mechanical Repairs</p> <p>Subgroup: Repairs and Alterations</p> <p>Task Group: T. McBee (PM), K. Moore, S. Frazier, G. Galanes, R. Troutt, J. Hayes, S. Marks</p> <p>Explanation of Need: A new supplement is needed to provide guidance for firms who would like to engage in mechanical repairs utilizing their R Certificate.</p> <p>SG R&A January 2026 Meeting Action: T. McBee asked for TG members. The following were added to the TG: K. Moore, S. Frazier, G. Galanes, R. Troutt, J. Hayes, J. Ferriera, S. Marks</p>		

Item Number: A25-44	NBIC Location: Part 3, 4.4.1	Attachment 13
<p>General Description: Initial Service Leak Tests</p> <p>Subgroup: Repairs and Alterations</p> <p>Task Group: J. Ferreira (PM), L. Dutra, H. Fee</p> <p>Explanation of Need: To clarify when an Initial Service Leak Test is permissible and that it differs from In-Service leak tests.</p> <p>SG R&A January 2026 Meeting Action: J. Ferreira presented a PR. A discussion was held on Part 3, 4.4.1 c), Initial Service Leak Test (ISLT) and how this is being misused. B31 Codes were referenced as the only CoC allowing ISLT, however “R” Cert Holders are incorrectly ‘testing’ repairs by placing the unit in-service to verify leak tightness. Discussion on if the verbiage of ISLT in 4.4.1 c) or adding this to the glossary were held. TG drafted a proposal to delete 4.4.1 c) which was UA.</p>		

Item Number: A25-50	NBIC Location: Part 3, S11.3.1	No Attachment
<p>General Description: Expand the scope of Encapsulation</p> <p>Subgroup: Repairs and Alterations</p> <p>Task Group: B. Boseo (PM), P. Gilston, K. Derrick, M. Schaser</p> <p>Explanation of Need: Now that Supplement 11 has been approved, the scope of Encapsulation can now be expanded.</p> <p>UPDATE: Failed SG LB 11/11/25 (12-2-5)</p> <p>SG R&A January 2026 Meeting Action: B. Boseo presented a proposal that was revised based on the SG LB comments. The proposal was discussed regarding the rationale for exempting fire-tube boilers specifically from encapsulation. This was a PR. Phil Gilston was added to the TG as he is on the 2/3 TG. Kiwi Derrick and Matt Schaser were also added.</p>		

Item Number: A25-51

NBIC Location: Part 3, 1.5.1

Attachment 14

General Description: NBIC Part 3, 1.5.1 q) R-Stamp Controls

Subgroup: Repairs and Alterations

Task Group: Stacy Marks (PM), L. Baker, S. Frazier

Explanation of Need: With the newly allowed marking methods which give alternatives to hard stamping there is a requirement to describe the marking controls in the QMS. This revision will guide industry on expectations.

SG R&A January 2026 Meeting Action: Stacy Marks presented a proposal addressing controls and custody, which was **revised and UA**. This is tied to A24-17.

Item Number: A25-53

NBIC Location: Part 3, 3.3.4.2

Attachment 15

General Description: Supplement 11 Reference Clean Up

Subgroup: Repairs and Alterations

Task Group: L. Baker (PM), T. LeBeau, A. Triplett

Explanation of Need: References to 3.3.4.8 need to be corrected to S11.2.2 in:

-Table 1.5.1 row a) and b)

-3.3.4.1

-3.3.4.2 a)

-3.3.4.2 d)

-S2.13 c)

-S7.4 a)

-Table S9.2 Reference (19)

-Table S9.3 Reference (20)

Also

-the reference in 2.5.3.2 d) 4) b needs to be changed from 3.3.5 to S11.2.3

-the reference in S11.3.1 a) states: "Except as required in 3.4.3 c) 1)...", this should now reference S11.3.1 c) 1).

SG R&A January 2026 Meeting Action: L. Baker presented a proposal to correct references now pointing to S11. The **proposal was UA**.

Item Number: A25-59	NBIC Location: Part 3, S11.1	No Attachment
<p>General Description: Supplement 11 Scope Updates</p> <p>Subgroup: Repairs and Alterations</p> <p>Task Group: M. Schaser (PM), B. Boseo</p> <p>Explanation of Need: Updating the scope of Supplement 11 to include additional guidance and limitations as well as updating the subsection and paragraphs to remove “Engineering” and replace with “Advanced”.</p> <p>SG R&A January 2026 Meeting Action: M. Schaser presented a proposal with new S11 scope verbiage. The proposal was discussed and additional work is needed. This was a PR.</p>		
Item Number: A25-60	NBIC Location: Part 3, 3.4.1	Attachment 16
<p>General Description: Pressure Test Exemption per Part 3 Paragraph 3.4.1 d)</p> <p>Subgroup: Repairs and Alterations</p> <p>Task Group: M. Schaser (PM), H. Fee, M. Vogt, K. Derrick</p> <p>Explanation of Need: Update wording in Part 3, paragraph 3.4.1.d to be consistent and more robust.</p> <p>SG R&A January 2026 Meeting Action: M. Schaser presented a proposed change with the additional verbiage. The proposal was UA as revised.</p>		
Item Number: A25-75	NBIC Location: Part 3, S5.7.2	Attachment 17
<p>General Description: Yankee Dryer alteration plan approval</p> <p>Subgroup: Repairs and Alterations</p> <p>Task Group: P. Shanks (PM), A. Khssassi, T. Seime</p> <p>Explanation of Need: Yankee dryer alteration plans have a different approval path than an alteration on other PRI's, there is no obvious technical need for the path to be different, and this different path has the potential to cause confusion and errors.</p> <p>SG R&A January 2026 Meeting Action: P. Shanks presented a proposal to have the AIA/OUIO accept the R&A plan for Yankee Dryers, in lieu of just the Repair Inspector. The proposal was UA.</p>		

Item Number: A25-83	NBIC Location: Part 3, 2.5.3.4	Attachment 18
<p>General Description: Edits to NBIC Part 3, 2.5.3.4 Welding Method 4</p> <p>Subgroup: Repairs and Alterations</p> <p>Task Group: J. Siefert</p> <p>Explanation of Need: Siefert to present this <i>general discussion item</i> at the SG meeting for discussion on next action(s)</p> <p>SG R&A January 2026 Meeting Action: J. Siefert present a proposal that was slightly revised by the SG. The proposal was UA as revised.</p>		

Item Number: A25-84	NBIC Location: Part 3, 2.5.3	Attachment 19
<p>General Description: Edits to NBIC Part 3, 2.5.3</p> <p>Subgroup: Repairs and Alterations</p> <p>Task Group: J. Siefert</p> <p>Explanation of Need: Siefert to present this <i>general discussion item</i> at the SG meeting for discussion on next action(s)</p> <p>SG R&A January 2026 Meeting Action: J. Siefert presented a proposal that will go to SG and then SC R&A via LB.</p>		

Item Number: A25-85 NBIC Location: Part 3, 2.5.3.6; S8 Attachment 20
General Description: Inclusion of Grade 92 into 2.5.3.6 and Supplement 8
Subgroup: Repairs and Alterations
Task Group: J. Siefert
Explanation of Need: Siefert to present this <i>general discussion item</i> at the SG meeting for discussion on next action(s)
SG R&A January 2026 Meeting Action: J. Siefert presented a proposal that was UA .

11. Future Meetings

- July 13-16, 2026 – Salt Lake City, UT
- January 11-14, 2027 – Nashville, TN

12. Adjournment @ 4:17 PM by Chair Underwood.

Respectfully submitted,

Terrence Hellman

Terrence Hellman

Interp TG - Jan 2026

Here	Full Name	Email Address	Company Name	Registration Type	Task Group Interpretations	Member
x	Boseo, Brian	bmboseo@burnsmcd.com	Burns & McDonnell	In-person	Yes	M
x	Carlson, Michael	camx235@lni.wa.gov	State of Washington	In-person	Yes	M
x	Derrick, Kiwi	kiwi.derrick@chevron.com	Chevron	In-person	Yes	M
x	Ferreira, Jon	jonathan_ferreira@hsb.com	Hartford Steam Boiler	In-person	Yes	M
x	Galanes, George	ggalanes@diamondtechnicalservices.com	DTS, Inc.	In-person	Yes	M
x	Hrubala, Bernie	bhrubala@comcast.net	TUV Rheinland AIA	In-person	Yes	M
x	Marks, Stacey	stacey.marks@bureauveritas.com	BVI&I	In-person	Yes	M
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x	Moore, Kathy	kathymoore@joemoorecompany.com	Joe Moore & Company, Inc.	In-person	Yes	M
x	Quisenberry, Michael	michael@spartan-mech.com	Spartan Boiler & Mechanical	In-person	Yes	M
x	Schaser, Matt	mschaser@e2g.com	The Equity Engineering Group, Inc.	In-person	Yes	M
x	Seime, Trevor	tsseime@nd.gov	State of North Dakota	In-person	Yes	M
x	Toth, Marty	mtoth@boiscotraininggroup.com	ECS Consulting & The Boisco Training Group	In-person	Yes	M
x	Triplett, Andrew	triplett@ornl.gov	UT-Battelle, LLC	Remote	Yes	M
x	Baker, Lane	LBaker@us.tuv.com	TUV Rheinland AIA services LLC	In-person	Yes	
x	Becker, Chuck	hggbecker@yahoo.com	Bureau Veritas	In-person	Yes	
x	Becker, Patricia	pbecker@epri.com	EPRI	In-person	Yes	
x	Chatham, Everett	echatham@becht.com	Becht	In-person	Yes	
x	Collins, Riley	rileycollins@eastman.com	Eastman Chemical Company	In-person	Yes	
x	Creaser, Eben	eben.creaser@gmail.com	Province of New Brunswick	In-person	Yes	
x	Derby, Robert	rderby@uanet.org	United Association ITF	In-person	Yes	
x	DeSantis, Nicholas	nicholas.desantis@framatome.com	Framatome, Inc.	In-person	Yes	
x	Dutra, Louis	ldutra@emcor.net	EMCOR Mesa energy systems	In-person	Yes	
x	Gilston, Philip	philip_gilston@hsb.com	Hartford Steam Boiler	In-person	Yes	
x	Hayes, John	jhayes@ccsboiler.com	Combustion & Control Solutions Inc.	In-person	Yes	
x	Misiewicz, Ken	kmisiewicz@pleuneservice.com	Pleune Service Company	In-person	Yes	
x	Reamey, Raymond	rreamey@turner-industries.com	Turner Industries Group, L.L.C.	In-person	Yes	
x	Schultz, Christopher	CSCHULTZLU30@GMAIL.COM	United Association	In-person	Yes	
x	Shanks, Paul	paul.shanks@tuvsud.com	ARISE Boiler Inspection and Insurance Company RRG	In-person	Yes	
x	Smith, Jeremy	jeremy.smith@labor.nc.gov	NC Department of Labor- Boiler Safety Bureau	In-person	Yes	
x	Sowinski, James	jsowinski@e2g.com	Equity Engineering	In-person	Yes	
x	Thompson, Alex	Alex.thompson@iconboiler.com	ICON Boiler, Inc.	In-person	Yes	
x	Troutt, Rob	rtrtconsulting@gmail.com	RTX Consulting, LLC	In-person	Yes	
x	Underwood, Bob	robert_underwood@hsb.com	Hartford Steam Boiler	In-person	Yes	
x	Valdez, Richard	rvaldez@prim.com	Rick Valdez	In-person	Yes	
x	Verderose, Edward	ed@exithomepros.com	Industrial Steam Boiler Corporation	In-person	Yes	
x	Vogt, Mark	mark.vogt@vistracorp.com	VISTRA	In-person	Yes	
x	Wadkinson, Melissa	mwadkinson@icloud.com	Fulton Thermal Corporation	In-person	Yes	
x	Warburton, David	David.Warburton@myfloridacfo.com	State of Florida	In-person	Yes	
x	Khassasi, Aziz	aziz.khassasi@rbq.gouv.qc.ca	Régie du Bâtiment du Québec	Remote	Yes	
x	Bozoluk, Jason	sinanboz78@gmail.com	American Bureau of Shipping	Remote	Yes	
x	burns, mike	mburns@nbbi.org	NBBI	Remote	Yes	
x	CRIHAN, IULIAN	IulianMihail.Crihan@rbq.gouv.qc.ca	REGIE DU BATIMENT DU QUEBEC	Remote	Yes	
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x	sanford, Keith	keith.sanford@tdlr.texas.gov	State of texas	Remote	Yes	
x	SATHASIVAM, VINOTH KUMAR	VINO2488@GMAIL.COM	PROMINENT TEAM CONSULTANCY - L.L.C	Remote	Yes	
x	Shah, M. A.	boilersandpressurevessels9@gmail.com	AIS	Remote	Yes	
x	Yimgna Mengouo, Hervé	site-inspection@petrocertif.com	Seb Energy Ltd / Seb Institute of Welding and Technology (SIWET)	Remote	Yes	
x	Amato, Joel	jamato@nationalboard.org	NBBI	Staff	Yes	
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x	Cochran, Lee	lcochran@nationalboard.org	NBBI	Staff	Yes	
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x	Viers, Robert	rviers@nationalboard.org	NBBI	Staff	Yes	
x	Zehendner, Amy	azehendner@nbbi.org	NBBI	Staff	Yes	
x	McGuitre, Bob	Remote				
x	Dennard, Dionna	Remote				
x	Steve Frazier	Person				
x	Gavon Copp	Person				
x	Hagan Fee	person				
x	John Mirjalali	person				
x	Alex Chang	person				
x	Don Patton	person				
x	John Huntington	person				



THE NATIONAL BOARD
OF BOILER AND PRESSURE VESSEL INSPECTORS

PROPOSED REVISION OR ADDITION

<p>Item No. A21-53 Rev 06</p>
<p>Subject/Title Supplement 8 Weld and Post Repair Inspection of Creep Strength Enhanced Ferritic Steel Pressure Equipment</p>
<p>NBIC Location NBIC Part 3 Repairs and Alterations Supplement 8 S8.5 a)</p>
<p>Project Manager and Task Group Philip Gilston, Mark Horbaczewski</p>
<p>Source (Name/email) Mark Kincs / mark.r.kincs@xcelenergy.com</p>
<p>Statement 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 in service Authorized Inspection Agency, not the Repair Inspector, whose duties end with completion of repair documentation. As part of the Inservice Inspector pre-inspection activities is a requirement to review repairs/alterations (Part 2, 4.5.2 a) 7) to ascertain the history of the equipment being inspected. In the report of inspection forms NB-6 and NB-7 in section 10 comments to be addressed include verification of repairs.</p>
<p>Background Information The post-repair inspection requirements specified in S8.5 are unique. There is no other mention of such inspections elsewhere in NBIC–Part 3. Presumably, Welding Method 6 repairs don't require post-repair inspection due to the perceived low-level of associated risk (inside the boiler setting). Related SG Inspection item 22-06. This proposed revision is to ensure that there is correct and sufficient information for the “Inservice Inspector” to review and validate that the inspection plan is being followed. <u>Based on discussions in SG and SC meetings in July 2025 the following notes are provided for additional explanation of the intent of the proposal:</u></p> <ol style="list-style-type: none"> <u>1. The post repair inspection plan can be prepared at any time during the repair process, but before the R-Report is signed.</u> <u>2. The repair is agreed with the Repair Inspector, and if required the Jurisdiction. The repair plan shall be referenced in the remarks section of the R-Report.</u> <u>3. The post repair inspection plan will remain in place while the pressure part is in service. Inspection intervals can be revised based on gathered inspection data.</u> <u>4. The repair is defect free at its completion. The inspection plan is to ensure no new defects occur in the repair area, e.g., in the weld , HAZ etc..</u> <u>5. Once the pressure part is returned to service, the Inservice Inspector will review the R report, as part of their normal duties and verify the plan is being enacted. There is no requirement on the Inservice Inspector to observe any of the inspections, only to verify they are being performed.</u>

Rev 04 (Based on comments from SG Letter ballot)

S8.5 a), Revised opening of sentence eliminating specifically when the plan is prepared per Mr. Schaser.

S8.5 a), Revised the middle part of the first sentence from ‘...to ensure safe operation and margin to locate and monitor defect growth in the weld repair area based...’ to ‘...to ensure safe operation by ensuring no new defects form in the weld repair area based...’.

S8.5 b), ‘re-inspection’ has been revised to ‘inspection’ per Mr. Collins comment.

S8.5 b) iii, removed end of life requirement per Mr. Siefert.

S8.5 c), revised ‘Post Inspection Repair Plan’ to ‘Post Repair Inspection Plan’ per Mr. Khssassi.

S8.5 c), removed the words requiring the inspection plan to be attached to the R Report for submittal. The plan is still to be referenced in the ‘Remarks’.

Rev 05

[Notes added to the background to provide further clarity on timing of actions and roles of Inspectors.](#)

Rev 06

[Proposal substantially revised based on comments from Mr. Shanks and Mr. Boseo.](#)

S8.5 POST REPAIR INSPECTION

- a) After the completion of weld repairs to CSEF steels, post inspection requirements shall be developed and implemented based on acceptance from the Inspector, and if applicable, the Jurisdiction.
- b) Post-repair inspection intervals and methods of examination shall be implemented to ensure safe operation and margin to locate and monitor defect growth in the weld repair area. The selected non-destructive examination method shall provide meaningful results and shall follow NBIC Part 3, Section 4.
- c) Post repair inspection shall be on-going until the component reaches end of life or is replaced. The Owner/User may revise the re-inspection interval based on inspection results from previous inspections.

S8.5 POST REPAIR INSPECTION

- a) A post repair inspection plan shall be developed by the owner or user prior to the completion of the weld repairs to ensure continued safe operation of the pressure retaining item..
- b) The post repair inspection plan shall include but not be limited to:
 - i. Method of examination, the selected non-destructive examination method ~~shall provide meaningful results and~~ shall follow NBIC Part 3, Section 4.
 - ii. Examination intervals
- c) The post repair inspection plan shall be subject to review and acceptance by the Repair Inspector, and if required, the Jurisdiction.
- d) The post repair inspection plan shall be referenced in the Remarks section of the R report. The R report shall be registered with the National Board.
- e) The owner or user may revise the inspection interval based on inspection results from previous inspections.
- f) Post repair inspection shall be on-going until the component is removed or replaced.

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.
23-35
Subject/Title
Definition of "non-load bearing attachment"
NBIC Location
Part 3: Repairs and Alterations; Sections 3; Paragraphs: 3.3.2 , e), 2)
Project Manager and Task Group
PM – Tom White, Aziz Khssassi
Source (Name/email)
Tom White/thomas.white@nrg.com
Statement of Need
The term "nonload bearing attachment" is used as a basis for determining a routine repair (Part 3: 3.3.2, e), 2) but the term is not defined. Defining "Nonload Bearing Attachment" by adding a sentence to Part 3: 3.3.2, e), 2) would alleviate the confusion. I would also at this time hyphenate "non-load".
Current Wording in Part 3:
3.3.2 ROUTINE REPAIRS
e) The following repairs may be considered as routine repairs and shall be limited to these categories:
<ol style="list-style-type: none"> 1) Welded repairs or replacements of valves, fittings, tubes, or pipes NPS 5 (DN 125) in diameter and smaller, or sections thereof, where neither postweld heat treatment nor NDE other than visual is required by the original code of construction. This includes their attachments such as clips, lugs, skirts, etc., but does not include nozzles to pressure-retaining items; 2) The addition or repair of nonload bearing attachments to pressure-retaining items where postweld heat treatment is not required;
Background Information
A Certificate Holder replaces/repairs internal rails/supports for trays or bins that get rolled into an autoclave. These rails/supports are (typically) stitch welded along the inside of the shell. The Certificate Holder believes this is a non-load bearing attachment and performs this work as a routine repair. The attachment of internals is a loading design consideration for ASME Sect. VIII Div.1.
NBIC Interpretation 95-33 addresses this term in their reply to the interpretation. A "non-load bearing attachment" is a generally accepted design term referring to items that transmit an inconsequential load onto the pressure retaining boundary.
Definition in ASME B31.1 (2022) - Definition in PWHT Table 132.2-1 Note (7): Non-load carrying attachments are defined as items where no pressure loads or significant mechanical loads are transmitted through the attachment to the pipe or pressure-containing material.

Existing Text 3.3.2 ROUTINE REPAIRS	Proposed New Text 3.3.2 ROUTINE REPAIRS
<p>e) The following repairs may be considered as routine repairs and shall be limited to these categories:</p> <ol style="list-style-type: none"> 1) Welded repairs or replacements of valves, fittings, tubes, or pipes NPS 5 (DN 125) in diameter and smaller, or sections thereof, where neither postweld heat treatment nor NDE other than visual is required by the original code of construction. This includes their attachments such as clips, lugs, skirts, etc., but does not include nozzles to pressure-retaining items; 2) The addition or repair of nonload bearing attachments to pressure-retaining items where postweld heat treatment is not required; 	<p>e) The following repairs may be considered as routine repairs and shall be limited to these categories:</p> <ol style="list-style-type: none"> 1) Welded repairs or replacements of valves, fittings, tubes, or pipes NPS 5 (DN 125) in diameter and smaller, or sections thereof, where neither postweld heat treatment nor NDE other than visual is required by the original code of construction. This includes their attachments such as clips, lugs, skirts, etc., but does not include nozzles to pressure-retaining items; 2) The addition or repair of non-load bearing attachments to pressure-retaining items where postweld heat treatment is not required. A non-load bearing attachment bears no pressure loads and no significant mechanical loads are transmitted through the attachment to the pressure-retaining material. The determination that a load is not significant shall be agreed upon by the owner, Inspector, and where required the Jurisdiction.

VOTE							
Committee	Approved	Disapproved	Abstained	Not Voting	Passed	Failed	Date

AI 23-35

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

Background Information: A Certificate Holder replaces/repairs internal rails/supports for trays or bins that get rolled into an autoclave. These rails/supports are (typically) stitch welded along the inside of the shell. The Certificate Holder believes this is a non-load bearing attachment and performs this work as a routine repair. The attachment of internals is a loading design consideration for ASME Sect. VIII Div.1.

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

Date Opened: 6/5/2023

Date Closed:

Non-load carrying attachments are defined as items where no pressure loads or significant mechanical loads are transmitted through the attachment to the pressure-retaining material.

Existing definitions in other Code books:

[ASME B31.1 \(2024\)](#) - Definition in PWHT [Table 132.2-1](#), Note (7):

(7) *Non-load-carrying attachments are defined as items where no pressure loads or significant mechanical loads are transmitted through the attachment to the pipe or pressure-containing material.*

[ASME B31.3 \(2024\)](#) - Definition in PWHT [Table 331.1.3-1](#), Note (7)

(7) *Non-load-carrying attachments are defined as items where no pressure loads or significant mechanical loads are transmitted through the attachment to the pipe or pressure-containing material.*

[ASME Section VIII Div.2 \(2025\)](#)

3.11.2.9 Postweld Heat Treatment Requirements for Materials in Low Temperature Service.

...
(b)(2)... *Lightly loaded attachments, for this application, are defined as attachments in which the stress in the attachment weld does not exceed 25% of the allowable stress....*

6.2.2.5 Tests of Welders and Welding Operators

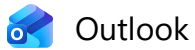
...
(b) *Welders and welding operators used in welding non-pressure-bearing attachments, that have essentially no loadcarrying function (such as extended heat transfer surfaces, insulation support pins, etc.), to pressure parts shall comply with the following....*

[ASME Section VIII Div.1 \(2025\)](#)

UW-28 QUALIFICATION OF WELDING PROCEDURE

(a) *Each welding procedure used in joining pressure parts to pressure parts or joining pressure parts to loadcarrying nonpressure parts, such as all permanent or temporary clips and lugs to pressure parts,*

...
(c) *The procedure used in welding non-pressure bearing attachments which have essentially no loadcarrying function (such as extended heat transfer surfaces, insulation support pins, etc.), to pressure parts shall meet the following requirements....*



Schaefer - Disapprove Vote - A23-35

From Benjamin Schaefer <bschaefer@aep.com>

Date Tue 1/13/2026 5:22 PM

To Terrence Hellman <THellman@nationalboard.org>

Cc Aziz Khssassi <aziz.khssassi@rbq.gouv.qc.ca>; Underwood Robert - Hartford-Remote-HSB
<robert_underwood@hsb.com>

Mr. Secretary,

I understand the intent of this item was to simplify and clarify what “nonload bearing attachments” are, but I don’t think the new wording as voted produces that affect. For this reason, I voted against this item. If anything, it seems to make the repair of these routine repairs more difficult and probably more time consuming.

Ben



Negative on item 23-35

From Siefert, John <jsiefert@epri.com>

Date Tue 1/13/2026 3:32 PM

To Terrence Hellman <THellman@nationalboard.org>

Existing wording in item 23-35: *The addition or repair of non-load bearing attachments to pressure-retaining items where postweld heat treatment is not required. **A non-load bearing attachment bears no pressure loads and no significant mechanical loads are transmitted through the attachment to the pressure-retaining material. The determination that a load is not significant shall be agreed upon by the owner, Inspector, and where required the Jurisdiction.***

Proposed wording: *The addition or repair of non-load bearing attachments to pressure-retaining items where postweld heat treatment is not required. **The determination that an attachment is non-load bearing shall be agreed upon by the owner, Inspector, and where required the Jurisdiction.***

Reason for my negative is clarity and avoiding a potential request for future interpretation regarding how we will define what constitutes 'significant' in the existing proposal.

John Siefert, Ph.D.

Area Lead – Materials



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PROPOSED REVISION OR ADDITION

Item No. A23-77	
Subject/Title Combined Changes to NDE Requirements for Repairs and Alterations	
NBIC Location Part: Repairs and Alterations; Section: 4; Paragraph: 4.2.a thru 4.2.b, 4.4	
Project Manager and Task Group PM – Thomas White, A. Triplett, P. Miller, P. Lentzer, R. Collins, S. Frazier, J. Walker, P. Becker	
Source (Name/Email) Andrew Triplett / triplettal@ornl.gov	
Statement of Need Multiple separate Action Items sought to revise various portions of the same paragraphs in Part 3, Section 4 (Items A23-36, A23-59, A23-77, and A23-04 [now included in 2025 Edition]). They have been incorporated into a single Item with the new 2025 wording, while modifying the format of these paragraphs slightly. Screenshots of the originally-proposed changes in A23-36, A23-59, and A23-77 are on Pages 3 and 4.	
Background Information At the January 2024 SG R&A meeting, it was proposed that instead of proceeding with separate Action Items seeking to revise the same paragraphs in Part 3, Section 4, it would be best to consolidate these into a single Item for this purpose, allowing for much easier integration into the NBIC.	
Existing Text (2025 Edition) 4.2 NONDESTRUCTIVE EXAMINATION a) All nondestructive examination (NDE) requirements, except for NDE personnel qualification requirements, 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). Where this is not possible or practicable, or where there is insufficient information available to determine the original NDE requirements, alternative NDE methods that provide meaningful results to verify the integrity of the repair or alteration, if acceptable to the Inspector, and were required, jurisdiction where the pressure-retaining item is installed, may be used, provided that all other requirements of this section are met. For welds that were subject to volumetric NDE during construction, repairs may be made to the base material and welded joints without volumetric examination under the following conditions: 1. The repair depth does not exceed the lesser of 1/8 in. (3 mm) or 25% of the nominal base material thickness; 2. The aggregate repair length is no longer than 6 in. (150 mm); and 3. The repair cavity and each layer of deposited weld, including the final weld surface, have been examined by magnetic particle (MT) or liquid penetrant (PT). b) When volumetric NDE is required by the original code of construction but is not possible or practicable, progressive PT or MT examination as described in paragraph 4.2 b) 1), below, may be used. This alternative NDE method is subject to the acceptance of the Inspector, owner, and when required, jurisdiction where the	Proposed Text (2025 Edition, A23-36, A23-59, A23-77) 4.2 NONDESTRUCTIVE EXAMINATION a) All nondestructive examination (NDE) requirements, except for NDE personnel qualification requirements, 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). Where this is not possible or practicable, or where there is insufficient information available to determine the original NDE requirements, alternative NDE methods that provide meaningful results to verify the integrity of the repair or alteration, if acceptable to the Inspector, and where required, jurisdiction where the pressure-retaining item is installed, may be used, provided that all other requirements of this section are met. <u>a) 1) When volumetric NDE is required by the original code of construction, For welds that were subject to volumetric NDE during construction, repairs may be made to the base material and welded joints without volumetric examination, and without prior acceptance by the Inspector or Jurisdiction,</u> under the following conditions: 1. The repair depth does not exceed the lesser of 1/8 in. (3 mm) or 25% of the nominal base material thickness; 2. The aggregate repair length is no longer than 6 in. (150 mm); and 3. The repair cavity and each layer of deposited weld, including the final weld surface, have been examined by magnetic particle (MT) or liquid penetrant (PT). <u>b) a) 2) When volumetric NDE is required by the original code of construction but and volumetric examination is not possible or practicable, progressive PT or MT examination as described in paragraph 4.2 b) 1), below, may be used in lieu of volumetric</u>

A23-36 PROPOSED CHANGES to 2023 NBIC; Part 3:**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 that provide meaningful results to verify the integrity of the repair or alteration may be used provided acceptable to the Inspector, and if required, the Jurisdiction where the pressure-retaining item is installed, where required, accept the alternative NDE method(s) may be used, provided that and all other requirements of this section are met.**

Where the welds were subject to volumetric NDE during construction, repairs may be made to the base material and weld joints without volumetric examination ~~under~~ **provided all the following conditions are met:**

- 1) The repair depth does not exceed the lesser of 1/8 inch (3 mm) or 25% of the nominal base material thickness;
- 2) The aggregate repair length is no longer than 6 inches (150 mm);
- 3) The repair cavity and each layer of deposited weld, including the final weld surface, have been examined by MT or PT.

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

4.4 EXAMINATION AND TEST FOR REPAIRS AND ALTERATIONS

The following requirements shall apply to all repairs and alterations to pressure-retaining items:

a) The integrity of repairs, ~~alterations,~~ and replacement parts used in repairs ~~and alterations~~ shall be verified by examination or test; **in accordance with 4.4.1**

b) The integrity of ~~repairs,~~ alterations, and replacement parts used in ~~repairs and~~ alterations shall be verified by examination or test; **in accordance with 4.4.2**

~~bc)~~ **Examination or** testing methods used shall be suitable for providing meaningful results to verify the integrity of the repair or alteration. Any **impediment that compromises or limits a test method, such as** insulation, coatings, **oxidation,** or coverings ~~that may inhibit or compromise a meaningful test method~~ shall be removed, to the extent **acceptable to** the Inspector;

~~ed)~~ The "R" Certificate Holder is responsible for all activities relating to examination and test of repairs and alterations;

~~de)~~ Examinations and tests to be used shall be subject to acceptance of the Inspector and, where required, acceptance of the Jurisdiction.

A23-59 proposed changes**4.2 NONDESTRUCTIVE EXAMINATION**

a) Nondestructive examination (NDE) requirements, **except for NDE personnel qualification 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.

Where the welds were subject to volumetric NDE during construction, repairs may be made to the base material and weld joints without volumetric examination under the following conditions:

- 1) The repair depth does not exceed the lesser of 1/8 inch (3 mm) or 25% of the nominal base material thickness;
- 2) The aggregate repair length is no longer than 6 inches (150 mm);
- 3) The repair cavity and each layer of deposited weld, including the final weld surface, have been examined by MT or PT.

b) 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)**. When this is not possible or practicable, NDE personnel may be qualified and certified in accordance with their employer's written practice. ASNT SNT-TC-1A, *Recommended Practice Nondestructive Testing Personnel Qualification and Certification* (2008 edition), or ANSI/ASNT CP-189, *Standard for Qualification and Certification of Nondestructive Testing Personnel* (2008 edition), shall be used as a guideline for employers to establish their written practice. Provisions for training, experience, qualification, and certification of NDE personnel shall be described in the "R" Certificate Holder's written quality system.

A23-77 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~~ NDE requirements as the original welds; **all available documentation from original construction should be used to aid in determining these NDE requirements**. 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, **if** required, may be used; provided that all other requirements of this section are met.

PROPOSED REVISION OR ADDITION

Item No.	A24-17 Rev 3
Subject/Title	Specific Requirements For Stamping and Nameplates
NBIC Location	NBIC Part 3, 5.7.5 a) and b)
Project Manager and Task Group	S. Marks (PM), TG – B. Schafer, T. LeBeau, J. Ferreira, A. Khssassi
Source (Name/Email)	Certificate Administrator
Statement of Need	Allow alternative marking methods within the NBIC Part 3, Section 5, Paragraph 5.7.5 a) and b). Currently ASME Section VIII Div 1 (23), ASME Section I (23) - PG-106.6 and Mandatory Appendix VIII, and ASME CA-1 (22) all allow other methods of marking.
Background Information	Pressure vessel nameplates would look more professional with the use of mechanical etching or similar. There would not be any more stampings that are upside-down, cock-eyed, wrong location on the plate, or uneven striking pressure that results in the edges not showing up clearly. Item A25-51 addresses related revisions to QMS controls.
Existing Text	5.7.5 Specific Requirements For Stamping and Nameplates a) Required data shall be in characters of at least 5/32 in. (4 mm) high, except that characters for pressure relief valve repair nameplates may be smaller. Markings may be produced by casting, etching, embossing, debossing, stamping, or engraving. The selected method shall not result in any harmful contamination, or sharp discontinuities to, the pressure-retaining item. See NBIC Part 3, Figures 5.7.5-a through 5.7.5-e. b) The National Board Code Symbols ("R", "VR", and "NR") are to be stamped; do not emboss.
Proposed Text	a) Required data shall be in characters of at least 5/32 in. (4 mm) high, except that characters for pressure relief valve repair nameplates may be smaller. Markings may be produced by casting, etching, embossing, debossing, stamping, or engraving, <u>or laser. Any marking by laser is permitted only on stainless steel and aluminum. No coating that obscures the marking shall be allowed.</u> The selected method shall not result in any harmful contamination, or sharp discontinuities to the pressure-retaining item. See NBIC Part 3, Figures 5.7.5–a through 5.7.5-e. b) The National Board Code Symbols (" R ", " VR ", and "NR") are to be stamped; do not emboss. <u>shall be made by direct application of the National Board issued Stamp or as an alternative the following requirements may be applied:</u> 1) <u>The "R" and "NR" Symbol may be made by casting, embossing, engraving, etching, dot peening, laser, or any other process that will leave a legible and permanent image.</u>



**THE NATIONAL BOARD
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PROPOSED REVISION OR ADDITION

Item No. A 24-18 Rev 04		
Subject/Title Controlled Fill Definition		
NBIC Location All Parts, Section 9, Glossary of Terms		
Project Manager and Task Group Philip Gilston (PM), A. Triplett		
Source (Name/email) Philip Gilston (philip_gilston@hsb.com)		
Statement of Need There is no definition of the term 'controlled fill'.		
Background Information <p>Interpretation item I 23-79 addresses the use of the term 'controlled fill' in NBIC Part 3, 2.5.3 d in relation to Welding Method 6 for Grade 91 material.</p> <p>While the term 'controlled fill' is not specifically used in the text of Welding Method 6 (2.5.3.6), directions are given for such variables as typical preheats, electrode size for SMAW, and the use of stringer beads only. The term is used explicitly in Supplement 8 for CSEF repairs, where S8.3.b says that "To control heat input the weld repair shall be performed using a "controlled fill" technique"; details are also given on such items as preheats, electrode size, required fill pass overlap, etc., and a lot of detail is provided in schematics including specifics on weld bead placement.</p>		
Existing Text None	Proposed Text <u>Changes from Rev 03 shown</u> Controlled Fill – weld technique for a repair process to ensure satisfactory weld properties by controlling <u>tempering and minimizing the risk of cracking by addressing</u> variables including but not limited to heat input, preheat and interpass temperature, weld consumable type and size, weld technique (stringer or weave) and bead placement.	Clean Copy Controlled Fill – weld technique for a repair process to ensure satisfactory weld properties by controlling variables including but not limited to heat input, preheat and interpass temperature, weld consumable type and size, weld technique (stringer or weave) and bead placement.

Committee	VOTE				Passed	Failed	Date
	Approved	Disapproved	Abstained	Not Voting			

1.4.1 ACCREDITATION PROCESS

(25)

- a) The National Board administers accreditation programs for authorization of organizations performing repairs and/or alterations to pressure-retaining items in accordance with NB-415, *Accreditation of Repair ("R") Organizations*.
- b) Any organization may apply to the National Board to obtain an "R" *Certificate of Authorization* for the requested scope of activities. A review shall be conducted to evaluate the organization's QMS. The individual assigned to conduct the review shall meet the qualification requirements prescribed by the National Board. Upon completion of the review, any deficiencies regarding the organization's QMS will be documented, and a recommendation regarding the issuance of an "R" *Certificate of Authorization* will be made to the National Board.
- c) As part of the accreditation process, an applicant's QMS is subject to a review. National Board procedures provide for a confidential review resulting in a recommendation to issue or not issue an "R" *Certificate of Authorization*.
- d) The accreditation programs provide requirements for organizations performing repairs and/or alterations to pressure-retaining items for the applicable scope of activities.
 - 1) An organization's scope of activities includes the type of activity that will be performed, e.g., repairs, alterations, advanced repairs, advanced alterations, or a combination thereof; the location of such activities, e.g., shop, field site, or both; and the materials used for such activities, e.g., metallic or non-metallic.
- e) The organization may perform repairs and/or alterations in the shop, temporary locations, field, ~~or both~~ or a combination thereof; provided such operations are described in the organization's QMS.
- f) The jurisdiction, as defined in NBIC Part 3, Section 9, may audit the QMS 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 "R" *Certificates of Authorization* and use of the "R" Symbol stamp. These rules shall become binding on all "R" Certificate Holders.
- h) Temporary Locations
 - 1) In accordance with 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 submitted to the National Board using Form NB-481, National Board "R" Certificate of Authorization Temporary Location Request.
 - 2) The organization shall describe the use and control of a temporary location in their QMS.
 - 3) The Inspector's duties shall be the same regardless of the location of activities performed by the repair organization.

1.4.2 NATIONAL BOARD "R" SYMBOL STAMP

- a) The "R" Symbol Stamp is furnished on loan by the National Board for a nominal fee.
- b) Provisions may be made for the issuance of the "R" Symbol Stamp for use at various field locations. (25)
- c) Additional requirements shall be met in accordance with NB-415, *Accreditation of Repair ("R") Organizations*.

1.5 QUALITY MANAGEMENT SYSTEM

A holder of a National Board "R" *Certificate of Authorization* shall have and maintain a written QMS. The QMS shall identify the processes necessary to satisfactorily meet the requirements of the NBIC and shall be available for review. The QMS may be in the form of a manual and may consist of several documents depending on the projected scope of work. The QMS shall be treated confidentially by the National Board.

2025 NATIONAL BOARD INSPECTION CODE**(25) 1.5.1 OUTLINE OF REQUIREMENTS FOR A QMS FOR QUALIFICATION FOR THE NATIONAL BOARD "R" CERTIFICATE OF AUTHORIZATION**

The following is a guide for identifying features which should be covered in the written QMS as outlined in this section and shall be documented relative to the scope of work performed within the Certificate Holder's QMS. The intent, capability, and applicability for each required feature shall be stated. Work may be sub-contracted, provided the necessary controls for maintaining full responsibility for Code compliance by the National Board Certificate Holder certifying the work are clearly defined.

a) Title Page

The title page shall contain the Certificate Holder's company name, physical address, and scope of work.

The scope of work shall clearly indicate the type of repairs and/or alterations the Certificate Holder is capable of and intends to carry out. The scope of work indicated shall include the following, as applicable:

- 1) Repairs Only at Shop, Field Site, or Both Shop and Field Site
- 2) Alterations Only at Shop, Field Site, or BothShop and Field Site
- 3) Repairs and Alterations at Shop, Field Site, or BothShop and Field Site
- 4) Advanced Repairs and Advanced Alterations at Shop, Field Site, or Both Shop and Field Site
- 5) Metallic Repairs
- 6) Nonmetallic Repairs
- 7) Design Only

b) Contents Page

The QMS shall contain a page listing the contents of the manual by section, number (if applicable), revision level, and date of each section, as required for manual control.

c) Statement of Authority and Responsibility

A dated statement of authority and responsibility shall clearly identify that the QMS has the full support of management with the endorsement of a senior management official's signature. The statement of authority and responsibility shall also include:

- 1) A statement that all repairs and/or alterations carried out by the Certificate Holder shall meet the requirements of the NBIC, and if applicable, the jurisdiction;
- 2) The title of the individual who has the authority and responsibility to develop and implement QMS. This includes the freedom to identify quality problems, initiate, recommend, and provide solutions, and where required, stop or prohibit work from continuing; and
- 3) A statement that ensures conflict or disagreements in the implementation of the QMS shall be brought to the attention of the Certificate Holder's senior management official for a resolution that will not conflict with the requirements of the code, jurisdictional/regulatory authority, or QMS.

d) QMS Control

The QMS shall define how revisions of individual sections, exhibits, or documents will be identified, and how distribution and retrieval will be achieved to ensure only the latest accepted revisions are available for use. In addition, the following shall be documented:



24-21 Item

From Louis Dutra <LDutra@emcor.net>

Date Tue 1/13/2026 12:37 PM

To Terrence Hellman <THellman@nationalboard.org>

Terry,

I disapproved this item because as being a Certificate holder this has confusion about basic/ advanced and the elongated conversations I feel like the advanced and basic need to be more clarified and defined together for this item to be moved forward.

Thank you!

Louis Dutra
Boiler Services Manager/ Quality Control Manager
EMCOR Service / Mesa Energy Systems
2 Cromwell
Irvine, Ca. 92618
Cell 949-966-7304
LDutra@emcor.net



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A24-21

From Seime, Trevor S. <tsseime@nd.gov>

Date Tue 1/13/2026 12:37 PM

To Terrence Hellman <THellman@nationalboard.org>

My disapproval of this item is due to the fact that I feel it needs to be expanded to define and clarify what an "Advanced Repair/Alteration" is for all users to understand.

R/

Trevor Seime

Office of the Director • Boiler Inspection Program • Chief Boiler Inspector

701-220-4723 • 701-328-5200 (fax) • tsseime@nd.gov • <https://deq.nd.gov/>





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PROPOSED REVISION OR ADDITION

Item No.	
A24-96	
Subject/Title	
Add examples of repairs and alterations specific to Electrochemical Cell Stacks	
NBIC Location	
Part: 3; Supplement xx	
Project Manager and Task Group	
PM – A. Triplett, R. Collins, R. Miletti	
Source (Name/Email)	
Matthew Sweetland / msweetland@estacks.energy	
Statement of Need	
With inclusion of electrochemical cell stacks as “U” stamped pressure vessels under ASME BPVC Section VIII Division 1 and Code Case 3078, these stacks are starting to be shipped and registered with the National Board. Lists of repairs and alterations are needed to help guide an understanding of limitations for electrochemical cell stacks. Based on discussion at the July 2025 NBIC meetings with Robert Underwood and George Galanes, and due to planned changes in the NBIC that will affect the scope and contents of the new Supplement 11, the best place to include this information would be in a new Supplement xx “Electrochemical Cell Stack Repairs and Alterations”.	
Background Information	
Electrochemical cell stacks are being built and registered with the National Board under ASME BPVC Section VIII Division 1 and Code Case 3078. Once deployed, if some modification is required by the end user, having repair and alteration lists in NBIC Part 3 will help guide decisions by Owners, Inspectors, and Jurisdictions. Illustrations of a typical electrochemical cell stack, related NBIC language for plate heat exchangers, and an Interpretation applicable to electrochemical cell stacks (23-07) are included in this Action Item.	
Note 1: Robert Underwood and Terry Hellman have confirmed with Gary Scribner, NBBI Assistant Executive Director – Technical, that the National Board has no issue with the addition of definitions within NBIC Supplements which are specific to that Supplement, and which will not appear in Section 9 of Parts 1-4.	
Note 2: While Interpretation 23-07 clarifies that some mechanical-only activities on electrochemical cell stacks that do not affect pressure-retaining items are not covered by current NBIC rules, the addition of this Supplement will place these activities in NBIC space when they affect the unit’s mechanical or electrochemical performance. To lower the burden on this subset of activities, the requirements in this Supplement provide a path for some mechanical-only repairs to not require standard examination/testing or stamping unless mandated by the Jurisdiction.	
Existing Text	Proposed Text
None.	<p><u>SUPPLEMENT xx</u> <u>ELECTROCHEMICAL CELL STACK UNIT REPAIRS AND ALTERATIONS</u></p> <p><u>Sxx.1 SCOPE</u></p> <p><u>a) This Supplement provides requirements and guidelines for repairs and alterations to electrochemical cell stack units fabricated in accordance with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1. These requirements shall be used in conjunction with the applicable rules in this Code. When the standard governing the original construction is not the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, and where the Jurisdiction requires that repairs or alterations to such units be performed in accordance with this Code, the requirements of NBIC Part 3, 1.2 b) shall apply.</u></p> <p><u>b) Mechanical replacement of cell components is outside the scope of this Supplement, unless such activities involve one or more of the following:</u></p> <ol style="list-style-type: none"> <u>1) Changes that may affect the unit’s mechanical or electrochemical performance;</u> <u>2) Welding, brazing, or fusing; or</u> <u>3) The replacement or installation of stamped parts.</u>



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Sxx.2 DEFINITIONS SPECIFIC TO ELECTROCHEMICAL CELL STACK UNIT REPAIRS AND ALTERATIONS

Active Cell Component – Any component located completely between the end plates of an electrochemical cell stack unit which plays an active role in the mechanical or electrochemical performance of a cell. Examples include insulator plates (e.g., dielectric plates), separator plates, cell frames, current collectors, membrane electrode assemblies (MEA), fluid isolators, compressive force elements (e.g., internal springs), and gaskets.

Electrochemical Performance – The ability of an electrochemical cell stack unit to perform its intended electrochemical function, wherein electricity is applied to a fluid or gas to cause chemical reactions that produce known chemicals or elements in predictable quantities.

Mechanical Performance – The ability of an electrochemical cell stack unit to perform its intended pressure-retaining function under known mechanical conditions, including pressure, temperature, flow, and physical loadings and stresses. Changes to pressure-retaining items or known mechanical conditions shall be interpreted as potentially affecting the unit's mechanical performance.

Sxx.3 QUALITY MANAGEMENT SYSTEM

Organizations performing repairs and alterations to electrochemical cell stack units under the rules of this Supplement shall include in their written Quality Management System the following:

- a) The scope of activities to be performed;
- b) The process by which the competent technical advice described in Sxx.4 may be obtained prior to conducting repair or alteration performance activities; and
- c) Reference to, or inclusion of, the examination, testing, and stamping requirements in Sxx.7 and Sxx.8.

Sxx.4 MECHANICAL AND ELECTROCHEMICAL PERFORMANCE

The operating nature of electrochemical cell stack units is technically complex, and slight variations in chemical, electrical, and mechanical characteristics (even within permissible ranges allowed by specification) can dramatically affect the performance operation and expected life of the item. Due to this, prior to conducting repair or alteration performance activities, potential effects of the work on the item's mechanical and electrochemical performance shall be determined. In addition, competent technical advice should be obtained from the Original Equipment Manufacturer (OEM) or another qualified source prior to conducting repair or alteration performance activities, with such advice being required especially important in the following cases:

- a) When activities under this Supplement may affect the mechanical or electrochemical performance of the electrochemical cell stack unit to such an extent that its expected life may be shortened; and
- b) When the available documentation for an electrochemical cell stack unit, including the Manufacturer's Data Report (MDR) and OEM drawings, does not provide enough information to assess how activities under this Supplement will affect the mechanical or electrochemical performance of the item.

Commented [AT1]: The definitions here have been reviewed for technical accuracy by Matthew Sweetland with Electrochemical Stack Engineering LLC, the original submitter of this Item. In Rev 4 of this Item the term "active" was removed from this definition to prevent NBIC users from assuming that since some cell components are "active", others may be "non-active"; according to Matt Sweetland, all cell components play some role in the unit's electrochemical or mechanical performance.

Commented [AT2]: As this is outside the scope of VIII-1 construction code considerations, but is important to the proper functioning of these units, this definition is intended to be open-ended enough that users/OEMs can determine R&A activity impact based on the technical nature of the electrochemical cell stack unit being repaired/alterd.

Commented [AT3]: This definition is intended to be broad enough to cover most R&A activities which aren't like-for-like replacements.



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Sxx.5 REPAIR OF ELECTROCHEMICAL CELL STACK UNITS

The following activities on electrochemical cell stack units are classified as repairs under this Code:

- a) Applicable repairs listed in NBIC Part 3, 3.3.2 and 3.3.3, including those listed for plate heat exchangers in 3.3.3 u); and
- b) Changes to, or replacement of, active-cell components that will not affect the mechanical performance of the unit.

Sxx.6 ALTERATION OF ELECTROCHEMICAL CELL STACK UNITS

The following activities on electrochemical cell stack units are classified as alterations under this Code:

- a) Applicable alterations listed in NBIC Part 3, 3.4.4, including those listed for plate heat exchangers in 3.4.4 i) 2);
- b) Changes to active-cell components that may affect the mechanical performance of the unit; and
- c) The following changes from what is described on the MDR or OEM drawings:
 - 1) A reduction in number of cells below any minimum, or when no minimum is specified; and
 - 2) An increase in number of cells above any maximum, or when no maximum is specified.

Sxx.7 EXAMINATION AND TEST

a) The examination and testing requirements in NBIC Part 3, 4.4.1, only apply to the following repair activities on electrochemical cell stack units:

- 1) Those listed in NBIC Part 3, Section 3;
- 2) Those that involve welding, brazing, or fusing; and
- 3) Those that involve the replacement or installation of stamped parts.

b) When repair and alteration activities on an electrochemical cell stack unit may affect the item's electrochemical performance, or where examination/testing in accordance with Sxx.7 a) is not required, the unit shall receive an operational test after the completion of work to verify successful performance operation of the unit and to verify the integrity of the repair or alteration. The scope and acceptance criteria of this test shall be a matter of agreement between the Owner, "R" Certificate Holder, Inspector, and where required, the Jurisdiction. A short description of this test shall be included on the applicable Form "R" Report.

Sxx.8 STAMPING

Unless required by the Jurisdiction where the electrochemical cell stack unit is installed, repair activities on electrochemical cell stack units that do not require examination and test under Sxx.7 a) do not require stamping or nameplate attachment as described in NBIC Part 3, 5.7, provided the repair procedure has been accepted by the Inspector. Routine repairs may also be exempt from stamping and nameplate attachment when allowed by NBIC Part 3, 3.3.2. When stamping or nameplate attachment is not performed, it shall be documented on the NB-66, Form R-1, Report of Repair.

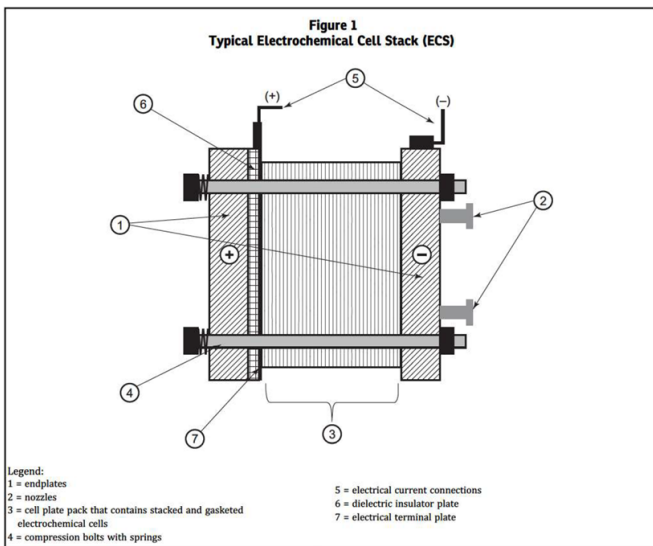
Commented [AT4]: This list is intended to encompass all R&A activities other than mechanical replacement of cell components that do not affect the unit's pressure-retaining function. The inclusion of the "stamped parts" language is to cover a potential situation where the ASME boundary for these units expands to require stamping of non-pressure-retaining parts internal to the unit - there's no indication this will happen, but I've been told that ASME VIII-1 discussions about electrochemical cell stack units are ongoing, so it's a possibility. Having this language in Part 3 now will preclude a situation where these activities do not get appropriately tested and stamped.

Commented [AT5]: Because electrochemical performance is outside the scope of VIII-1 construction code considerations, this testing is left broad enough that NBIC users can determine appropriate measures for their specific equipment, while still meeting the overarching examination/testing fundamentals from NBIC Part 3, 4.4.

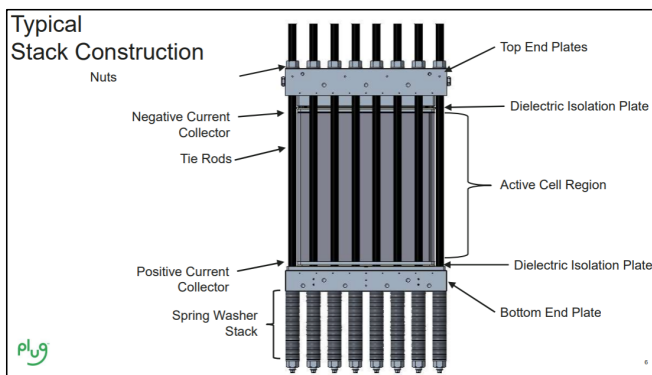
Commented [AT6]: The exemption provided here is tailored for repair activities that involve mechanical replacement of internal electrochemical cell stack components that don't affect the unit's pressure-retaining function.



VOTE:							
COMMITTEE	Approved	Disapproved	Abstained	Not Voting	Passed	Failed	Date
SG R&A	18	0	0	0	Passed	N/A	10/31/25



Typical Electrochemical Cell Stack configuration (from ASME Code Case 3078)



Typical Electrochemical Cell Stack configuration (from Plug Power)



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2025 NBIC Part 3, 3.3.3 u)

- u) Repairs to plate heat exchangers (PHE) are limited to the following:
- 1) Welding on any pressure part, i.e. not limited to a flange, nozzle, or endplate;
 - 2) In kind replacement of endplates, or welded nozzles;
 - 3) Replacement of any failed connection or frame bolting, representing the replacement parts described in Part 3, 3.2.2-a), with no change of material or grade as described on the Manufacturer's Data Report (MDR) or Original Equipment Manufacturer's (OEM) drawing;
 - 4) The addition or repair of load bearing attachments (e.g., welded supports or lifting lugs) to the endplates; and
 - 5) Replacement of parts bearing certification or manufacturer's stamping with no-change in material allowed as described on the MDR or verifiable OEM drawing.

2025 NBIC Part 3, 3.4.4 j) 2)

- j) For plate heat exchangers, in addition to the applicable examples of alterations above, the following changes from what is listed on the MDR or described on the Original Equipment Manufacturer's (OEM) drawing:
- 2) Any change in material whether described at 3.3.3 s) or as described at 3.4.4 g):
 - a. A change in connection bolt or frame compression bolt diameter or material grade;
 - b. A change in material grade or nominal dimensions of any end plates or nozzles.

INTERPRETATION 23-07

Subject: Replacement of nonpressure-retaining parts in Electrolyzer PEM Stack

Edition: 2023

Question 1: Is the replacement of mechanically installed nonpressure parts not listed on the MDR within a mechanically assembled ASME Section VIII pressure-retaining item that does not affect the pressure parts considered a repair or routine repair by the NBIC?

Reply 1: No, the NBIC does not address the requirements for mechanical repairs to these types of components.

Question 2: Is the mechanical assembly of an ASME Section VIII pressure-retaining item after only mechanically installed nonpressure parts have been replaced required to be documented on Form R-1, Report of Repair?

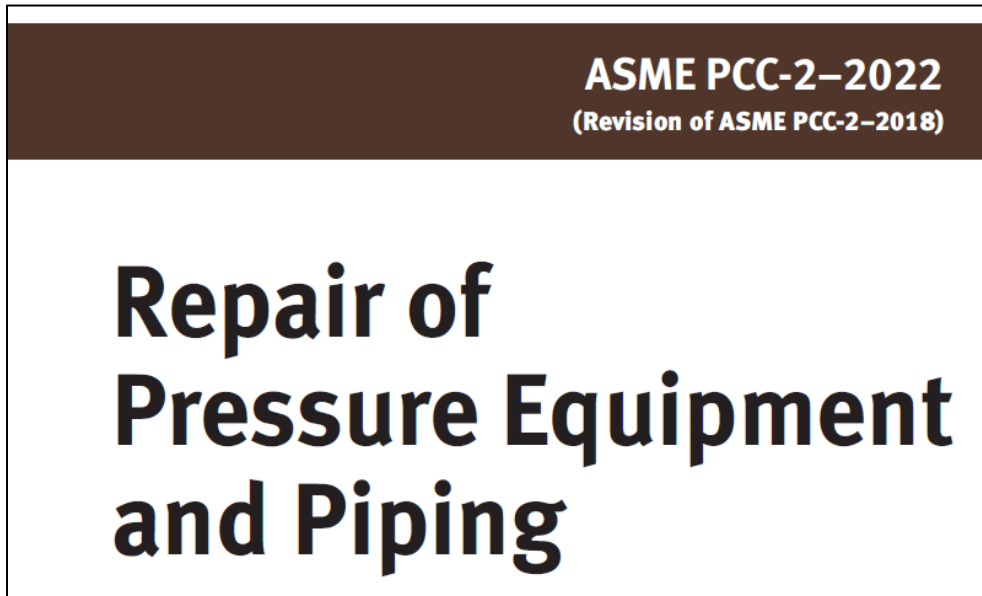
Reply 2: No, this is beyond the scope of NBIC Part 3.

S11.2.X WELDED LAP PATCH

- a) A welded lap patch is a repair method used to maintain the structural integrity of the pressure retaining item by providing an external boundary over the area exhibiting damage in the form of a "welded lap patch" as described by ASME PCC-2 (i.e. Full Encirclement Steel Reinforcing Sleeves for Piping, Fillet Welded Lap Patches with Reinforcing Plug Welds, or Fillet Welded Lap Patches).
- 1) Welded lap patches shall be further restricted as follows:
 - a. Not permitted for use in Power Boilers
 - b. Pressure retaining items which operate under internal pressure unless an engineering evaluation has been performed to qualify for operation under external pressure.
 - c. Pressure retaining items which operate at temperatures below the creep range (e.g., time independent allowable stresses).
 - d. Pressure retaining items which operate above the minimum design metal temperature.
 - e. No lethal service.
 - f. No cyclic service.
 - g. Not permitted where environmental or service-related cracking damage mechanisms have been identified.
 - h. A lap patch installed over an existing lap patch is prohibited.
 - i. The distance between adjacent lap patches or between the lap patch and a major structural discontinuity (MSD), i.e., head-to-shell junction, saddle supports, etc., shall not be less than $2\sqrt{Rt}$ where R is the outside radius of the spherical or cylindrical component in inches (mm), and t is equal to the nominal wall thickness of the spherical or cylindrical component in inches (mm). Lap patches closer than $2\sqrt{Rt}$ to a nozzle shall be integrated with the nozzle as reinforcement pads.
 - 3) ASME PCC-2 shall be used for the design of the welded lap patch and shall be in accordance with the original code of construction, when practicable. Design of a welded lap patch shall consider currently stamped design conditions, taking into account current service conditions and damage mechanisms. Use of this method shall be acceptable to the Inspector and where required, the Jurisdiction and shall be limited to pressure containing equipment owned and operated by an owner or user.
 - a. Lap patch material should be the same (e.g., composition, physical and mechanical properties) as that of the pressure retaining item's original construction. Lap patch material of a different nominal composition and, equal to or greater in allowable stress from that used in the original design, may be used provided the material satisfies the requirements of the original code of construction under which the vessel was built and has compatible thermal expansion properties.
 - 4) The "R" Certificate Holder responsible for the design of the welded lap patch shall ensure a Fitness for Service Assessment (FFSA) has been performed on the area of the item being patched in accordance with NBIC, Part 2, 4.4.1, supporting the continued service of the item. The welded lap patch shall not remain in place beyond its calculated remaining life determined in the FFSA .
 - a) The remaining life of the pressure retaining item shall be documented on the Form NB-403 in the Remarks section. The Form NB-403 shall be prepared in accordance with NBIC Part 2. The Form NB-403 shall be affixed to the Form R-1 and identified in the Remarks section.
 - b) The thinned or leaking area shall be fully covered, 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.

- c) A welded lap patch method shall not be used where cracks are present unless the cracks have been removed, stopped, repaired, or the condition that led to the crack formation and propagation has been eliminated.
- 5) Hazards associated with welding on degraded components should be addressed with the owner or user by the use of engineering controls, administrative controls and personal protective equipment.
 - a) When the pressure retaining item will remain in service while implementing a welded lap patch, the requirements and limitations described within ASME PCC-2, Part-1 shall be used in conjunction with ASME PCC-2, Part-2.
 - b) 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.
- 6) Test or examination methods shall be in accordance with NBIC, Part 3, 4.4.1, considering recommendations provided in ASME PCC-2, Part-2.
- 7) After the completion of weld repairs, post repair inspection requirements shall be established in accordance with NBIC Part 3, S11.2.2.
- 8) Documentation and distribution requirements for repair methods identified in this supplement are identified in NBIC Part 3, Section 5.
- 9) Organizations performing these repairs under an "R" stamp program shall register such repairs with the National Board.

Prior Precedence to PCC-2 Activities allowed in the NBIC Code:



3.2.6 REFERENCE TO OTHER CODES AND STANDARDS

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

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

Some examples are as follows:

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

S11.3 ENGINEERED ALTERATION METHODS (25)

S11.3.1 ENCAPSULATION (25)

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.

NBIC Action Item A25-22
 Submitted by Luis Ponce (LPonce@nbbi.org)
 June 12, 2025



**THE NATIONAL BOARD
 OF BOILER AND PRESSURE VESSEL INSPECTORS**

Subject:	Revise Part 3, Table 2.5.1
NBIC Location:	2025 Part 3, Table 2.5.1
Statement of Need:	There have been changes to materials in the ASME Code that have made a review/revision of Table 2.5.1 necessary. If anything, the obsolete group numbers should be deleted. It will be up to the committee to decide whether to add the missing P/group numbers and the associated temperatures.
Background Information:	An NBBI student challenged a question on an exam which referenced Table 2.5.1. The research of the table revealed there are some material group numbers that no longer exist and some new ones (P No & Gr No) that are not addressed.

2.5.1 PREHEATING

- a) Preheating may be employed during use of a process to assist in completion of the joint. The need for and the temperature of preheat are dependent on a number of factors such as chemical analysis, degree of restraint of the items being joined, material thickness, and mechanical properties. The procedure specification for the material being joined shall specify the preheat temperature requirements.
- ~~b) See minimum temperatures for preheating given in NBIC Part 3, Table 2.5.1 as a general guide. It is cautioned that the preheating temperatures listed may not be the same as those of the original code of construction and do not necessarily ensure satisfactory completion of the joint. Requirements for individual materials within the P-Number listing may have preheating requirements more or less restrictive than this general guide. When reference is made in this section to materials by the ASME designation, P-Number and Group Number, the suggestions of this section apply to the applicable materials of the original code of construction, either ASME or other, which conform by chemical composition and mechanical properties to ASME materials having the ASME P-Number and Group Number designations.~~
- b. Minimum temperatures for preheating shall be in accordance with the original code of construction or as provided in alternative welding methods in 2.5.3.

NBIC Action Item A25-22
 Submitted by Luis Ponce (LPonce@nbbi.org)
 June 12, 2025

Proposed Text:

~~± 7x E 4 1 1~~

MINIMUM TEMPERATURES FOR PREHEATING

Thicknesses referenced are nominal at the weld for the parts to be joined.	
a) P No. 1 Group Nos. 1, 2, and 3, <u>and 4</u>	1) 175°F (70°C) for material that has both a specified maximum carbon content in excess of 0.30% and a thickness at the joint in excess of 1 in. (25 mm). 2) 50°F (10°C) for all other materials in this P-Number.
b) P No. 3 Group Nos. 1, 2, and 3	1) 175°F (70°C) for material that has either a specified minimum tensile strength in excess of 70,000 psi (480 MPa) or a thickness at the joint in excess of 5/8 in. (16 mm). 2) 50°F (10°C) for all other materials in this P-Number.
c) P No. 4 Group Nos. 1 and 2	1) 250°F (120°C) for material that has either a specified minimum tensile strength in excess of 60,000 psi (410 MPa) or a thickness at the joint in excess of 1/2 in. (13 mm). 2) 50°F (10°C) for all other materials in this P-Number.
d) P No. 5A Group 1 and 5B, Group 1, <u>5C</u> <u>Group 1, 3, 4, and 5,</u> and P No. 15E Group 1	1) 400°F (205°C) for material that has either a specified minimum tensile strength in excess of 60,000 psi (410 MPa) or has both a specified minimum chromium content above 6.0% and thickness at the joint in excess of 1/2 in. (13 mm). 2) 300°F (150°C) for all other materials in this P-Number.
e) P No. 6 Group Nos. 1, 2, and 3, <u>and 4</u>	400°F (205°C)
f) P No. 7 Group Nos. 1 and 2	None
g) P No. 8 Group Nos. 1, <u>and 2, 3, and 4</u>	None
h) P No. 9 Group	1) 250°F (120°C) for P-9A Gr. 1 materials 2) 300°F (150°C) for P-9B Gr. 1 materials 3) <u>XXX° F (XXX°C) for P-9C Gr. 1 materials (insert applicable values) — delete</u>

NBIC Action Item A25-22
 Submitted by Luis Ponce (LPonce@nbbi.org)
 June 12, 2025

SECTION 2

<p>i) P-No. 10 Group</p> <div style="border: 1px solid red; padding: 5px; width: fit-content; margin: 10px auto;"> <p>These 2 are the same</p> </div>	<p>1) 175°F (79°C) for P-10A Gr. 1 materials</p> <p>2) 250°F (120°C) for P-10B Gr. 2<u>1</u> materials</p> <p>3) 175°F (79°C) for P-10C Gr. 3 materials</p> <p>4) 250°F (120°C) for P-10F Gr. 6 materials</p> <p>5) P-10H, 10I, 10J and 10K None</p> <p>6) 200 F (95 C) for P-10H NONE</p> <p>7) 200 F (95 C) for P-10I NONE</p> <p>8) 200 F (95 C) for P-10J Gr. 1 materials — delete</p> <p>9) 200 F (95 C) for P-10K Gr. 1 materials</p> <p>5) For P-10C Gr. 3 materials, preheat is neither required nor prohibited, and consideration shall be given to the limitation of interpass temperature for various thicknesses to avoid detrimental effects on the mechanical properties of heat treated material.</p> <p>6) For P-10D Gr. 4 and P-10E Gr. 5 materials, 300°F (150°C) with interpass temperature maintained between 350°F and 450°F (175°C and 230°C).</p>
<p>j) P-No. 11 Group</p>	<p>1) P-11A Group Group 1 — None (Note 1) Group 2 — Same as for P No. 5 (Note 1) Group 3 — Same as for P No. 5 (Note 1) Same as for P No. 5 (Note 1) Group 4 — 250°F (120°C) Group 5 — XXXXX — delete</p> <p>2) P-11B Group Group 1 — Same as for P No. 3 (Note 1) Group 2 — Same as for P No. 3 (Note 1) Group 3 — Same as for P No. 3 (Note 1) Group 4 — Same as for P No. 3 (Note 1) Group 5 8 — Same as for P No. 3 (Note 1) Group 6 9 — Same as for P No. 5 (Note 1) Group 7 10 — Same as for P No. 5 (Note 1)</p> <p>3) P-11C Group Group 1 — XXXXXX — delete</p>

Note 1:

c. Consideration shall be given to the limitation of interpass temperature for various thicknesses to avoid detrimental effects on the mechanical properties of heat treated materials.

NBIC Action Item A25-25

Submitted by Bob Underwood (robert_underwood@hsb.com)

June 12, 2025



**THE NATIONAL BOARD
OF BOILER AND PRESSURE VESSEL INSPECTORS**

Subject:	Repair of PRIs Without Complete Removal of Defect
NBIC Location:	2025 Part 3, S11.2.2
Statement of Need:	To clarify this repair activity can be used for welded or non-welded repairs. This proposal will remove reference to welded repairs in S11.2.2 and only refer to "repair."
Background Information:	The intent of S11.2.2 (formerly 3.3.4.8) is that this activity be permitted in conjunction with a welded or non-welded repair activity. However, the current wording appears to permit it only when performing a welded repair activity.

Proposed Text:

- 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

NBIC Action Item A25-25

Submitted by Bob Underwood (robert_underwood@hsb.com)

June 12, 2025

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-service 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 determined 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.



PROPOSED REVISION OR ADDITION

Item No. A 25-29 Rev 01
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
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, weld metal etc. This item is to review these references and identify if a single reference description is beneficial for users of the Code.
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. Definitions of Weld Metal, Filler Metal and Weld Filler Material have been approved under item A23-13 and will be published in 2025.
Rev 01 1.5.1(i), revised materials to consumable per Mr. Riley 1.6.6.2(i)(2), revised materials to consumable per Mr. Riley 2.5.3.5 c), deleted the word deposit and revised the fourth sentence per Mr. Triplett. 2.5.3.6 c) 5) b, revised the word 'is' to 'are' per Mr. Triplett. 2.5.3.7 i) 4), corrected 'of' to 'or' in sixth line per Mr. Underwood and Mr. Triplett. 2.5.3.7 i) 2), revised the word 'is' to 'are' per Mr. Triplett. S8.3 e), revised 'an' to 'a' in the third line per Mr. Triplett. 9.1, revised the word 'the' to 'a' in the third line per Mr. Triplett.

Paragraph	Current Text	Proposed Text
1.5.1(i)	The QMS shall describe the method used to ensure that only acceptable materials (including welding material) are used for repairs and/or alterations. The QMS shall include a description of how existing material is identified and new material is	The QMS shall describe the method used to ensure that only acceptable materials (including welding material consumables) are used for repairs and/or alterations. The QMS shall include a description of how existing material is identified and new material is

	ordered, verified, and identified. The QMS shall identify the title of the individual(s) responsible for each function and a brief description of how the function is to be performed.	ordered, verified, and identified. The QMS shall identify the title of the individual(s) responsible for each function and a brief description of how the function is to be performed.
1.6.6.2(i)(2)	Welding, brazing and fusing materials shall be identified and controlled.	Welding, brazing and fusing materials <u>consumables</u> shall be identified and controlled.
2.5.3.1 e) 1)	Provided the carbon equivalent of the base material to be welded is determined to be 0.40 or less.	Provided the carbon equivalent of the base material-metal to be welded is determined to be 0.40 or less.
2.5.3.1 e) 2)	The electrodes and filler metals are classified by the filler metal specification with a diffusible hydrogen designator of H4 or lower.	The electrodes and filler metals <u>weld consumables</u> are classified by the filler metal specification with a diffusible hydrogen designator of H4 or lower
2.5.3.2 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 specification 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;	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 <u>those</u> that are classified by the filler metal <u>weld consumable</u> specification 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;
2.5.3.2 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	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 <u>weld consumable</u> manufacturer with a diffusible-hydrogen designator of H4 (e.g., E7018-H4); and
2.5.3.2 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.	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 <u>metal</u> .
2.5.3.3 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;	The test material for the welding procedure qualification shall be of the same P-No. and Group No. as the base material-metal specification of the repair. In the event that the original material-base metal 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-base metal being repaired, but in no case shall the material be lower in strength;
2.5.3.3 g) 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	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-weld 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;	electrodes or filler metals that are classified by the filler-metal-weld consumable specification with a diffusible-hydrogen designator of H8 or lower for the FCAW and SMAW processes;
2.5.3.3 g) 3)	After completion of welding using SMAW 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	After completion of welding using SMAW 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-weld consumable manufacturer with a diffusible- hydrogen designator of H4 (e.g., E7018-H4); and
2.5.3.3 g) 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.	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-metal .
2.5.3.4 c)	The welding shall be limited to the SMAW, FCAW, GMAW or GTAW processes using low-hydrogen 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 contamination by hydrogen producing sources. The surface of the metal prepared for welding shall be free of contaminants;	The welding shall be limited to the SMAW, FCAW, GMAW or GTAW processes using low-hydrogen electrodes and filler metals-weld consumables classified by the filler-metal -specification with a diffusible-hydrogen designator of H8 or lower, and suitably controlled by maintenance procedures to avoid contamination by hydrogen producing sources. The surface of the metal prepared for welding shall be free of contaminants;
2.5.3.4 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;	The test material for the welding procedure qualification shall be of the same P-No. and Group No. as the base material-metal specification of the repair. In the event that the original material-base metal 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-base metal being repaired, but in no case shall the material be lower in strength;
2.5.3.4 g) 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;	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 those that are classified by the filler-metal-weld consumable specification with a diffusible-hydrogen designator of H8 or lower for the FCAW and SMAW processes;
2.5.3.4 g) 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	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-weld consumable manufacturer with a diffusible-hydrogen designator of H4 (e.g., E7018 H4); and

2.5.3.5 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);	The welding shall be limited to the SMAW, FCAW, GMAW and machine or automatic GTAW processes. The filler-metalweld consumable used for joining the dissimilar materials shall be either an A-No 8 weld metal in Section IX Table QW-442 or Nickel- Chrome-Chromium alloy classification (of F-No 43) in Section IX, QW-432 . When selecting a filler-metalweld consumable for dissimilar metal weld joints, determine if the weld joint will be exposed to elevated temperature service. Weld metals with chemistry matching A-No 8 (per Section IX Table QW-442) 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-metalweld consumable shall be used for dissimilar weld joints exposed to service temperatures at or above 800°F (427°C);
2.5.3.6 c) 5) 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;	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-weld consumable diametersize is-are to be shown on the WPS;
2.5.3.6 c) 5) 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., INCOWELD A), UNS N08087;	The filler-metalweld consumable shall be limited to an austenitic, nickel-base typefiller metal to those assigned to F-number- Number 43 in Section IX, QW-432 and limited to the following consumablesclassifications: A or SFA-5.14 ERNiCr-3 (e.g., Filler Metal 82), A or SFA-5.11 ENiCrFe-3 (e.g., INCONEL Welding Electrode 182), ENiCrFe-2 (e.g., INCOWELD A), UNS N08087 or ENiCrFe-4;
2.5.3.6 c) 5) 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	A martensitic, iron-base filler-metalweld consumable to those assigned to F-number Number 4 or F-number- Number 6 in ASME Section IX, QW-432 and limited to the following consumablesclassifications: A or SFA-5.5 E8015-B8, E8018-B8 or A or SFA-5.28 ER80S-B8; and
2.5.3.6 c) 5) 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.	For weld build-up repairs due to wastage, the filler-metalweld consumable shall be limited to those assigned to F-number- Number 43 in ASME Section IX, QW-432.
2.5.3.7 i) 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.	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 sizeweld consumable diameter is-are to be shown on the WPS.
2.5.3.7 i) 4)	For the joining of ASME P-No. 15E, Group 1 to P-No. 5A, the filler metal shall be limited to a martensitic, 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	For the joining of ASME P-No. 15E, Group 1 to P-No. 5A, the filler-metalweld consumable shall be limited to a martensitic, 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.	consumables classifications: A or SFA-5.5 E8015-B8, E8018-B8 or A or SFA-5.28 ER80S-B8.
2.5.3.7 i) 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.	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 weld consumable assigned to F-No. 43 in ASME Section IX, QW-432 and limited to the following consumables classifications: A or SFA-5.14 ERNiCr-3, A or SFA-5.11 ENiCrFe-3, ENi-CrFe-2, or UNS N08087 ENiCrFe-47 .
3.3.3 a)	Weld repairs or replacement of pressure parts or attachments that have failed in a weld or in the base material;	Weld repairs or replacement of pressure parts or attachments that have failed in a weld or in the base material metal ;
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 butt weld or single butt weld 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.	Except as provided in NBIC Part 3, 3.3.4.8, a repair of a defect in a welded joint or base material metal 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 butt weld or single butt weld 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.
3.3.4.2 a)	Cracks Except as provided in NBIC Part 3, 3.3.4.8, a repair of a crack in a welded joint or base material shall not be made until the defect has been removed. A suitable nondestructive examination method such as MT or 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 butt weld or single butt weld with or without backing, as allowed by the original code of construction.	Cracks Except as provided in NBIC Part 3, 3.3.4.8, a repair of a crack in a welded joint or base material metal shall not be made until the defect has been removed. A suitable nondestructive examination method such as MT or 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 butt weld or single butt weld with or without backing, as allowed by the original code of construction.
3.3.4.3 e) 2) d.	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;	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 metal 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 classification or specification . 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;
4.2 a)	All nondestructive examination (NDE) requirements, except for NDE personnel	All nondestructive examination (NDE) requirements, except for NDE personnel

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	<p>qualification requirements, 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 NDE requirements as the original welds. Where this is not possible or practicable, or where there is insufficient information available to determine the original NDE requirements, alternative NDE methods that provide meaningful results to verify the integrity of the repair or alteration, if acceptable to the Inspector, and where required, the jurisdiction where the pressure-retaining item is installed, may be used, provided all other requirements of this section are met.</p> <p>For welds that were subject to volumetric NDE during construction, repairs may be made to the base material and welded joints without volumetric examination, under the following conditions:</p> <ol style="list-style-type: none"> 1) The repair depth does not exceed the lesser of 1/8 in. (3 mm) or 25% of the nominal base material thickness; 2) The aggregate repair length is no longer than 6 in. (150 mm); and 3) The repair cavity and each layer of deposited weld, including the final weld surface, have been examined by magnetic particle (MT) or liquid penetrant (PT). 	<p>qualification requirements, 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 NDE requirements as the original welds. Where this is not possible or practicable, or where there is insufficient information available to determine the original NDE requirements, alternative NDE methods that provide meaningful results to verify the integrity of the repair or alteration, if acceptable to the Inspector, and where required, the jurisdiction where the pressure-retaining item is installed, may be used, provided all other requirements of this section are met.</p> <p>For welds that were subject to volumetric NDE during construction, repairs may be made to the base material-metal and welded joints without volumetric examination, under the following conditions:</p> <ol style="list-style-type: none"> 1) The repair depth does not exceed the lesser of 1/8 in. (3 mm) or 25% of the nominal base material-metal thickness; 2) The aggregate repair length is no longer than 6 in. (150 mm); and 3) The repair cavity and each layer of deposited weld metal, including the final weld surface, have been examined by magnetic particle (MT) or liquid penetrant (PT).
S1.2.10 a)	<p>Except as provided in NBIC Part 3, 3.4.4.8, a repair of a defect in a welded joint or base material shall not be made until the defect is 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 butt weld or a single butt weld 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.</p>	<p>Except as provided in NBIC Part 3, 3.4.4.8, a repair of a defect in a welded joint or base material-metal shall not be made until the defect is 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 butt weld or a single butt weld 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.</p>
S2.13 c)	<p>Except as provided in NBIC Part 3, 3.3.4.8, a repair of a defect, such as a crack in a welded joint or base material, shall not be made until the defect has been removed. A suitable nondestructive examination method such as magnetic particle (MT) or liquid penetrant (PT) may be necessary to assure complete removal of the defect. If the defect penetrates the full thickness of the material, the repair shall be made with a complete penetration weld such as a</p>	<p>Except as provided in NBIC Part 3, 3.3.4.8, a repair of a defect, such as a crack in a welded joint or base material-metal, shall not be made until the defect has been removed. A suitable nondestructive examination method such as magnetic particle (MT) or liquid penetrant (PT) may be necessary to assure complete removal of the defect. If the defect penetrates the full thickness of the material, the repair shall be made with a complete penetration weld such as a</p>

	a double butt weld or a single butt weld 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, the Jurisdiction.	double butt weld or a single butt weld 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, the Jurisdiction.
S5.6.3 e)	The plug material shall conform in all respects to the material specification of the base material;	The plug material shall conform in all respects to the material specification of the base material metal;
S6.11 b)	For hydrogen control when low alloy steel filler metals are used, the filler metal classification shall include an H4 supplemental diffusible hydrogen designator (maximum 4 ml [H ₂]/100 g deposited metal) for each of the following welding processes: 1) electrodes for shielded- metal arc welding (SMAW) conforming to SFA-5.5; 2) electrodes and fluxes for submerged arc welding (SAW) conforming to SFA-5.26; 3) electrodes and rods for gas- shielded metal arc welding (GMAW) conforming to SFA-5.28; 4) electrodes for flux-cored arc welding (FCAW) conforming to SFA 5.29.	For hydrogen control when low alloy steel filler metals weld consumables are used, the filler metal classification shall include an H4 supplemental diffusible hydrogen designator (maximum 4 ml [H ₂]/100 g deposited metal) for each of the following welding processes: 1) electrodes for shielded- metal arc welding (SMAW) conforming to SFA-5.5; 2) electrodes and fluxes for submerged arc welding (SAW) conforming to SFA-5.26; 3) electrodes and rods for gas- shielded metal arc welding (GMAW) conforming to SFA-5.28; 4) electrodes for flux-cored arc welding (FCAW) conforming to SFA 5.29.
S6.11 c)	Practices used for controlling storage and exposure of filler metals shall be those developed by the "R" Certificate Holder or those recommended by the filler metal manufacturer.	Practices used for controlling storage and exposure of filler metals weld consumables shall be those developed by the "R" Certificate Holder or those recommended by the filler metal weld consumable manufacturer.
S8.2.1 a)	9Cr-1Mo-VNbN Filler Metal (i.e. matching to Grade 91) + Controlled Fill + Low PWHT (Minimum temperature is 1250°F, 675°C). Acceptable filler materials are referenced in Table S8.2.1. The minimum time and maximum heat treatment temperature shall be in accordance with the original code of construction. For reference, where the Ni+Mn content of the filler metal is not known, the maximum PWHT temperature shall be 1425°F (775°C). This maximum shall be enforced to avoid over-tempering or exceeding the absolute maximum PWHT temperature. PWHT hold times at temperature shall be as follows:	9Cr-1Mo-VNbN Filler Metal (i.e. designed to matching to Grade 91 base metals) + Controlled Fill + Low PWHT (Minimum temperature is 1250°F, 675°C). Acceptable filler materials weld consumables are referenced in Table S8.2.1. The minimum time and maximum heat treatment temperature shall be in accordance with the original code of construction. For reference, where the Nickel + Manganese content of the filler metal weld consumable is not known, the maximum PWHT temperature shall be 1425°F (775°C). This maximum shall be enforced to avoid over-tempering or exceeding the absolute maximum PWHT temperature. PWHT hold times at temperature shall be as follows:
S8.2.1 b)	9Cr-1Mo Filler Metal + Controlled Fill and No PWHT. Acceptable filler materials are detailed in Table S8.2.1.	9Cr-1Mo Filler Metal + Controlled Fill and No PWHT. Acceptable filler materials weld consumables are detailed in Table S8.2.1.
S8.2.1 c)	Ni-base Filler Metal + Controlled Fill and No PWHT. Acceptable nickel base consumables include selected ASME F No. 43 filler metals as detailed in Table S8.2.1.	Ni- ckel base Filler Metal + Controlled Fill and No PWHT. Acceptable nickel base weld consumables include selected ASME F-F- No. 43 types per ASME Section IX, QW-432 filler metals as detailed in Table S8.2.1.
Table S8.2.1	See Attachment A	
S8.2.2 a)	For repairs in P-No. 15E, Group 1, Grade 91, CSEF steel 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	For repairs in P-No. 15E, Group 1, Grade 91, CSEF steel joined welded 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

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	original code of construction, the filler metal shall be limited to an austenitic, nickel-base filler metal having a designation F-No. 43 and limited to the following consumables: ERNiCr-3, ENiCrFe-3, ENiCrFe-2, ERNiCrFe-4, ENiCrFe-4, ENiCr3Tx-y, ENiCrFe2Tx-y, or ENiCrFe3Tx-y. UNS N08087. This weld repair option does not require PWHT.	code of construction, the filler metal shall be limited to an austenitic, nickel-base filler metalweld consumable having a designation F-No. 43 per ASME Section IX, QW-432 and limited to the following weld consumable classifications: A or SFA-5.14 ERNiCr-3, or ERNiCrFe-4, A or SFA-5.11 ENiCrFe-3, ENiCrFe-2, or ERNiCrFe-4, ENiCrFe-4, A or SFA 5.34 ENiCr3Tx-y, ENiCrFe2Tx-y, or ENiCrFe3Tx-y. This weld repair option does not require PWHT.
S8.2.2 b)	<p>b) For repairs in P-No. 15E, Group 1, Grade 91, CSEF steel joined to P-No. 4, Group 1, or P-No. 5A, Group 1, the filler metal shall be limited to:</p> <p>1) A martensitic, iron-base filler metal having a designation F-No. 4 or F-No. 6 and limited to the following consumables: E8015-B8, E8018-B8, or ER80S-B8. This weld repair option does not require PWHT; or</p> <p>2) A martensitic, iron-base filler metal having a designation F-No. 4 or F-No. 6 and limited to the following consumables: E9015-B91, E9016-B91, E9018-B91, E91T1-B91, or ER90S-B91. This weld repair option requires PWHT at a minimum temperature of 1250°F (675°C).</p>	<p>b) For repairs in P-No. 15E, Group 1, Grade 91, CSEF steel joined to P-No. 4, Group 1, or P-No. 5A, Group 1, the filler metal shall be limited to:</p> <p>1) A martensitic, iron-base filler metalweld consumable having a designation F-No. 4 or F-No. 6 per ASME Section IX, QW-432 and limited to the following consumablesweld consumable classifications: A or SFA-5.4 E8015-B8, E8018-B8, or A or SFA-5.28 ER80S-B8. This weld repair option does not require PWHT; or</p> <p>2) A martensitic, iron-base filler metalweld consumable having a designation F-No. 4 or F-No. 6 per ASME Section IX, QW-432 and limited to the following weld consumable classifications: A or SFA-5.5 E9015-B91, E9016-B91, E9018-B91, A or SFA-5.29 E91T1-B91, or A or SFA-5.28 ER90S-B91. This weld repair option requires PWHT at a minimum temperature of 1250°F (675°C).</p>
S8.3 e)	When the SMAW process is specified, the weld beads deposited onto the base material shall not exceed an electrode diameter of 1/8 in. (3.2 mm). The remaining fill passes shall not exceed an electrode diameter of 5/32 in. (4.0 mm). When the GTAW process is specified, any limits for filler metal size shall be reflected in the qualified PQR and WPS.	When the SMAW process is specified, the weld beads deposited onto the base material-metal shall not exceed an electrode-weld consumable diameter of 1/8 in. (3.2 mm). The remaining fill passes shall not exceed an electrode diameter of 5/32 in. (4.0 mm). When the GTAW process is specified, any limits for filler metalweld consumable size shall be reflected in the qualified PQR and WPS.
9.1	Brazing — A group of metal joining processes which produce coalescence of materials by heating them to a suitable temperature, and by using a filler metal having a liquidus above 840°F (450°C) and below the solidus of the base materials. The filler metal is distributed between the closely fitted surfaces of the joint by capillary action.	Brazing — A group of metal joining processes which produce coalescence of materials by heating them to a suitable temperature, and by using a filler metal brazing consumable having a liquidus above 840°F (450°C) and below the solidus of the base materials. The filler metal is distributed between the closely fitted surfaces of the joint by capillary action.
9.1	Welding — A group of processes which produce a localized coalescence of metallic or nonmetallic materials by heating the materials to the suitable temperature, with or without the application of pressure, and with or without the use of filler material.	Welding — A group of processes which produce a localized coalescence of metallic or nonmetallic materials by heating the materials to the a suitable temperature, with or without the application of pressure, and with or without the use of filler material a weld consumable .

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TABLE S8.2.1

ALTERNATIVE WELD REPAIR METHODS, [FILLER METALS](#) [WELD CONSUMABLES](#) AND WELDING PROCESSES FOR GRADE 91 STEEL.

Acceptable Weld Repair Method		Welding Process and Filler Metal / Weld Consumable AWS or ASME SFA Classification
Filler Metal	Welding Procedure	
Matching (9Cr-1Mo-VNbN)	Controlled Fill + Low PWHT	<ul style="list-style-type: none"> • SMAW – E9015-B91, E9016-B91 or E9018-B91 • FCAW – E91T1-B91 • GTAW – ER90S-B91
9Cr-1Mo	Controlled Fill	<ul style="list-style-type: none"> • SMAW – E8015-B8, E8016-B8 or E8018-B8 • FCAW – E81T1-B8 • GTAW – ER80S-B8
Ni- ckel base	Controlled Fill	<ul style="list-style-type: none"> • SMAW – ENiCrFe-2, ENiCrFe-3, ENiCrFe-4 • FCAW – ENiCr3Tx-y¹, ENiCrFe2Tx-y¹, or ENiCrFe3Tx-y¹ • GTAW – ERNiCr-3, ERNiCrFe-4

¹Clarification on the 'x-y' Designators may be found in ASME BPVC Section IIC, SFA-5.34/SFA-5.34M Specification for Nickel-Alloy Flux Cored and Metal Cored Welding Electrodes.

- 5) Hold-time for the pressure test shall be a minimum of 10 minutes prior to examination by the Inspector. Where the test pressure exceeds the MAWP of the item, the test pressure shall be reduced to the MAWP for close examination by the Inspector. Hold-time for close examination shall be as necessary for the Inspector to conduct the examination.

TABLE 4.4.1

Minimum Liquid Temperature for Pressure Testing (°F)	Thickness (inches) of Pressure-Retaining Object (Note 1)
60	$t \leq 0.5$
70	$t > 0.5 \leq 1$
85	$t > 1 \leq 2$
100	$t > 2 \leq 4$
110	$t > 4$

Note 1:

Thickest section of the pressure-retaining object.

TABLE 4.4.1 M

Minimum Liquid Temperature for Pressure Testing (°C)	Thickness (mm) of Pressure-Retaining Object (Note 1)
15	$t \leq 13$
20	$13 < t \leq 25$
29	$25 < t \leq 50$
38	$50 < t \leq 100$
43	$t > 100$

Note 1:

Thickest section of the pressure-retaining object

b) Pneumatic Test

A pneumatic test may be conducted. Concurrence of the owner shall be obtained in addition to that of the Inspector and Jurisdiction where required. The test pressure shall be the minimum required to verify leak tightness integrity of the repair, but shall not exceed the maximum pneumatic test pressure of the original code of construction. Precautionary requirements of the original code of construction shall be followed;

~~c) Initial Service Leak Test~~

~~When an initial service leak test is permitted by the original code of construction, such testing may also be used to verify the leak tightness integrity of repairs;~~

d)c) Vacuum Test

A vacuum test may be conducted. Vacuum test methods used shall be suitable to verify the leak tightness integrity of the repair;

NBIC Action Item A25-51
 Submitted by Stacey Marks
 1/13/2026 Rev. 4



**THE NATIONAL BOARD
 OF BOILER AND PRESSURE VESSEL INSPECTORS**

Subject:	NBIC Part 3, 1.4.2 and 1.5.1 q) R-Stamp Controls
NBIC Location:	2025 NBIC Part 3, 1.4.2 and 1.5.1 q)
Statement of Need:	With the newly allowed marking methods which give alternatives to hard stamping there is a requirement to describe the marking controls in the QMS. This revision will guide industry on expectations.
Background Information:	ASME CA-1 allows the code symbol stamp to be made by casting, embossing, engraving, etching, dot peening, or any other process that will leave a legible and permanent image. NBIC users have asked to be allowed to use these alternative methods as well, see item A24-17. NBIC committee expressed concern about the robustness of the required QMS controls.

Proposed Text:

1.4.2 NATIONAL BOARD “R” SYMBOL STAMP

- a) The “R” Symbol Stamp is furnished on loan by the National Board for a nominal fee.
- b) Provisions may be made for the issuance of the “R” Symbol Stamp for use at various field locations.
- c) Additional requirements shall be met in accordance with NB-415, Accreditation of Repair (“R”) Organizations.

d) Alternatives to stamping are permitted in accordance with 5.7.5 b).

1.5.1 OUTLINE OF REQUIREMENTS FOR A QMS FOR QUALIFICATION FOR THE NATIONAL BOARD “R” CERTIFICATE OF AUTHORIZATION

- q) Control of the “R” Symbol Stamp
 - 1) The QMS shall contain provide adequate controls for the custody of the “R” Symbol stamp. In addition:
 - 12) The QMS shall make provisions for Inspector acceptance of the application of the “R” Symbol stamp to the pressure-retaining item or nameplate. See also 5.7.5 b) 3).
 - 23) The accepted abbreviation of the “R” Certificate Holder’s name shall be included in the QMS;

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5.2.5	Preparation of Form NR-1, Report of Repair/Replacement Activities for Nuclear Facilities	80

2025 NATIONAL BOARD INSPECTION CODE(25) **TABLE 1.5.1**

Form "R" Reports, Records, or Documents	Instructions	Minimum Retention Period
a) Form "R" Reports and supporting records and documentation	The organization performing repairs and alterations shall retain a copy of the completed Form "R" Report on file, and all records substantiating the summary of work described in Item 19 of NBIC Part 3, Table S9.2 and S9.3 for a minimum of 5 years. When the method of repair described in NBIC Part 3, 3.3.4.8 <u>11.2.2</u> is used, the record retention period shall as be described in Table 1.5.1 b), below.	5 years
b) Form "R" Report with NB-403, <i>Report of Fitness for Service Assessment</i> attached	<p>When the method of repair described in NBIC Part 3, 3.3.4.8<u>11.2.2</u> is used, the record retention period shall be for the duration described on the Fitness- for-Service Assessment (FFSA) form required by the repair method and as described in NBIC Part 2, 4.4.</p> <p>Notes:</p> <ol style="list-style-type: none"> 1. The "R" Certificate Holders should be aware that some referenced codes and standards identified in NBIC Part 2, 1.3 describe requirements for permanent record retention throughout the service life of each equipment item. 2. When the "R" Certificate Holder is not the owner or user of the equipment, the record retention period is limited to the FFSA results described on line 8 of the Form NB-403. 	5 years or as described on line 8 as reported on Form NB-403, whichever period is longer.
c) Continuity records for a welder, welding operator, bonder, or cementing technician	Minimally, continuity records for a welder, welding operator, bonder, or cementing technician within the Certificate Holder's QMS shall be described and established at the time of the applicant's initial certificate review and demonstrated at each triennial review required thereafter.	As applicable to the scope of work identified on the "R" <i>Certificate of Authorization</i> , the continuity records are subject to review during each National Board triennial certificate review. Continuity records shall be maintained for a minimum of 5 years.

- 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.
- b) 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, ~~3-3-5S~~11.2.3 with the following requirements:

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

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- a) The welding shall be limited to the SMAW, FCAW, and GTAW processes;
- b) 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;
- c) 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);
- d) The qualification thickness for the test plates and repair groove depths shall be in accordance with ASME Section IX; and
- e) 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 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
 - 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.

(25) 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 shall not penetrate the full thickness except as permitted below.
 - 1) ASME Section VIII, Division 2 pressure vessels, where application of PWHT on inservice vessels has been demonstrated to be detrimental to the vessel's material; or
 - 2) Tube-to-header welds in steam service.
- b) Full thickness weld repairs, as permitted in 2.5.3.4 a) 1) and 2), above, shall be completed in accordance with NBIC Part 3, ~~3-3-5~~[S11.2.3](#), and the following additional requirements:
 - 1) The full thickness repair shall be verified as being full penetration.
 - 2) Volumetric examination of the full thickness weld shall be performed.
- c) 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;

- a) Subject to the administrative procedures of the Jurisdiction and approval of the Inspector, the replacement of a riveted section or part by welding;
- b) The repair or replacement of a pressure part with a code-accepted material that has a nominal composition and strength that is equivalent to the original material, and is suitable for the intended service;
- c) Replacement of a pressure-retaining part with a material of different nominal composition and, equal to or greater in allowable stress from that used in the original design, provided the replacement material satisfies the material and design requirements of the original code of construction under which the pressure-retaining part was built. The minimum required thickness shall be at least equal to the thickness stated on the original *Manufacturer's Data Report*;
- d) The replacement of a pressure relieving device (PRD) attached by welding, provided the replacement device's relieving capacity is equal to or greater than the PRD capacity required by the original code of construction; or
- e) Repairs to plate heat exchangers (PHE) are limited to the following:
 - 1) Welding on any pressure part, i.e. not limited to a flange, nozzle, or endplate;
 - 2) In kind replacement of endplates, or welded nozzles;
 - 3) Replacement of any failed connection or frame bolting, representing the replacement parts described in Part 3, 3.2.2-a), with no change of material or grade as described on the Manufacturer's Data Report (MDR) or Original Equipment Manufacturer's (OEM) drawing;
 - 4) The addition or repair of load bearing attachments (e.g., welded supports or lifting lugs) to the endplates; and
 - 5) Replacement of parts bearing certification or manufacturer's stamping with no-change in material allowed as described on the MDR or verifiable OEM drawing.

3.3.4 REPAIR METHODS

3.3.4.1 SCOPE

Except as provided in NBIC Part 3, ~~3.3.4.8~~S11.2.2, 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 butt weld or single butt weld 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.

3.3.4.2 DEFECT REPAIRS

a) Cracks

Except as provided in NBIC Part 3, ~~3.3.4.8~~S11.2.2, a repair of a crack in a welded joint or base material shall not be made until the defect has been removed. A suitable nondestructive examination method such as MT or 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 butt weld or single butt weld with or without backing, as allowed by the original code of construction.

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b) Unstayed Boiler Furnace Cracks

Cracks at the knuckle or at the turn of the flange of the furnace opening require immediate replacement of the affected area or specific approval of repairs by the Jurisdiction (See NBIC Part 3, Figure 3.3.4.2-a).

c) Rivet or Staybolt Hole Cracks

Cracks radiating from rivet or staybolt holes may be repaired if the plate is not seriously damaged. If the plate is seriously damaged, it shall be replaced. For suggested methods of repair, see NBIC Part 3, Figure 3.3.4.2-b.

d) Minor Defects

Minor cracks, isolated pits, and small plate imperfections should be examined to determine the extent of the defect and whether repair by welding is required. Except as provided in NBIC Part 3, [3.3.4.8S11.2.2](#) prior to repair by welding, the defects shall be removed to sound metal. Liquid penetrant or magnetic particle examination may be used before or after welding.

e) Defective Bolting

Defective bolting material shall not be repaired but shall be replaced with suitable material that meets the specifications of the original code of construction.

f) Bulges

- 1) A bulge on a watertube shall be investigated to determine the cause and extent of damage to the tube prior to repair. If the bulge has resulted in metallurgical changes to the original tube material, as determined by field metallography, installation of a new length of tubing or tube patch (see NBIC Part 3, 3.3.4.6 b) is required. If the bulge has cracks as determined by NDE, installation of a new length of tubing or a tube patch is required. If the bulge does not exhibit cracks and has not resulted in metallurgical changes to the original tube material, a mechanical repair may be considered subject to the concurrence of the Inspector or Jurisdiction.
- 2) A bulge on a plate shall be investigated to determine the cause and extent of damage to the plate prior to repair. If the bulge has resulted in metallurgical changes to the original plate material, as determined by field metallography, installation of a flush patch (see NBIC Part 3, 3.3.4.6 a)) is required. If the plate has cracks as determined by NDE, installation of a flush patch is required. If the bulge does not exhibit cracks and has not resulted in metallurgical changes to the original plate material, a mechanical repair may be considered, subject to the concurrence of the Inspector or Jurisdiction.

g) Blisters

A blister may be caused by a defect in the metal such as lamination where one side exposed to the fire overheats but the other side retains its strength due to the cooling effect of the water. After the blistered material has been removed, the remaining wall thickness shall be determined by ultrasonic thickness testing. A surface examination using liquid penetrant testing or magnetic particle testing shall be made to ensure the remaining material contains no defects. If the remaining wall thickness is adequate, in the judgment of the Inspector, the area may be repaired by welding as covered in NBIC Part 3, 3.3.4.3. If the remaining wall thickness is not adequate, a plate will require a flush patch (See NBIC Part 3, 3.3.4.6 a)) and a tube will require a new length of tube or tube patch [see NBIC Part 3, 3.3.4.6 b)].

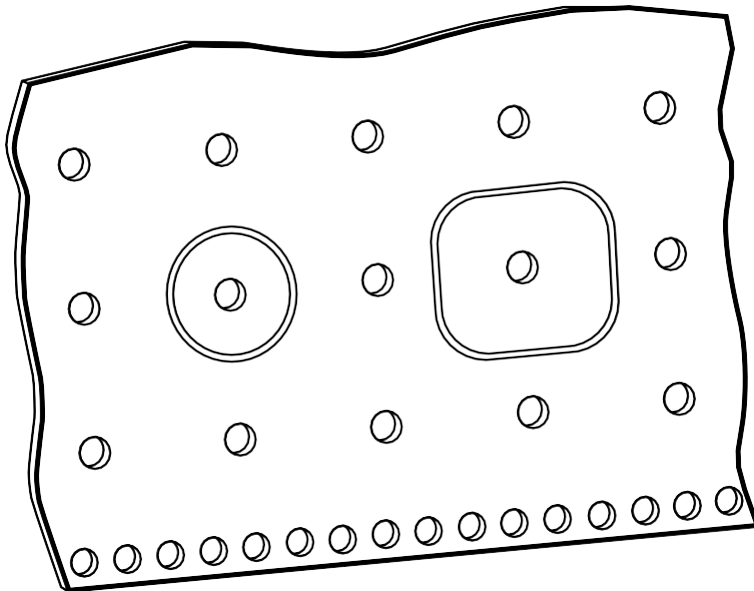
S2.13 REPAIR METHODS

- a) Before performing any welding activity, consideration shall be given to ensure the weldability of historical boiler materials. Materials used for patches shall be made from material that is at least equal in quality and strength to the original material.
- b) 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.
- c) Except as provided in NBIC Part 3, ~~3-3.4.8~~S11.2.2, a repair of a defect, such as a crack in a welded joint or base material, shall not be made until the defect has been removed. A suitable nondestructive examination method such as magnetic particle (MT) or liquid penetrant (PT) may be necessary to assure complete removal of the defect. If the defect penetrates the full thickness of the material, the repair shall be made with a complete penetration weld such as a double butt weld or a single butt weld 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, the Jurisdiction.
- d) Welded repairs at or near riveted seams requiring preheating or postweld heat treatment shall be carefully made to prevent loosening in the riveted seams, especially when localized heating is used. Where necessary to control expansion or to gain access for welding, rivets at the defective section and to each side of it may be removed. Reuse of rivets is prohibited.

S2.13.1 REPAIR OF THREADED STAYBOLT HOLES

Staybolt holes may be repaired by welding, reaming, re-tapping to a larger size, or by installing a flush patch. (See NBIC Part 3, Figure S2.13.1). If the staybolt hole was threaded and is to be repaired by welding, the threads shall be removed prior to welding.

FIGURE S2.13.1
SINGLE STAYBOLT FLUSH PATCH



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SUPPLEMENT 7

REPAIR AND ALTERATIONS OF PRESSURE VESSELS IN LIQUEFIED PETROLEUM GAS SERVICE**S7.1 SCOPE**

This supplement provides requirements and guidelines that apply to the repairs or alterations to pressure vessels designed for storing Liquid Petroleum Gas (LPG) and which are fabricated in accordance with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, or the API-ASME Code for Unfired Pressure Vessels for Petroleum Liquid and Gases. When the standard governing the original construction is not the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1 or the API-ASME Code for Unfired Pressure Vessels for Petroleum Liquid and Gases, the requirements of NBIC Part 3, 1.2 b), shall apply. In addition to this supplement, the applicable paragraphs of NBIC Part 3 shall be met. Vessels used for anhydrous ammonia service shall not be considered for repair or alteration activities in accordance with this supplement.

S7.2 GENERAL AND ADMINISTRATIVE REQUIREMENTS

- a) Refer to NBIC Part 3, Section 1 for all applicable post construction activities pertaining to general and administrative requirements.
- b) Repairs or alterations shall conform to the edition of the ASME Code or standard most applicable to the work.

S7.3 WELDING

Refer to NBIC Part 3, Section 2 for all applicable post construction activities pertaining to welding requirements.

S7.4 REQUIREMENTS FOR REPAIRS AND ALTERATIONS

- a) Refer to NBIC Part 3, Section 3 for all applicable post construction activities pertaining to requirements for repairs and alterations.

Excluded is NBIC Part 3, ~~3.3.4.8~~S11.2.2 *Repair of Pressure-Retaining Items Without Complete Removal of Defects*.

- b) Radiographic or ultrasonic examinations are considered to be suitable alternative nondestructive examination methods to ensure complete removal of the defect, as described in NBIC Part 3, 3.3.4.1.

S7.5 REQUIREMENTS FOR CHANGE OF SERVICE FROM ABOVE GROUND TO UNDERGROUND SERVICE

(25)

ASME LPG storage vessels may be changed from above-ground service to underground (UG) service under the conditions of NBIC Part 2, S7.10.

S7.6 EXAMINATION AND TESTING

Refer to NBIC Part 3, Section 4 for all applicable post construction activities pertaining to examination and testing.

TABLE S9.2

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

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 " <i>Certificate of Authorization</i> ".
(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 <u>3-3.4.8S11.2.2</u> 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" <i>Certificate of Authorization</i> number.
(29)	Indicate month, day, and year that the "R" <i>Certificate of Authorization</i> expires.

TABLE S9.3**GUIDE FOR COMPLETING THE NB-229, FORM R-2, *REPORT OF ALTERATION***

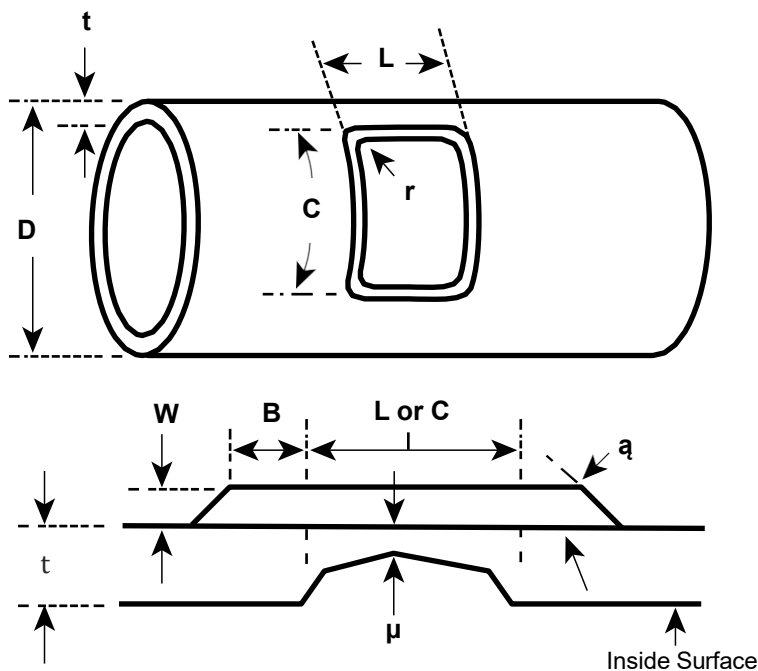
Reference to Circled Numbers in the Form	Description
(1)	Initials of the National Board "R" <i>Certificate of Authorization</i> authorized representative who registers the Form R-2.
(2)	Initials of the Inspector who certified the completed Form R-2 for registration.
(3)	When registering a Form R-2 with the National Board, this line is solely designated for a unique sequential number assigned by the "R" Certificate Holder. As described in NBIC Part 3, Paragraph 5.6, a log shall be maintained identifying unique and sequentially numbered Form "R" reports that are registered with the National Board. For rerating only, the Design Organization registers the Form R-2.
(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" <i>Certificate of Authorization</i> holder performing the design as it appears on the " <i>Certificate of Authorization</i> ".
(6)	The name and address of the National Board "R" <i>Certificate of Authorization</i> holder performing the construction activity as it appears on the " <i>Certificate of Authorization</i> ."
(7)	Name and address of the owner of the pressure-retaining item.
(8)	Name and address of the plant or facility where the pressure-retaining item is installed.
(9)	Description of the pressure-retaining item, such as boiler or pressure vessel, or piping. Include the applicable unit identification.
(10)	Name of the original manufacturer of the pressure-retaining item. If the original manufacturer is unknown, indicate by, "unknown."
(11)	Document the serial number of the pressure-retaining item if assigned by the original manufacturer. If there is no serial number assigned or it is unknown, indicate "unknown."
(12)	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."
(13)	Indicate the jurisdiction number assigned to the pressure retaining item, if available.
(14)	Indicate any other unique identifying nomenclature assigned to the pressure retaining item by the owner or user.
(15)	Identify the year in which fabrication/construction of the pressure retaining item was completed.

TABLE S9.3 CONT'D

Reference to Circled Numbers in the Form	Description
(16)	Indicate edition and addenda of the NBIC under which this work is being performed, as applicable.
(17)	Indicate the name, section, division, edition, and addenda (if applicable) of the original code of construction for the pressure-retaining item.
(18)	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.
(19)	Provide a detailed summary of the scope of design that was performed. When additional space is required to describe the design scope, a Form R-4 shall be used and attached (check box if needed).
(20)	The information to be considered when describing the construction scope of work should include such items as, the nature of the alteration (i.e. welding, bonding, cementing), the specific location of the work performed to the pressure retaining item, the steps taken to remove a defect or as allowed by NBIC Part 3, Paragraph 3.3.4.8S11.2.2 to remain in place, and the method of alteration described as listed in the examples of NBIC Part 3, Paragraph 3.4.4 or applicable supplement. When additional space is required to describe the construction scope, a Form R-4 shall be used and attached (check box if needed).
(21)	Indicate type of pressure test applied (liquid, pneumatic, vacuum, leak). If no pressure test applied, indicate "none."
	(22) Indicate test pressure applied.
(23)	Indicate maximum allowable working pressure (MAWP) for the pressure retaining item. (As altered)
(24)	When registering a Form R-2 with the National Board, this line is solely designated for a unique sequential number assigned by the "R" Certificate Holder. As described in NBIC Part 3, Paragraph 5.6, a log shall be maintained identifying unique and sequentially numbered Form "R" reports that are registered with the National Board. For rerating only, the Design Organization registers the Form R-2.
(25)	If applicable, document the unique purchase order, job, or tracking number assigned by organization performing work.
(26)	As applicable, identify what 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.
(27)	Indicate any additional information pertaining to the work involved (e.g. code cases, interpretations used).
(28)	Type or print name of the National Board "R" <i>Certificate of Authorization</i> authorized representative responsible for design certification.

FIGURE S11.2.1-a
EXTERNAL OVERLAY TERMS AND DEFINITIONS

(25)



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

α = 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

S11.2.2 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 United States Department of Transportation (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 any part of the defect may remain, 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 ensure 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, jurisdiction, and shall be maintained until the defect can be completely removed and the item repaired.

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- a. If the UDS is lost or destroyed, the ASME nameplate and the applicable ASME Section VIII, Division 2 or Division 3 Manufacturer's Data Report, Partial Data Reports, and/or Manufacturer's Design Report shall be used to reconstruct the UDS. The reconstructed UDS shall meet the requirements of and be certified in accordance with the latest edition of ASME Section VIII, Division 2 or Division 3. (25)

2) Authorized Inspection Agency Acceptance (25)

- a. After the repair plan is reviewed and certified, it shall be submitted for acceptance to the Authorized Inspection Agency/Owner-User Inspection Organization employing the Inspector performing the acceptance inspection and signing the Form R-1.

S11.3 ENGINEERED ALTERATION METHODS**S11.3.1 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 ~~3.4.3~~**S11.3.1** 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 NB-229, Form R-2, *Report of Alteration* 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).

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(S3.2), (S4.18.2.1), (S4.18.2.2), (S4.18.2.4)

Demonstration

(1.6.4), (4.2), (S6.11), (9.1)

Deposits

(S1.2.13.1)

De-rate

(5.9), (S4.17.5), (S5.6.1)

Design

(Foreword), (Introduction), (1.4.1), (1.5.1), (1.6.6.2), (1.6.7.2), (1.6.8.2), (1.6.9), (3.2.2), (3.2.4), (3.2.5), (3.3.4.3), (~~3.3.5.2~~S11.2.3), (3.4.2), (~~3.4.5.4~~S11.3.2), (5.2.2), (5.4), (S2.4), (S2.13.9.5), (S4.6), (S4.15), (S4.16.3), (S4.17.2), (S4.17.3), (S4.17.4), (S4.17.5), (S4.17.6), (S4.18.2.1), (S4.18.2.2), (S4.18.2.4), (S4.18.2.5), (S5.3.1), (S5.4), (S6.8.1), (S6.15), (S9)

Diffusible Hydrogen

(2.5.3.1), (2.5.3.2), (2.5.3.3), (2.5.3.4), (S6.9)

Dissimilar Metal

(2.5.3), (2.5.3.5)

Documentation

(Foreword), (Introduction), (1.6.4), (1.6.6.2), (1.6.7.2), (1.6.8.2), (1.6.9), (4.3), (5.1), (5.2), (S1.1.1), (S2.12), (S4.13.1), (S4.14.2), (S4.14.3), (S4.14.4), (S5.6.1), (S5.6.2), (S6.16.1), (S7.6), (7.1), (9.1)

Drains

(S1.2.13.1)

Drawings

(1.5.1), (1.6.6.2), (1.6.7.2), (1.6.8.2), (3.2.1), (3.2.2), (3.2.3), (3.2.4), (S2.13.9.5), (S3.2), (S4.2), (S4.8), (S4.9), (S4.14), (S4.16.2), (S4.16.3), (S4.17.2), (S6.5), (S6.6), (S6.17.4), (S9.6), (S9.7)

E

Encapsulation

(3.4.3), (S11.3.1)

Engineering

(~~3.3.4.8~~S11.2.2), (~~3.3.5.2~~S11.2.3), (~~3.4.5.4~~S11.3.2), (S2.2), (S4.6), (S4.16.3), (S4.17.3), (S4.17.4), (S4.17.5), (S4.18.2.3), (S4.18.2.6), (S5.4), (S5.6.2), (S6.8.1), (7.2)

Erosion

(3.3.4.3), (3.4.2), (S5.6.1), (S7.14.2)

Evidence of Leakage

Boilers (S2.13)

Piping

(S3.5.4), (S4.15), (S4.17.6)

Examination

(Introduction), (1.5.1), (1.6.6.2), (1.6.7.2), (1.6.8.2), (2.5.3), (2.5.3.2), (2.5.3.4), (3.2.2), (3.3.4.1), (3.3.4.2), (3.3.4.3), (3.3.4.6), (4.1), (4.2), (4.3), (4.4), (4.4.1), (4.4.2), (S1.2.10), (S1.2.11.2), (S2.8), (S2.11), (S2.13), (S2.13.10.3), (S2.13.14.1), (S3.2), (S4.2), (S4.12), (S4.13.1), (S4.14), (S4.15), (S4.17.6), (S5.2), (S5.4), (S5.6.2), (S6.11), (S6.13), (S6.18), (S6.18.1), (S7.4), (S7.5), (S9.2), (S9.6), (S9.7)

Exhibits

(1.5.1), (1.6.6.2), (1.6.7.2), (1.6.8.2)

Expansion Supports

(S1.2.3), (S1.2.5), (S1.2.6.3), (S1.2.10), (S2.13)

External Weld Buildup

(3.3.4.3)

F**Fabricator**

(S4.6), (S4.9), (S4.16.3), (S4.17.2), (S4.17.3), (S4.17.4), (S4.18.2.1), (S4.18.2.2), (S4.18.2.4)

Fatigue

(~~3.3.4.8~~S11.2.2), (3.4.2), (S1.2.11.1)

Federal Inspection Agency

(1.3)

Federal Railroad Administration (FRA)

(S1.1.1), (S2.1)

Ferrules

(S1.2.9.7)

Fiber-Reinforced Vessels

(1.5.1), (5.5.3), (5.7.5), (5.8), (S4.1), (S9.2)

Fillet Weld

(2.5.2), (2.5.3.4)

Field Repair

(1.4.1), (1.4.2), (3.3.4.2), (S3.5.1), (S4.4), (S4.5),

Filament Wound

(S4.5), (S4.18.2.4)

Firebox

(S1.1.3.1), (S1.2.2), (S1.2.3), (S1.2.6.1), (S1.2.6.2), (S1.2.6.3), (S1.2.7), (S1.2.9.2), (S1.2.9.4), (S1.2.9.5), (S1.2.9.8), (S1.2.11.1), (S1.2.11.3), (S1.2.11.4), (S1.2.11.5), (S2.7), (S2.7.1), (S2.13.2), (S2.13.5), (S2.13.10.4), (S2.13.11.1), (S2.13.11.2), (S2.13.11.3)

Fittings

(1.2), (3.3.2), (S1.2.6.1), (S1.2.6.2), (S1.2.6.3), (S1.2.13.1), (S2.13.13.3), (S2.13.13.4), (S4.15), (S4.17.6), (S5.5)

Flanges

(3.2.6), (3.3.2), (3.3.3), (3.3.4.2), (3.3.4.3), (S1.2.11.5), (S2.7), (S4.9), (S5.5), (S5.7.2),

Flush Patch

(3.3.3), (3.3.4.1), (3.3.4.2), (3.3.4.3), (3.3.4.6), (S1.2.10), (S1.2.11.1), (S1.2.11.3), (S1.2.11.4), (S1.2.11.6), (S2.13.1), (S2.13.9.1), (S2.13.9.2), (S2.13.9.3), (S2.13.10.3), (S2.13.10.4), (S2.13.11.1), (S2.13.11.2), (S2.13.11.3), (S2.13.12.3), (S2.13.14.1), (S2.13.14.3)

Foreign Inclusion

(S4.12)

Form**NR-1**

(1.6.6.2), (1.6.7.2), (1.6.9), (S9.6)

NVR-1

(1.6.6.2), (1.6.7.2), (1.6.9), (S9.7)

R-1

(3.3.4.9), (5.2.1), (S3.5.4), (S9.2)

R-2

(5.2.2), (S9.3)

R-3

(5.2.3), (S9.4))

R-4

(5.2.4), (S9.5)

Fracture

(4.4.1), (4.4.2), (S3.5.2.1), (S3.5.2.2), (S3.5.2.3), (3.5.3), (3.5.3.1)

Fusible Plugs

(S2.13.14.3)

G**Gage Glass**

(S1.2.13.1)

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Gages

(1.6.7.2), (3.3.3), (4.3), (S1.2.13.1), (S4.13.1), (S6.13)

Gasket Surface

(S1.2.3), (S3.3), (S3.5.2.4), (S3.5.4.2)

Gel Coat Repairs

(S4.18.2), (S4.18.2.8)

Gradient Control Band (GCB)

(2.5.2)

Graphite Pressure Equipment

(5.7.5), (5.10), (S3.1), (S3.2), (S3.5.6), (S3.5.6.1), (S9.2)

Grooving

(S1.2.11.3), (S2.13), (S2.13.9.1), (S2.13.9.2), (S2.13.9.4), (S2.13.10.1), (S2.13.10.4), (S2.13.11.1), (S2.13.12.1), (S2.13.12.2), (S2.13.14.2)

H

Handhole

(3.3.4.3), (S2.13.14.2), (S2.13.14.4)

Hardness

(2.5.3.2), (2.5.3.3), (2.5.3.4), (2.5.3.5), (3.2.1), (S4.12), (S4.18.2.1), (S4.18.2.2), (S4.18.2.4)

Heated Band (HB)

(2.5.2)

Heat Treatment

(1.5.1), (1.6.7.2), (2.1), (2.5.2), (2.5.3), (2.5.3.1), (2.5.3.2), (2.5.3.6), (3.2.1), (3.2.2), (3.3.2), (3.3.4.3), (S1.2.10), (S1.2.11.2), (S2.10), (S2.13), (S2.13.9.2), (S2.13.9.3), (S6.8.1), (S6.10.2), (S6.10.3)

Hold Time

(4.4.1), (4.4.2), (S4.15), (S4.17.6), (S6.18.1)

Hot Tapping

(2.5.3)

Hydrogen

(2.5.3), (2.5.3.1), (2.5.3.2), (2.5.3.4), (2.5.3.5), (2.5.3.6), (S1.1.3), (S2.7), (S6.9), (S6.10.3)

Hydrophilic Solvent

(S3.5.1), (S3.5.3.1)

Hydrostatic Test

(S2.13.8), (S6.8.1), (S9.6), (S9.7), (9.1)

I

Identification Mark

(1.6.6.2), (1.6.7.2), (1.6.8.2), (2.2.5), (3.2.2), (S4.10.4), (S6.6), (S6.9.5), (S9.6)

Impervious

(S3.5.1), (S3.5.3)

Impregnated

(S3.1), (S3.2), (S3.5.4), (S3.5.6), (S3.5.6.1)

Inspection(Foreword), (Introduction), (1.3), (1.3.2), (1.4.2), (1.5.1), (1.6.1), (1.6.3), (1.6.6.2), (1.6.7.2), (1.6.8.2), (3.2.2), (3.3.4.3), (~~3-3.4.8~~S11.2.2), (3.4.1), (3.4.2), (5.3), (5.4), (S1.2.11.4), (S1.2.12.2), (S2.1), (S2.3), (S2.8), (S2.13.3), (S2.13.10.4), (S2.13.14.1), (S3.2), (S3.4), (S4.2), (S4.9), (S4.12), (S4.14), (S4.17.5), (S4.17.6), (S5.1), (S5.6.1), (S6.6), (S6.8.1), (S6.8), (S6.8.1), (S6.12), (S6.14), (S7.7), (S8.5), (S9)**Inquiries**

(Foreword)

Install/Installation(1.2), (1.6.2), (1.6.6.2), (1.6.7.2), (2.5.3), (3.2.1), (3.3.3), (3.3.4.1), (3.3.4.2), (3.3.4.6), (~~3-3.4.8~~S11.2.2), (3.4.1), (S1.2.1), (S1.2.2), (S1.2.3), (S1.2.5), (S1.2.6), (S1.2.6.1), (S1.2.6.2), (S1.2.6.3), (S1.2.9.2), (S1.2.9.4), (S1.2.10), (S1.2.11.1), (S1.2.11.4), (S1.2.11.6), (S1.2.12.1), (S1.2.12.2), (S2.13.1), (S2.13.2), (S2.13.4), (S2.13.5), (S2.13.8), (S2.13.9.1), (S2.13.9.2), (S2.13.9.4), (S2.13.10.3), (S2.13.10.4), (S2.13.11.1), (S2.13.11.2), (S2.13.14.2), (S3.2), (S3.3), (S3.5.1), (S3.5.3.1), (S4.7), (S4.17.5), (S4.17.6), (S4.18.2.5), (S5.6.3), (S6.5)**Insulation**

(2.5.2), (3.4.1), (4.4), (S8.3)

Internal

(3.2.2), (3.3.4.3), (3.4.4), (S3.2), (S3.5.4), (S4.9), (S4.17.5), (S4.18.2.3), (S4.18.2.5), (S5.5), (S6.6), (S6.8.1)

Interpretations

(Introduction), (10.1)

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(4.4.1), (S4.2)

Jurisdiction

(Foreword), (Introduction), (1.2), (1.3), (1.3.1), (1.4.1), (1.6.4), (1.6.7.2), (1.6.8.1), (1.6.9), (2.5.3), (3.2.4), (3.2.7), (3.3.2), (3.3.3), (3.3.4.2), (3.3.4.3), (3.3.4.8S11.2.2), (3.3.4.9), (3.3.5.2), (3.4.1), (3.4.5.1S11.3.2), (4.2), (4.4.1), (5.2), (5.5), (5.7.2), (5.8.1), (5.11), (S1.1.1), (S2.8), (S4.6), (S4.16.3), (S4.17.2), (S4.17.3), (S4.17.4), (S9), (9.1)

Jurisdictional Authority

(Foreword), (1.6.7.2), (S4.15), (S4.17.6)

Jurisdictional Requirements

(1.4), (1.5.1), (1.6.5), (1.6.6.2), (2.5.2), (3.3.4.1), (3.3.4.2), (3.3.4.4), (3.3.4.8S11.2.2), (3.4.1), (3.4.2), (4.2), (4.4), (4.4.1), (4.4.2), (5.3), (5.4), (5.5), (5.7.2), (5.8.1), (5.11), (S1.1.2), (S1.1.3), (S1.2.10), (S2.2), (S2.3), (S2.5), (S2.6) (S2.7), (S2.7.2), (S3.2), (S4.7), (S4.16.3), (S4.16.4), (S4.17.5), (S9.2), (S9.7)

K**Knuckles**

(3.3.4.2), (S1.2.9.4), (S1.2.11.2), (S1.2.11.5), (S2.13.10.3), (S2.13.10.4), (S2.13.11.1), (S2.13.11.2), (S2.13.11.3), (3.2.6), (3.3.2)

L**Laminate**

(3.3.4.2), (S4.10.1), (S4.10.2), (S4.10.5), (S4.18.1), (4.18.2.1), (S4.18.2.2), (S4.18.2.3), (S4.18.2.4), (S4.18.2.7), (S4.18.2.8)

Lap Joints

(3.3.4.2), (3.3.4.4), (S2.13.9.2)

Leakage

(S1.2.5.1), (S2.13), (S3.5.4), (S4.15), (S4.17.6), (S4.18.2.7), (S9.6)

Leak Testing

(4.4.1), (S3.5.4)

Ligaments

(S1.2.11.6), (S2.13.12.2), (S3.5.4)

Linings

(3.3.3), (S6.12)

Liquefied Petroleum Gas

(S7.1), (S7.5)

Liquid Penetrant Examination

(2.5.3), (3.3.4.1), (3.3.4.2), (3.3.4.3), (S1.2.10), (S2.13), (S5.6.2)

Liquid Pressure Test

(4.4.1), (4.4.2), (S6.18.1)

Liquid Temperature

(4.4.1), (4.4.2)

Loading

(1.2), (S1.2.3), (S1.2.5), (S4.17.6), (S5.6.1), (S5.6.4)

Local Post Weld Heat Treatment (PWHT)

(2.5.2), (2.5.3.6), (S6.10.2)

Local Thinning

(S5.6.1), (S5.6.4)

Location

(1.4.1), (1.4.2), (1.6.2), (1.6.4), (1.6.6.2), (1.6.7.2), (2.5.3), (2.5.3.6), (3.3.4.9), (3.4.1), (5.8.2), (5.9), (5.11), (S4.17.5), (S5.6.1), (S5.6.2), (S9.2), (S9.6), (S9.7)

Locomotive Boilers**Arch Tube**

(S1.1.3.1), (S1.2.9), (S1.2.9.2), (S1.2.9.3), (S1.2.9.5), (S1.2.9.7)

Ferrules

(S1.2.9.7)

Flue

(S1.1.3.1), (S1.2.9), (S1.2.9.1), (S1.2.9.6), (S1.2.9.7), (S1.2.9.8), (S1.2.11.6), (S1.2.13.1)

Inspection

(S1.2.11.4), (S1.2.12.2)

Installation

(S1.2.1), (S1.2.2), (S1.2.3), (S1.2.5), (S1.2.6), (S1.2.6.1), (S1.2.6.2), (S1.2.6.3), (S1.2.9.2), (S1.2.9.4), (S1.2.9.6), (S1.2.9.7), (S1.2.10), (S1.2.11.1), (S1.2.11.2), (S1.2.11.4), (S1.2.11.6), (S1.2.12.1), (S1.2.12.2)

Minimum Wall Thickness

(S1.2.9), (S1.2.9.2), (S1.2.9.3), (S2.13.7)

Riveted Patches

(S1.2.10)

Riveted Seam

(S1.2.10), (S1.2.11.1), (S1.2.11.2), (S1.2.12.1)

M**Magnetic Particle Examination**

(2.5.3), (3.3.4.1), (3.3.4.2), (3.3.4.3), (S1.2.10), (S2.13), (S5.6.2)

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(Introduction), (5.4), (S1.1.1), (S5.5), (S6.20)

Owner-User Inspection Organization(Introduction), (1.3), (~~3.3.5.2~~[S11.2.3](#)), (3.4.4.1)**P****Partial Penetration Weld**

(2.5.2), (S1.2.9.2)

Patch Bolts

(S1.2.6.1), (S1.2.8), (S2.13.6)

Patches

(3.3.3), (3.3.4.1), (3.3.4.2), (3.3.4.3), (3.3.4.6), (S1.2.1), (S1.2.6.1), (S1.2.8), (S1.2.10), (S1.2.11.1), (S1.2.11.2), (S1.2.11.3), (S1.2.11.4), (S1.2.11.5), (S1.2.11.6), (S2.13), (S2.13.1), (S2.13.6), (S2.13.9.1), (S2.13.9.2), (S2.13.9.3), (S2.13.9.4), (S2.13.10.3), (S2.13.10.4), (S2.13.11.1), (S2.13.11.2), (S2.13.11.3), (S2.13.12.2), (S2.13.12.3), (S2.13.14.1), (S2.13.14.2), (S2.13.14.3), (S4.18.2.1), (S4.18.2.2), (S4.18.2.4)

Performance Qualification

(2.2.3), (2.2.4), (2.2.6), (2.4), (2.5.3), (S4.10.2), (S4.10.5), (S6.9.3), (S6.9.4), (S6.9.6)

Personnel Safety

(Foreword), (Introduction), (S2.3), (7.2)

Piecing

(3.3.4.5)

Pipe/Piping

(1.2), (1.6.7.2), (2.3), (2.5.2), (2.5.3), (3.2.2), (3.2.6), (3.3.2), (3.3.4.5), (S1.1.3.1), (S1.2.13.1), (S2.7.1), (S2.13.14.1), (S6.6), (S9), (7.4)

Pit

(3.3.4.2), (S1.2.11.4), (S2.13.10.4), (S4.12)

Plug

(S1.1.3.1), (S1.2.12.2), (S2.7.1), (S2.13.14.3), (S3.3), (S3.3.4.9), (S3.5.2.3), (S3.5.2.4), (S3.5.3), (S3.5.3.1), (S3.5.3.2), (S3.5.4), (S5.5), (S5.6.3), (S5.6.4)

Plug Stitching

(S3.5.2.3), (S3.5.3), (S3.5.3.1), (S3.5.3.2)

Pneumatic Testing

(4.4.1), (4.4.2), (S4.15), (S4.17.6), (S6.8.1), (S6.18.1), (S9.6), (S9.7), (9.1)

Portable Tank (DOT)

(S6.20)

Postweld Heat Treatment

(1.5.1), (2.5.2), (2.5.3), (2.5.3.1), (2.5.3.6), (3.2.1), (3.3.2), (3.3.4.3), (S1.2.10), (S1.2.11.2), (S2.10), (S2.13), (S2.13.9.2), (2.13.9.3), (S6.10.2), (S6.10.3), (S8.2)

Precision Bores

(S4.18.2), (S4.18.2.2)

Preheating

(2.5.1), (2.5.3), (2.5.3.1), (2.5.3.2), (2.5.3.3), (2.5.3.4), (2.5.3.6), (3.2.1), (S1.2.10), (S2.10), (S2.13), (S2.13.9.2), (S6.10.1)

Preparation of Forms

(5.2.1), (5.2.2), (S6.19)

Pressure Control

(S8.3)

Pressure Gages

(4.3), (S4.13.1), (S6.13)

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User(Introduction), (1.3), (1.4.1), (2.1), (2.3), (3.2.6), (~~3.3.5.2~~S11.2.3), (~~3.4.5.1~~S11.3.2), (5.3), (5.4), (S1.1.1), (S2.1), (S2.2), (S2.3), (S3.2), (S4.16.3), (S4.17.3), (S5.4), (S5.5), (S6.16.3), (S7.8), (9.1)**V****Vacuum Test**

(4.4.1), (S3.5.4), (S4.15), (S4.17.6)

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(1.1), (1.2), (1.4.1), (1.6.6.2), (3.3.2), (4.4.1), (4.4.2), (5.7.5), (S1.2.13.1), (S6.18.1), (S9.6), (S9.7)

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(1.5.1), (1.6.4), (1.6.6.2), (1.6.7.2), (1.6.8.2), (1.6.9), (9.1)

Visual Acuity

(4.4.1), (S4.2)

Visual Examination(3.3.2), (~~3.4.3~~S11.3.1), (4.4.1), (4.4.2), (S4.2), (S4.12), (S6.8.1)**“VR” Authorization**

(Introduction), (1.1)

“VR” Certificate Holder

(9.1)

“VR” Certificate of Authorization

(S9.7))

“VR” Stamp

(S9.7))

W**Wasted Areas**

(3.3.2), (3.3.3), (3.3.4.2), (3.3.4.3), (S2.13.9.1), (S2.13.10.1), (S2.13.11.1), (S2.13.12.1), (S2.13.14.2)

Water Column

(S1.2.13.1)

Water Gage Connection

(S1.2.13.1)

Water Gage Glass

(S1.2.13.1)

Waterside(3.3.4.9), (S1.2.11.2), (S1.2.11.3), (S1.2.11.4),
(S2.13.9.3), (S2.13.10.4)**Weld Buildup**(3.3.2), (3.3.3), (3.3.4.3), (S1.2.3), (S1.2.6.1),
(S1.2.10), (S1.2.11.3), (S1.2.11.4), (S1.2.11.5),
(S1.2.11.6), (S1.2.12.2), (S2.13), (S2.13.9.1),
(S2.13.10.1), (S2.13.10.4), (S2.13.11.1),
(S2.13.12.1), (S2.13.14.1), (S2.13.14.2),
(S2.13.14.3), (S11.2.1)**Welder**

(1.5.1), (2.2.3), (2.2.5), (2.2.6), (2.2.6.1), (2.5.3)

Welders Continuity

(2.2.6), (S6.9.6)

Welders Identification

(2.2.5), (S6.9.5), (S7.12.5)

Welding(1.4.1), (1.5.1), (1.6.6.2), (1.6.7.2), (1.6.8.2), (2.1),
(2.2), (2.2.1), (2.2.1.1), (2.2.2), (2.2.3), (2.2.4),
(2.2.5), (2.2.6), (2.2.6.1), (2.3), (2.4), (2.5.1), (2.5.3),
(2.5.3.1), (2.5.3.2), (2.5.3.3), (2.5.3.4), (2.5.3.5),
(2.5.3.6), (3.2.1), (3.2.2), (3.3.2), (3.3.3), (3.3.4.2),
(3.3.4.3), (3.3.4.4), (3.3.4.6), (3.3.4.9),
(~~3.4.3~~S11.3.1), (5.7.5), (S1.1.2), (S1.1.3), (S1.2.1),
(S1.2.3), (S1.2.4), (S1.2.6), (S1.2.6.1), (S1.2.6.2),
(S1.2.6.3), (S1.2.8), (S1.2.9.1), (S1.2.9.2),
(S1.2.9.6), (S1.2.9.7), (S1.2.10), (S1.2.11.1),
(S1.2.11.2), (S1.2.11.3), (S1.2.11.4), (S1.2.11.5),
(S1.2.11.6), (S1.2.12.1), (S1.2.12.2), (S2.7), (S8.1),
(S8.2), (S8.3), (S8.4), (S8.5), (S9.4), (S9.5), (S9.6)**Welding Methods**(2.5.3.1), (2.5.3.2), (2.5.3.3), (2.5.3.4), (2.5.3.5),
(2.5.3.6)**Welding Operator**(1.5.1), (2.2.3), (2.2.5), (2.2.6), (S6.8.1), (S6.9.3),
(S6.9.5), (S6.9.6)**Welding Procedures**

(2.2.1), (2.2.2), (S8.4)

Welding Records

(2.2.4), (S6.9.4)

Weld Repair(3.3.3), (3.3.4.3), (~~3.3.4.8~~S11.2.2), (4.2),
(S1.2.9.4), (S8.1), (S8.2), (S8.3), (S8.4), (S8.5)**Wrapper Sheet**

(S1.2.3), (S1.2.11.5)

X**Y****Yankee Dryers**(5.9), (S5.1), (S5.2), (S5.3), (S5.4), (S5.5), (S5.6),
(S5.7)**Z**

2025 NATIONAL BOARD INSPECTION CODE

NBIC Action Item A25-60
 Submitted by <Matt Schaser> (mschaser@e2g.com)
 Submitted on



**THE NATIONAL BOARD
 OF BOILER AND PRESSURE VESSEL INSPECTORS**

Subject:	Pressure Test Exemption per Part 3 Paragraph 3.4.1.d
NBIC Location:	Part 3, Paragraph 3.4.1.d
Statement of Need:	Update wording in Part 3, paragraph 3.4.1.d to be consistent and more robust.
Background Information:	The current wording in Part 3, paragraph 3.4.1.d in the 2025 edition of NBIC is inconsistent in its use of the wording “pressure test” and “test pressure”. Also, the current wording does not distinguish between test methods in its criteria leading to potential misuse of the exemption. For example: The calculated test pressure for a pneumatic test may be lower than the original hydrotest test pressure suggesting that paragraph 3.4.1.d is satisfied. However, the intent of this criterion is that test pressures derived from the same method be compared.

Proposed Text:

Updates:

The pressure-retaining item has been pressure tested, as required, for the new service conditions. Any insulation, coatings, or coverings that may inhibit or compromise a meaningful pressure test shall be removed, to the extent identified by the Inspector. The pressure test may be waived if the original ~~test~~ pressure, ~~test~~ as recorded on the Manufacturer’s Data Report, is at least equal to the calculated test pressure required to verify the integrity of the pressure-retaining item for the new conditions, provided that the same type of pressure test (hydrostatic or pneumatic) is considered in the calculation of both test pressures. If the pressure test is waived, it shall be documented on the NB-229, Form R-2, Report of Alteration with this statement in the “Remarks” section: “Pressure test waived in accordance with NBIC Part 3, 3.4.1 d)”.

~~Full Rewrite for Readability (No additional content change):~~

~~Pressure-retaining item has been pressure tested as required, to ensure its integrity under new service conditions, with any insulation or coverings that could affect the test removed as directed by the inspector. However, this test may be waived if the original test pressure, as recorded on the Manufacturer’s Data Report, meets or exceeds the calculated requirement for the new conditions, provided that the same type of test (hydrostatic or pneumatic) was used in the determination of both test pressures. If the test is waived, this decision shall be documented on the NB-229, Form R-2, Report of Alteration, with the statement “Pressure test waived in accordance with NBIC Part 3, 3.4.1 d)”, included in the remarks section.~~

NBIC Action Item A25-75
 Submitted by Paul Shanks
 12/10/2025



**THE NATIONAL BOARD
 OF BOILER AND PRESSURE VESSEL INSPECTORS**

Subject:	Yankee Dryer alteration plan approval
NBIC Location:	NBIC Part 3, S5.7.2 b)
Statement of Need:	Yankee dryer alteration plans have a different approval path than an alteration on other PRI's, there is no obvious technical need for the path to be different and this different path has the potential to cause confusion and errors.
Background Information:	The repair Inspector generally does not accept repair or alteration plan, they would authorize the activity 1.3.2 a).a Accepting the repair / alteration plan is normally reserved for Div.2 or Div.3 vessels 3.3.5.2 b) / 3.4.5.1 d) but in those cases the acceptance is by the AIA not the repair Inspector.

Proposed Text:

S5.7.2 ALTERATION TYPES

b) Alteration plans to yankee dryers shall be accepted by the ~~Inspector~~[Authorized Inspection Agency/Owner-User Inspection Organization whose inspector will make the acceptance inspection and sign the Form R-2](#), and when required, by the Jurisdiction, prior to the start of work.



PROPOSED REVISION OR ADDITION

Item No. A25-83
Subject/Title Edits to NBIC Part 3, 2.5.3.4 Welding Method 4
NBIC Location Part 3, 2.5.3.4 Welding Method 4
Project Manager and Task Group John Siefert
Source (Name/email) jsiefert@epri.com
Statement of Need Minor changes, as supported by EPRI research, are requested for Welding Method 4 to allow for full penetration repairs in all configurations provided the weld or feature is operating in steam service.
Background Information Regarding 2.5.3.4 a), a recent EPRI testing program of full penetration welds in ex-service Grade 22 material did not show a marked deviation in creep performance whether these welds are subjected to PWHT or evaluated in the as-welded (repaired) condition. Background pptx file provides data comparisons. Regarding 2.5.3.4 h) 2), a recent EPRI testing program shows that AWS type -B3L consumables have sufficient strength for repairs to Grade 22 steel, particularly for repairs to service-exposed materials. Currently, ASME BPVC Section I prohibits the use of such filler metals in PW-5.6 (see excerpt from Section I after this table). It is the project manager's understanding that this rule was put in place in the immediate aftermath of long-seam weld failures and widespread cracking/leaks starting with Mohave in 1985 and through the late

<p>1980s and early 1990s where it was initially suspected that the filler metal carbon content was a contributing factor to the failures. While this was later determined not to be the case, this language has never been removed. Background pptx file shows that L-grade consumables have sufficient strength for the intended application (partial or full penetration welds in steam service).</p> <p>2.5.3.4 g) and h) Proposed edits are for clarity.</p>
<p>Rev 01 – proposed at the January 2026 meetings.</p>

Paragraph	Current Text	Proposed Text
2.5.3.4 a)	<p>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 shall not penetrate the full thickness except as permitted below.</p> <p>1) ASME Section VIII, Division 2 pressure vessels, where application of PWHT on inservice vessels has been demonstrated to be detrimental to the vessel’s material; or</p> <p>2) Tube-to-header welds in steam service.</p>	<p>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 shall not penetrate the full thickness except as permitted below.</p> <p>1) ASME Section VIII, Division 2 pressure vessels, where application of PWHT on inservice vessels has been demonstrated to be detrimental to the vessel’s material; or</p> <p>2) Tube-to-header weldsPressure retaining items in steam service.</p>
2.5.3.4 g) and h)	<p>g) 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 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);</p>	<p>g) 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 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);</p>

	<p>h) 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:</p>	<p>h) 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. <u>For pressure-retaining items repaired using this temper bead method, the hardness testing and carbon equivalency requirements in QW-290 may be waived provided the pressure-retaining item operates in steam service above 900°F (482°C);</u></p>
<p>2.5.3.4 h) 2)</p>	<p>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;</p>	<p>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 <u>those that are classified by the filler metal weld consumable</u> specification with a diffusible-hydrogen designator of H8 or lower for the FCAW and SMAW processes. <u>L-grade consumables with a carbon content ≤ 0.05 wt. % are permitted;</u></p>

Commented [JS1]: Item 25-29

Commented [JS2]: Item 25-29

Commented [JS3]: May need to modify to be consistent with Item 25-29

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permitted in [Parts PG, PWT, and PFT](#) and for which allowable stress values are given in Section II, Part D, Subpart 1, Tables 1A and 1B, for Section I construction and for which weld Group P-Numbers are assigned in Section IX.

PW-5.2 Carbon or alloy steel having a carbon content of more than 0.35% shall not be used in welded construction or be shaped by oxygen cutting or other thermal cutting processes.

PW-5.3 Austenitic stainless steel materials joined by electroslag welding shall be limited to SA-240 Grades 304 and 316, SA-182 Grades F304 and F316, and SA-351 Grade CF 8.

PW-5.4 Welding electrodes and filler metal shall be selected to provide deposited weld metal of chemical composition and mechanical properties compatible with the materials to be joined and the service conditions anticipated.

When Grade 91 filler metal (e.g., AWS B91, ISO CrMo91, etc.) is used to make pressure-retaining welds in P-No. 15E Gr. 1 materials, the nickel plus manganese (Ni + Mn) content of the filler metal shall not exceed 1.2%.

PW-5.5 Rimmed and semi-killed steels shall not be joined by the inertia and continuous drive friction welding processes.

PW-5.6 For pressure-retaining welds in $2\frac{1}{4}\text{Cr}-1\text{Mo}$ materials, other than circumferential butt welds less than or equal to $3\frac{1}{2}$ in. (89 mm) in outside diameter, when design metal temperatures exceed 850°F (455°C), the weld metal shall have a carbon content greater than 0.05%.

PW-9.2 Welding Grooves. The dimensions and shape of the edges to be joined by butt welds shall be such as to permit complete fusion and complete joint penetration.

PW-9.3 Transitions at Butt Joints Between Materials of Unequal Thickness. This paragraph is not intended to apply to joint designs specifically provided for elsewhere in this Code.

The requirements of [PW-9.3.1](#) through [PW-9.3.3](#), as applicable to the specific type of pressure part, shall be met.

PW-9.3.1 Shells, Drums, and Vessels (Including Those Fabricated From Materials Complying With Piping or Tubing Material Specifications). When materials of unequal thickness are joined via a butt joint, a tapered transition shall be provided if the difference in thickness is greater than one-fourth the thickness of the thinner material or $\frac{1}{8}$ in. (3 mm), whichever is less. Any process that will provide a uniform taper may be used to form the transition section. The weld may be partly or entirely in the tapered section or adjacent to it as indicated in [Figure PW-9.3.1](#). The tapered transition shall have a length not less than 3 times the offset between the adjoining surfaces, as shown in [Figure PW-9.3.1](#). Provisions for tapers at circumferential butt-welded joints connecting formed heads to main shells are contained in [PW-9.3.3](#).

For longitudinal joints, the middle lines of the adjoining materials shall be in alignment with the fabricating tolerances specified in [PW-33](#). Alternatively, the middle lines of the adjoining materials may be offset so that the inside or outside diameters form a continuous surface, provided the following conditions are met:

- (a) The ratio of plate thicknesses shall not exceed 2:1.

NBIC Part 3, 2025 Edition

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 shall not penetrate the full thickness except as permitted below.

1) ASME Section VIII, Division 2 pressure vessels, where application of PWHT on inservice vessels has been demonstrated to be detrimental to the vessel's material; or

2) Tube-to-header welds in steam service.

b) Full thickness weld repairs, as permitted in 2.5.3.4 a) 1) and 2), above, shall be completed in accordance with NBIC Part 3, 3.3.5, and the following additional requirements:

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

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

c) 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;

d) The welding shall be limited to the SMAW, FCAW, GMAW or GTAW processes using low hydrogen 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 contamination by hydrogen producing sources. The surface of the metal prepared for welding shall be free of contaminants;

e) 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;

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

g) 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 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);

h) 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).



PROPOSED REVISION OR ADDITION

Item No. A25-84
Subject/Title Edits to NBIC Part 3, 2.5.3
NBIC Location Part 3, 2.5.3 Alternative Welding Methods without Postweld Heat Treatment
Project Manager and Task Group John Siefert
Source (Name/email) John Siefert, jsiefert@epri.com
Statement of Need <p>Some concerns were raised about the requirement (should/shall) for technical guidance/expertise when using alternative welding methods, particularly the words in b) which read „b) Competent technical advice should be obtained from the manufacturer of the pressure-retaining item or from another qualified source.” This raised additional thoughts and insight for consideration in this proposal including:</p> <ul style="list-style-type: none"> • Whether competent technical advice needs to be sought in all cases. For example, Welding Method 1 has been codified for nearly 50-years. • End-use application is variable (environment and geometry), and some repair applications pose very low risk even in the event of failure. • Realization that these methods have seen extensive industry use over the years (including documented applications before the NBIC ever codified language to address them) • Madatory filing of R-1 forms to allow for the collection of data and then later a decision to continue or relax this requirement

The proposed edits reflect the initial discussion where it was asked to take out an item to address.

Background Information

N/A

Rev 01 – proposed at January 2026 meetings.

Paragraph	Current Text	Proposed Text
2.5.3 a)	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.	a) Under certain conditions, postweld heat treatment (PWHT), in accordance with the original code of construction, may be inadvisable or impractical. In such instances, the following alternative <u>welding methods 1 to 7 (2.5.3.1 to 2.5.3.7)</u> may be used. <u>The use of welding methods without PWHT shall be recorded on Form R1, and if applicable, Form R2.</u>
2.5.3 b)	b) Competent technical advice should 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.	b) Competent technical advice should 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. <u>Welding Methods 1 to 7 have been successfully applied, and modifications thereof continue to be informed by industry experience and research. Competent technical advice may be required if the repair is to be used in highly stressed areas, if service conditions are conducive to</u>

		<u>stress corrosion cracking or creep, if materials are at-risk to hydrogen embrittlement, for “on-stream” repairs, or “hot tapping” on piping systems.</u>
2.5.3. c)	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.	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.
2.5.3 d)	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	d) The detailed welding methods listed in the following subsections may be used as an alternative to postweld heat treatment (PWHT). <u>d) NBIC Part 3 Welding Method 1, 2.5.3.1, is a method in which the welding procedure requires an elevation of the preheat temperature. It was first introduced in the 1977 edition.</u> <u>e) In contrast, NBIC Part 3 Welding Method 2, 2.5.3.2, specifies the use of temper-bead welding, and includes requirements to address applications where the original code of construction required notch toughness. The current rules were substantially revised for the 1995 edition, although a form of this method existed prior to this date as a supplement.</u> <u>f) Welding Method 3, 2.5.3.3, requires the use of temper-bead welding and first appeared in the 1995 edition.</u> <u>g) Welding Method 4, 2.5.3.4, requires the use of temper-bead welding and was first adopted in the 1998 edition.</u>

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.

h) Welding Method 5, 2.5.3.5, requires the use of temper-bead welding for dissimilar metals and first appeared as an addendum to the 2004 edition.

i) Welding Method 6, 2.5.3.6, describes the use of a controlled fill technique for creep strength enhanced ferritic (CSEF) steel repairs and was introduced in the 2015 edition.

j) Welding Method 7, 2.5.3.7, describes the use of a controlled fill technique for dissimilar metals welded to CSEF steels and was introduced in the 2021 edition. 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.

k) 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.
2.5.3 e)	<p>le) 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.</p>	
2.5.3 f)	<p>mf) Methods that may be used as alternatives to postweld heat treatment are described in the following subsections.</p>	

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 may be used.

b) Competent technical advice should 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.



PROPOSED REVISION OR ADDITION

Item No. A25-85
Subject/Title Inclusion of Grade 92 and P-No. 5B into 2.5.3.6 and Supplement 8
NBIC Location 2.5.3.6 and Supplement 8
Project Manager and Task Group John Siefert
Source (Name/email) John Siefert, jsiefert@epri.com
Statement of Need Current verbiage restricts the use of Welding Method 6 and Supplement 8 to only P15E, Group 1, Grade 91 steel. Data has recently been supported to extend these alternative weld repair approaches to Grade 92 steel. One of the proposed filler metals for repair, AWS type -B8, is matching to 9Cr-1Mo steel. ASME BPVC Section IX classifies 9Cr-1Mo steel as P-No. 5B material. Extensive data has been developed on this weld metal in the as-welded condition and its use to make repairs without PWHT to 9Cr-1Mo steel. This class of steel, given that it does not contain deliberate additions of V, Nb or N, is less hardenable and weaker in strength compared to the CSEF steel grades 91 and 92.
Background Information Summary pptx file available in the sharepoint folder with supporting data. Screen shot of ASME BPVC Section IX, 2025 P-number listings provided on page 3 of the proposal file for reference.

Rev 01 – proposed at January 2026 meetings. Simple changes in multiple places to remove explicit reference to ‘Grade 91’

Paragraph	Current Text	Proposed Text
2.5.3.6	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:	This welding method provides requirements for welding only Grade 91 creep strength enhanced ferritic steel tube material P-No. 15E, Group 1 or P-No. 5B, Group 1 within the steam boiler setting. When using this welding method, the following applies:
2.5.3.6 c) 1)	The material shall be limited to P-No 15E, Group 1, Grade 91, creep strength enhanced ferritic steel (CSEF).	The material shall be limited to P-No 15E, Group 1 or P-No. 5B, Group 1; Grade 91, creep strength enhanced ferritic steel (CSEF).
2.5.3.6 c) 3)	The welding procedure qualification test coupon shall be P-No 15 E, Group 1, Grade 91.	The welding procedure qualification test coupon shall be P-No. 15 E, Group 1 or P-No. 5B, Group 1; Grade 91.
S8.1 a)	The technical information provided in this supplement pertains to weld repair and post repair inspection of creep strength enhanced ferritic steel (CSEF) pressure retaining items. The present guidance covers P-No. 15E, Group 1, Grade 91 and dissimilar welds made to this material (e.g. P-No. 4, P-No. 5A or P-No. 8, P-No. 42, P-No. 43 or P-No. 45). This Supplement provides guidance for full penetration and partial penetration weld repairs not covered under Welding Method 6 (NBIC Part 3, 2.5.3.6) or Welding Method 7 (NBIC Part 3, 2.5.3.7).	The technical information provided in this supplement pertains to weld repair and post repair inspection of creep strength enhanced ferritic steel (CSEF) pressure retaining items. The present guidance covers P-No. 15E, Group 1 or P-No. 5B, Group 1; Grade 91 and dissimilar welds made to either this material (e.g. P-No. 4, P-No. 5A or P-No. 8, P-No. 42, P-No. 43 or P-No. 45). This Supplement provides guidance for full penetration and partial penetration weld repairs not covered under Welding Method 6 (NBIC Part 3, 2.5.3.6) or Welding Method 7 (NBIC Part 3, 2.5.3.7).
S8.4 a)	The welding procedure qualification test coupon shall be ASME P-No. 15 E, Group 1, Grade 91 joined	The welding procedure qualification test coupon shall be ASME P-No. 15 E, Group 1 or P-No. 5B, Group 1;

	to itself, P-No. 4, P-No. 5A, P-No. 8, P-No. 42, P-No. 43, or P-No. 45.	Grade 91 joined to itself, P-No. 4, P-No. 5A, P-No. 8, P-No. 42, P-No. 43, or P-No. 45.
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Table QW/QB-422
Base Metal P-Numbers (Cont'd)

Spec No.	Designation, Alloy, Type, or Grade	UNS No.	Minimum Specified Tensile, ksi (MPa)	Welding			Brazing P-No.	Nominal Composition	Typical Product Form	Nominal Thickness Limits, in. (mm)
				P- No.	Group No.	ISO 15608 Group				
A or SA-334	9	K22035	63 (435)	9A	1	9.1	100	2Ni-1Cu	Welded tube	...
A or SA-334	3	K31918	65 (450)	9B	1	9.2	100	3.5Ni	Welded tube	...
A or SA-334	8	K81340	100 (690)	11A	1	9.3	100	9Ni	Welded tube	...
A or SA-335	P1	K11522	55 (380)	3	1	1.1	100	C-0.5Mo	Smls. pipe	...
A or SA-335	P2	K11547	55 (380)	3	1	4.2	100	0.5Cr-0.5Mo	Smls. pipe	...
A or SA-335	P12	K11562	60 (415)	4	1	5.1	110	1Cr-0.5Mo	Smls. pipe	...
A or SA-335	P15	K11578	60 (415)	3	1	...	100	1.5Si-0.5Mo	Smls. pipe	...
A or SA-335	P11	K11597	60 (415)	4	1	5.1	110	1.25Cr-0.5Mo-Si	Smls. pipe	...
A or SA-335	P22	K21590	60 (415)	5A	1	5.2	110	2.25Cr-1Mo	Smls. pipe	...
A or SA-335	P21	K31545	60 (415)	5A	1	5.2	110	3Cr-1Mo	Smls. pipe	...
A or SA-335	P5c	K41245	60 (415)	5B	1	5.3	120	5Cr-0.5Mo-Ti	Smls. pipe	...
A or SA-335	P5	K41545	60 (415)	5B	1	5.3	110	5Cr-0.5Mo	Smls. pipe	...
A or SA-335	P5b	K51545	60 (415)	5B	1	5.3	110	5Cr-0.5Mo-Si	Smls. pipe	...
A or SA-335	P91	K90901	85 (585)	15E	1	6.4	110	9Cr-1Mo-V	Smls. pipe	...
A or SA-335	P9	K90941	60 (415)	5B	1	5.4	110	9Cr-1Mo	Smls. pipe	...
A or SA-335	P92	K92460	90 (620)	15E	1	6.4	110	9Cr-2W	Smls. pipe	...
A or SA-336	F12	K11564	70 (485)	4	1	5.1	110	1Cr-0.5Mo	Forgings	...
A or SA-336	F11, Cl. 2	K11572	70 (485)	4	1	5.1	110	1.25Cr-0.5Mo-Si	Forgings	...
A or SA-336	F11, Cl. 3	K11572	75 (515)	4	1	5.1	110	1.25Cr-0.5Mo-Si	Forgings	...
A or SA-336	F11, Cl. 1	K11597	60 (415)	4	1	5.1	110	1.25Cr-0.5Mo-Si	Forgings	...
A or SA-336	F1	K12520	70 (485)	3	2	1.1	100	C-0.5Mo	Forgings	...
A or SA-336	F22, Cl. 1	K21590	60 (415)	5A	1	5.2	110	2.25Cr-1Mo	Forgings	...
A or SA-336	F22, Cl. 3	K21590	75 (515)	5A	1	5.2	110	2.25Cr-1Mo	Forgings	...
A or SA-336	F3VCb	K31390	85 (585)	5C	1	6.2	110	3Cr-1Mo-0.25V-	Forgings	...

Do we need to do anything with this?

INTERPRETATION 19-04

Subject: Welding Method 6 on Grade 92 steel (Part 3, 2.5.3.6)

Edition: 2019

Question: May Welding Method 6 also be used on CSEF steel which has been manufactured to the requirements in Code Case 2179, and otherwise classified as P No 15E Group 1?

Reply: No.



Vessel and feature cross-weld creep tests in Grade 92 to support inclusion into Welding Method 6 and Supplement 8



John A. Siefert, Ph.D.

January 12, 2026

Rev 0

INTERPRETATION 19-04

- **Subject:** Welding Method 6 on Grade 92 steel (Part 3, 2.5.3.6)
- **Edition:** 2019
- **Question:** May Welding Method 6 also be used on CSEF steel which has been manufactured to the requirements in Code Case 2179, and otherwise classified as P No 15E Group 1?
- **Reply:** No.

Outcome – need to generate relevant data to support eventual inclusion of Grade 92 into Welding Method 6 and Supplement 8

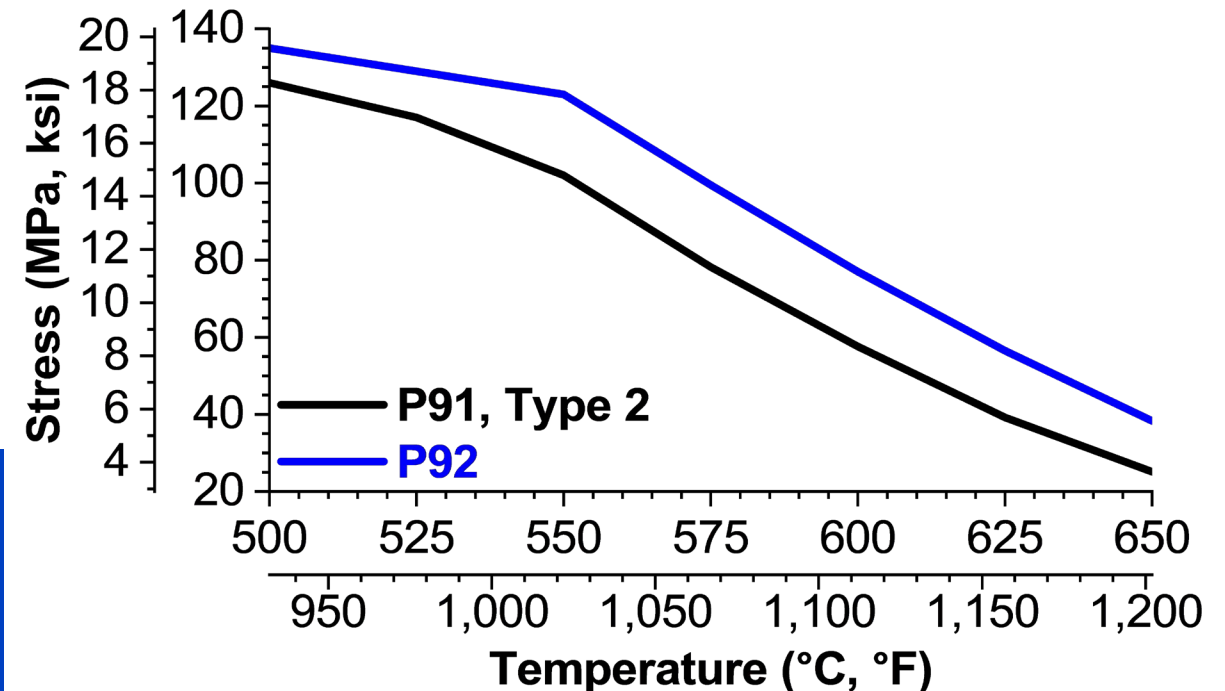
Reality – increasing use of Grade 92 over Grade 91 in modern HRSGs and piping systems due to higher stress allowable values in ASME BPVC Sec. IID

Materials – main alloying elements

Material		C	Mn	Si	Cr	Mo	V	N	Ni	Nb	W	B
SA-335 P91	Min	0.08	0.30	0.20	8.00	0.85	0.18	0.030		0.06		
	Max	0.12	0.60	0.50	9.50	1.05	0.25	0.070	0.40	0.10		
SA-335 P92	Min	0.07	0.30		8.50	0.30	0.15	0.03		0.04	1.50	0.001
	Max	0.13	0.60	0.50	9.50	0.60	0.25	0.07	0.40	0.09	2.00	0.006

- W is a more potent strengthening element compared to Mo
- B added for strength... introduces other concerns (BN)
- Grade 92 is stronger than Grade 91

ASME BPVC Section IX classifies both Grade 91 and 92 steels as P-No. 15E, Group 1



Data supporting repairs to Welding Method

6

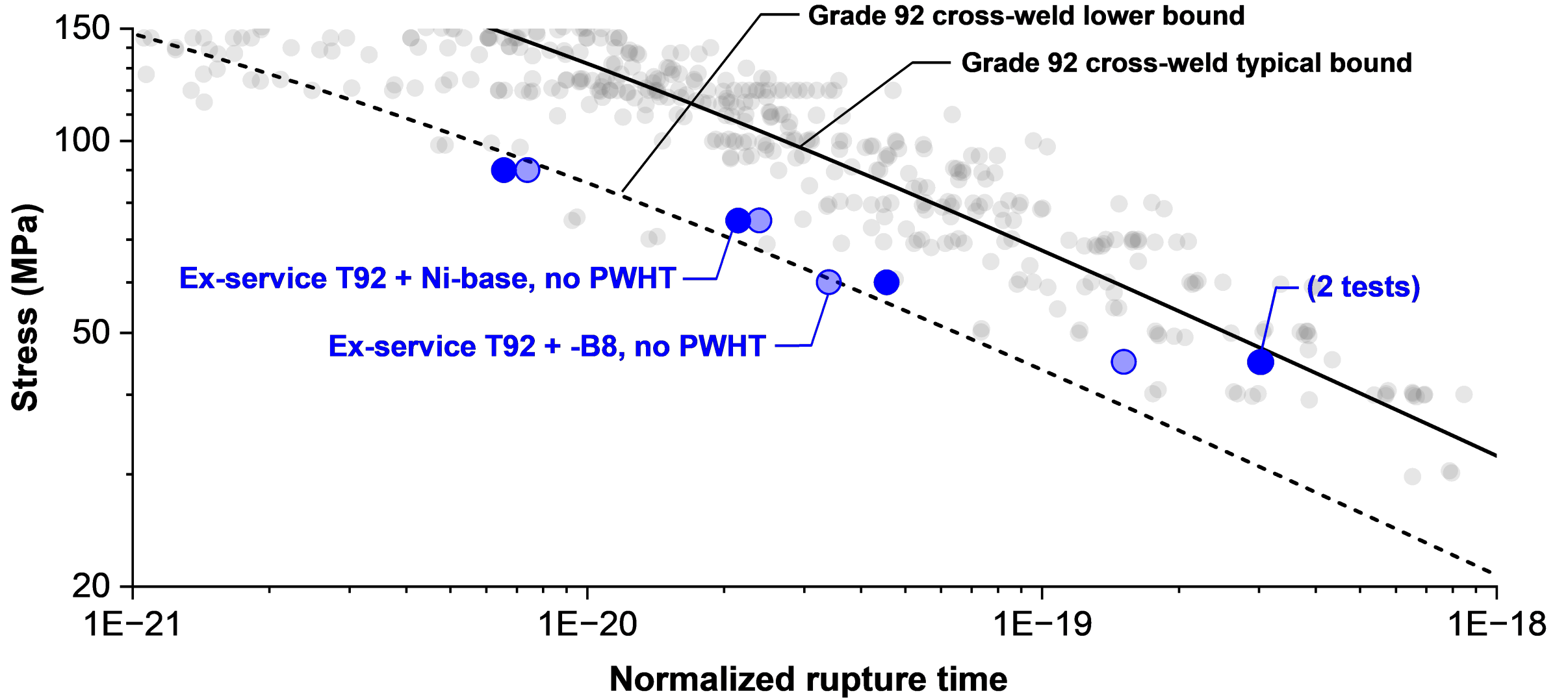
Background to vessel test program

- 45,000 hours of vessel testing (9 total tests, all completed) in ex-service T92 obtained from a supercritical plant in USA after superheater was retired from service after ~40,000 hours due to excessive oxidation and failures
 - Simulated repairs: AWS type –B8 + no PWHT or Ni-base + no PWHT
- 20,000 hours of vessel testing (6 total tests, 2 on-going) in ‘new’ T92 obtained from reputable manufacturer
 - AWS type –B8 + no PWHT (repair) or AWS type –B91 + PWHT (new construction)



**One-of-a-kind
study assessing
simulated repairs
in T92 to inform
additions to WM6
and S8**

Vessel tests in ex-service T92 material



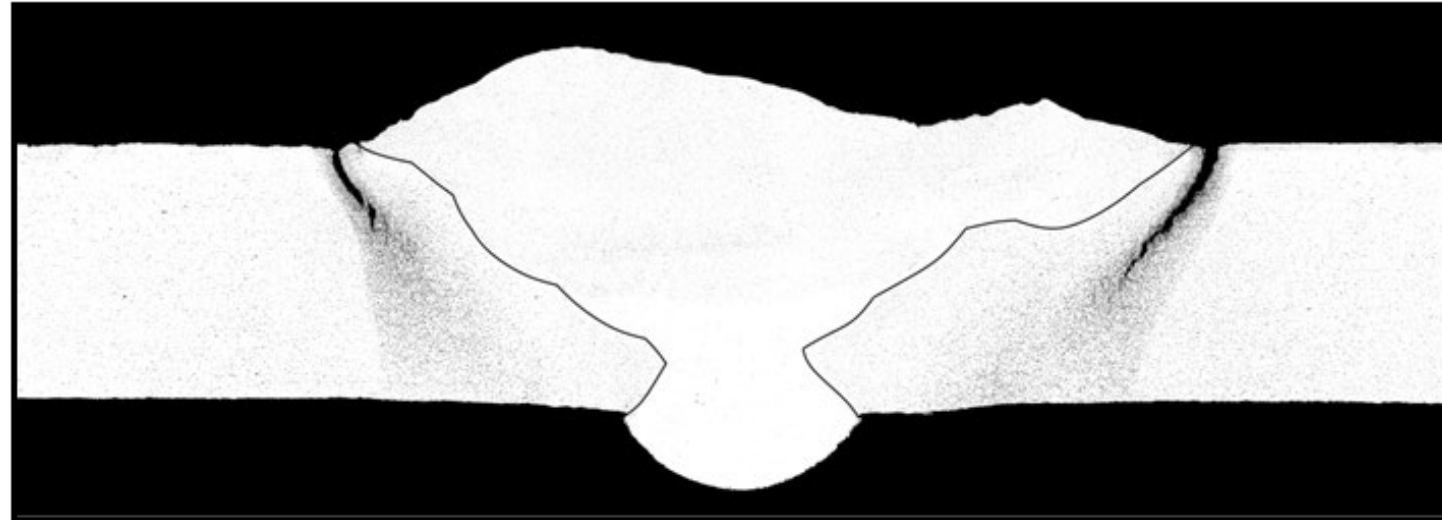
Repairs meet lower bound for 'new' cross-weld tests in Grade 92

Vessel tests in **ex-service T92** material – failure mode

Ex-service T92

Ni-base (ERNiCr-3 + ENiCrFe-3) + no PWHT

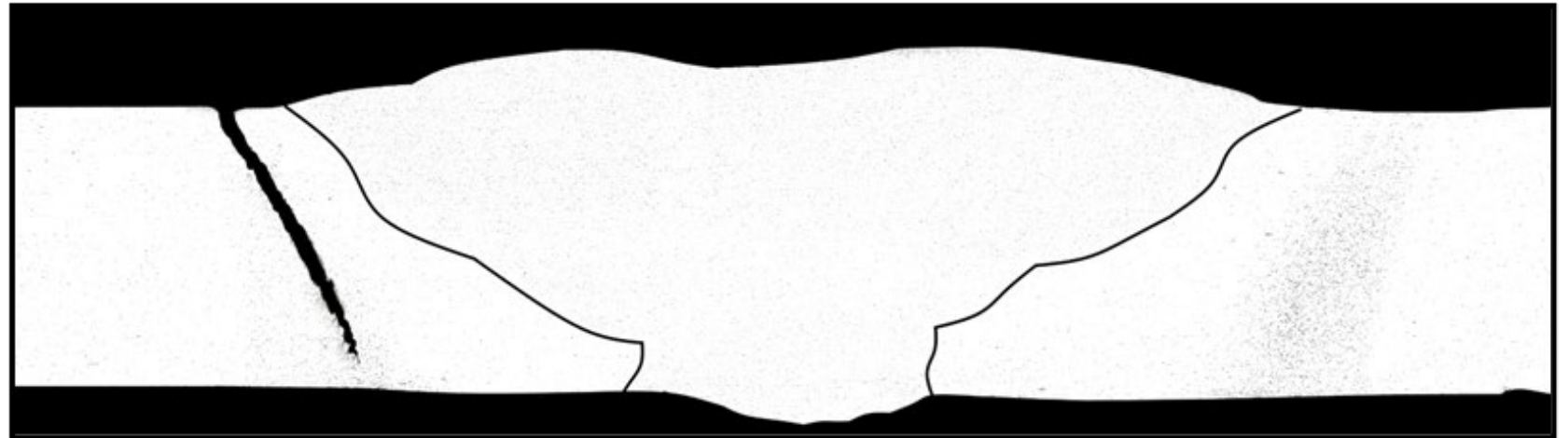
HAZ failure



Ex-service T92

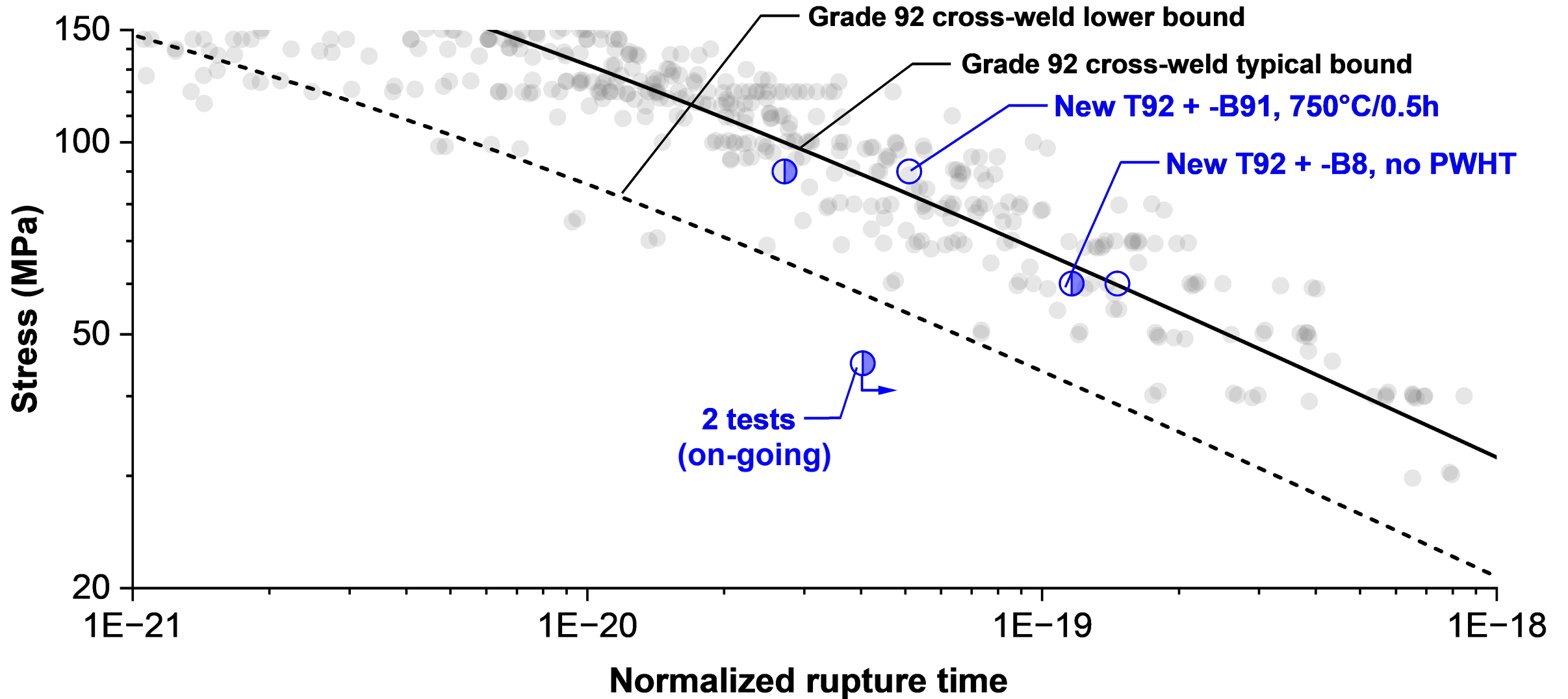
AWS type –B8 + no PWHT

HAZ failure



Failure typically in the T92 HAZ. Some weld metal damage may be observed in AWS type –B8 weld metal (comparable to Grade 91 investigations)

Vessel tests in new T92 material



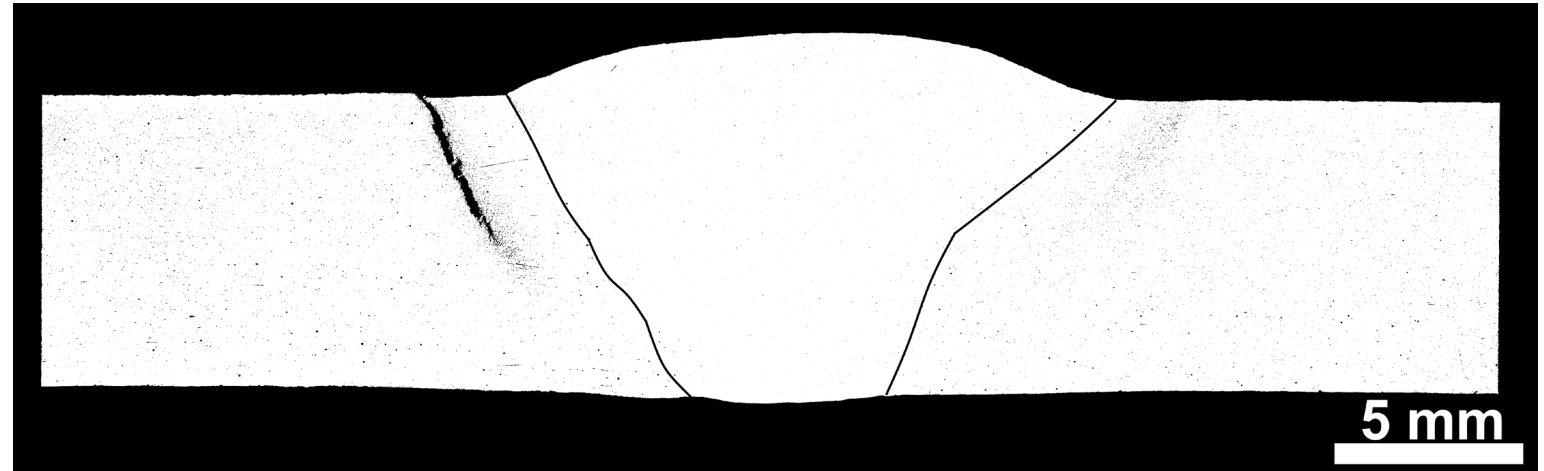
Repairs meet typical bound for 'new' cross-weld tests in Grade 92

Vessel tests in **new** T92 material – failure mode

Ex-service T92

AWS type –B8 + no PWHT

HAZ failure



Ex-service T92

AWS type –B91 + PWHT

HAZ failure



Failure typically in the T92 HAZ. Some weld metal damage may be observed in AWS type –B8 weld metal (comparable to Grade 91 investigations)

Summary

- AWS type –B91 + PWHT does not result in a marked decrease in performance and is equally acceptable for new construction welds or post-construction repairs
 - This is an important finding given the lack of availability in post-construction supply chain for matching filler metal to Grade 92 base metal
- In new material there is not a marked increase in performance for the AWS type –B91 + PWHT compared to AWS type –B8 + no PWHT repairs
 - At lower stress values, there is effectively no difference in performance
 - All failures were in the HAZ with some damage observed in AWS type –B8 weld metal for long-term tests
- Repairs in ex-service T92 generally met or exceeded the lower bound and were influenced by the degraded condition of the ex-service T92 parent material used to fabricate the vessel tests.

There are no red flags to inclusion of Grade 92 into Welding Method 6

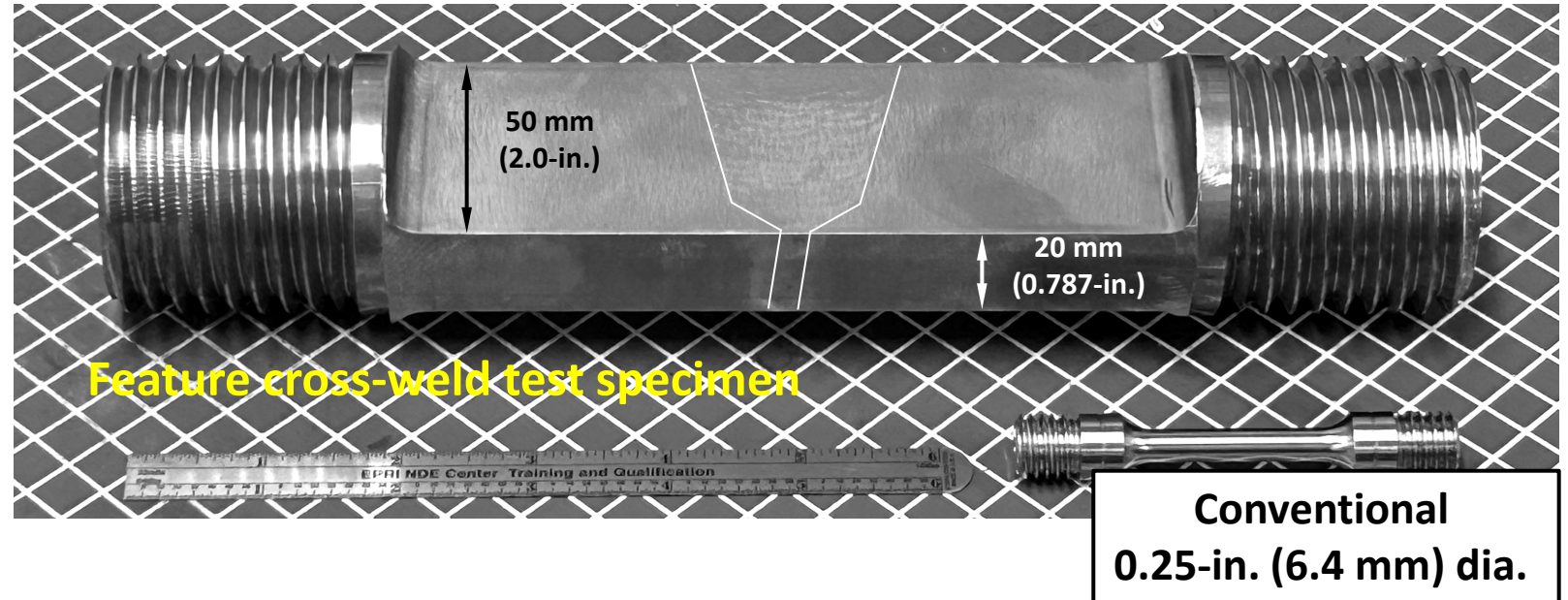


Data supporting repairs to Supplement 8

Test matrix for Grade 92 repairs

Temp.		Pressure		Est. life
°C	°F	MPa	ksi	hours
650	1,202	30	4.4	15,000
650	1,202	40	5.8	4,500
650	1,202	50	7.3	2,000
650	1,202	60	8.7	1,000
625	1,157	40	5.8	20,000
625	1,157	60	8.7	5,000
625	1,157	80	11.6	1,500
625	1,157	100	14.5	1,000
650	1,202	80	11.6	500
600	1,202	100	14.5	1,500

**Testing program
initiated in 2024**



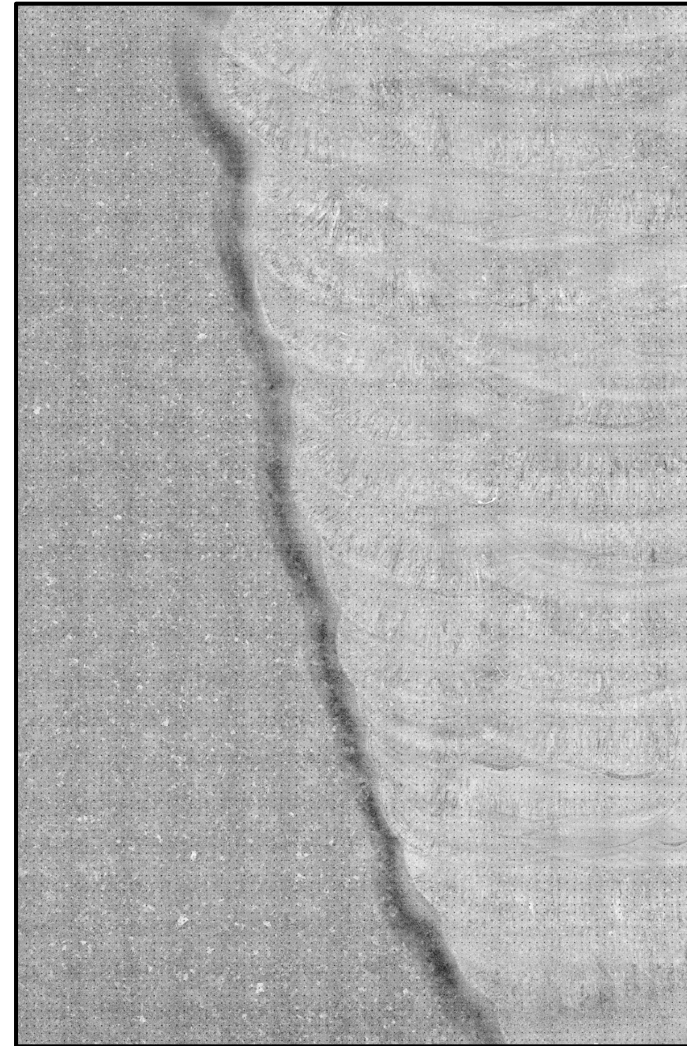
- Feature test specimen geometry includes entire through-thickness weld or repair geometry (2-in. [50.8 mm])
- 45,000 hours of testing in AWS type –B91 + PWHT
 - Includes multiple PWHT temperatures across allowable range
- 25,000 hours of testing in AWS type –B8 + no PWHT
- >100,000 hours expected at completion of test program in 2026

Repairs evaluated prior to and after testing

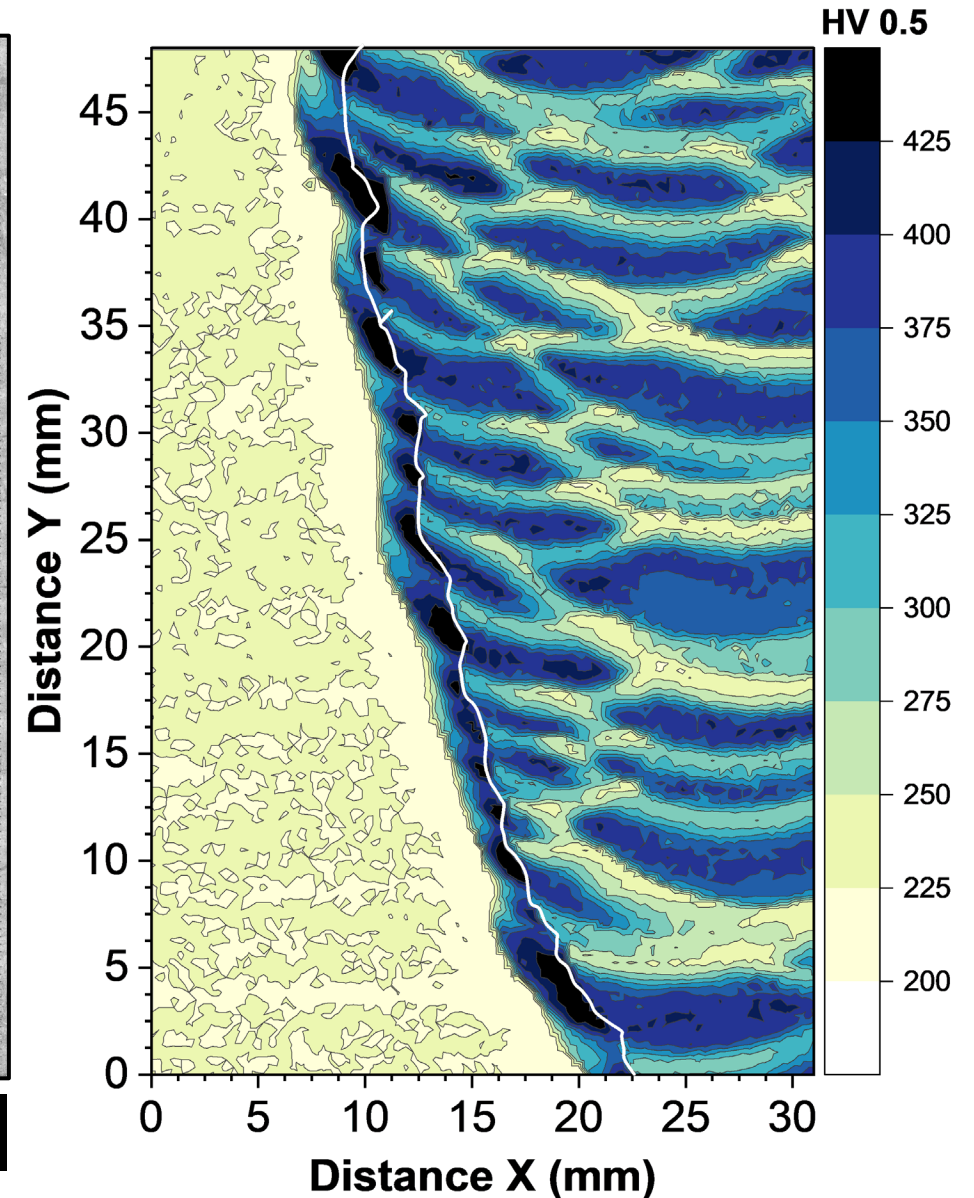
Characterization of simulated weld repair

- 0.25 mm spacing
- ~Full thickness (~50 mm) and sufficient width to capture deposited weld, HAZ, and base metal
- ~12,500 total indents

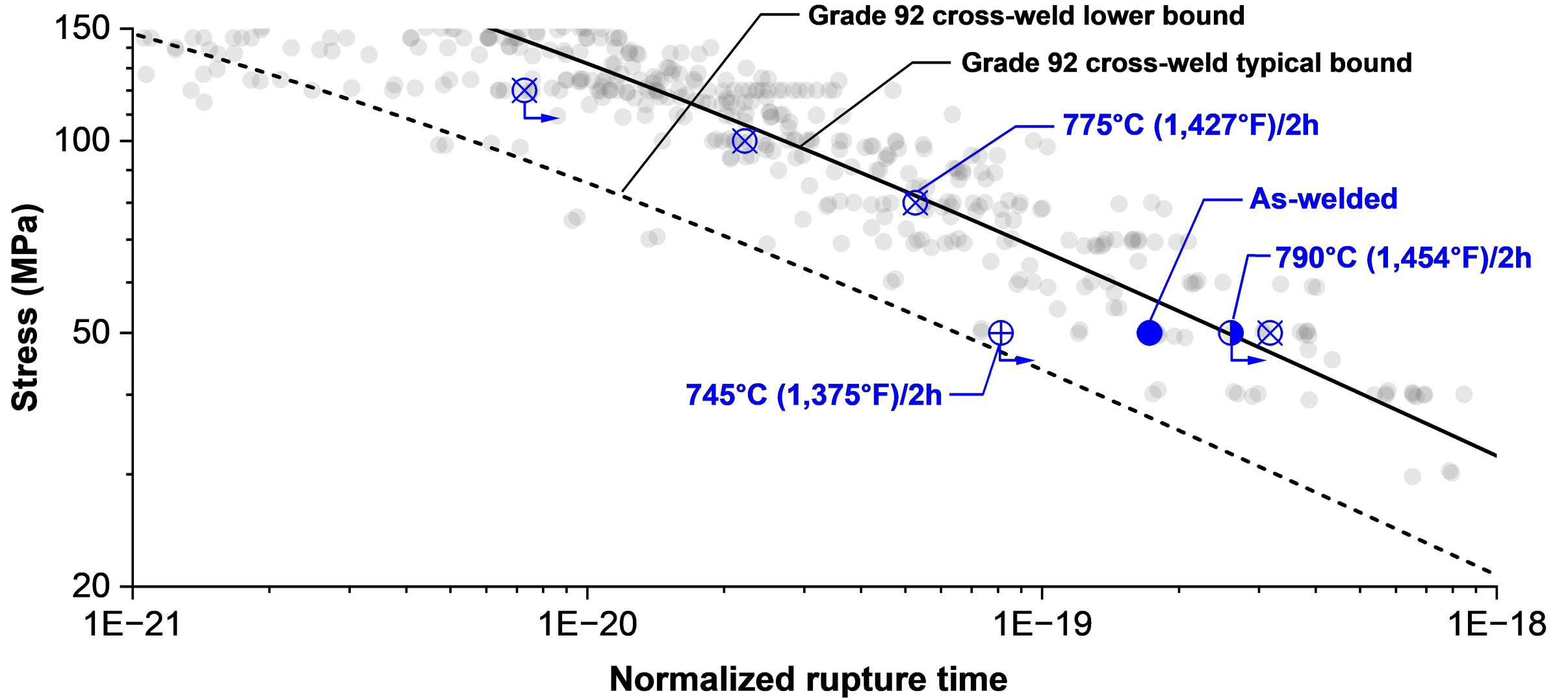
No gross defects or other anomalies that might otherwise influence creep performance



Etched hardness map

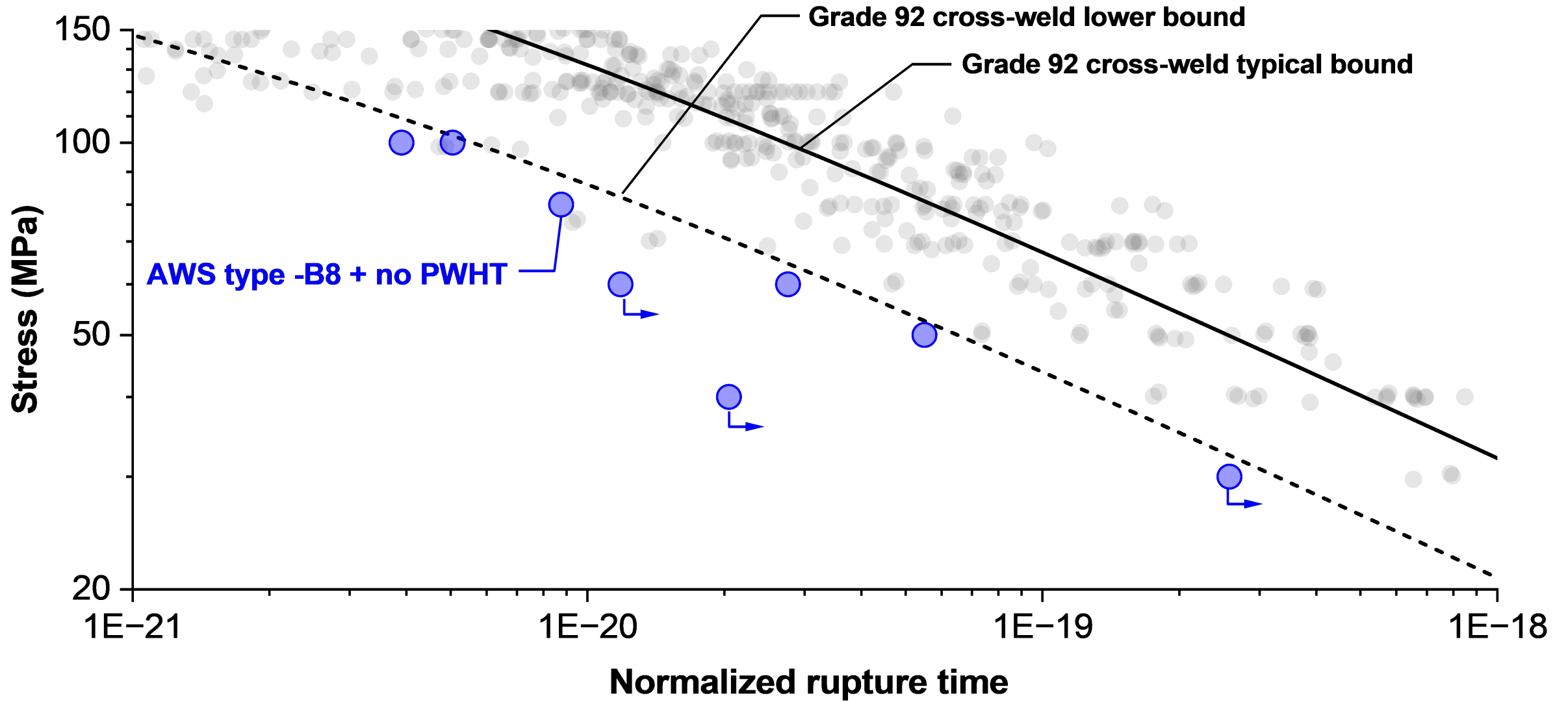


P92 + AWS type -B91 + PWHT



Trend unlikely to change with on-going tests (arrows)

P92 + AWS type -B8 + no PWHT



Trend unlikely to change with on-going tests (arrows)

Summary

- AWS type –B91 + PWHT does not result in a marked decrease in weld performance and is acceptable for new construction welds or post-construction repairs
 - PWHT did not have a marked effect on performance reinforcing the fact that PWHT is not a primary influence on the cross-weld creep behavior
 - The as-welded condition **with no deliberate PWHT** was comparable to the samples given a PWHT at 1,375, 1,425, or 1,455°F
- AWS type –B8 + no PWHT repair met the lower bound expectation for weld performance
 - Although test data shows reduced performance compared to the AWS type –B91 + PWHT, *the vessel tests subjected to multiaxial loading as would be encountered in-service* showed far less variability as presented previously
- Similar trends to those detailed here were noted in the development of Welding Method 6 and Supplement 8 for Grade 91 steel
 - Vessel testing to assess multiaxial performance is critical and cannot base recommendations solely on uniaxial test data

There are no red flags to inclusion of Grade 92 into Supplement 8



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