Date Distributed: 8/20/18



## THE NATIONAL BOARD

OF BOILER AND PRESSURE VESSEL

# NATIONAL BOARD SUBCOMMITTEE REPAIRS AND ALTERATIONS

# MINUTES

Meeting of July 18<sup>th</sup>, 2018 Columbus, OH

These minutes are subject to approval and are for the 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 Columbus, Ohio 43229-1183 Phone: (614)888-8320 FAX: (614)847-1828

### 1. Call to Order

The meeting was called to order at 8:00 a.m. on July 17, 2018 by Chairman, Mr. George Galanes.

### 2. Introduction of Members and Visitors

The attendees are identified on the attendance sign in sheet (Attachment Pages 1-2). With the attached attendance listing, a quorum was established.

### 3. Announcements

Announcements were made to the subgroup by Mr. Terrence Hellman.

- Items not approved at Main Committee this week will not make the 2019 Edition of the NBIC.
- The National Board will be hosting a reception for all committee members and visitors on Wednesday evening at 5:30pm at the pavilion.
- Breakfast will be provided on Thursday morning to NBIC Committee members and visitors.
- Lunch will be provided on Wednesday and Thursday to NBIC Committee members and visitors

### 4. Adoption of the Agenda

• Added membership approvals for SG Graphite elected Chair and membership reappointments.

The above listed item was added to the agenda and a motion was made to adopt the agenda as revised. The motion was unanimously approved.

### 5. Approval of the Minutes of January 10<sup>th</sup>, 2018 Meeting

The minutes from the January 2018 SC Repairs and Alterations meeting were unanimously approved.

### 6. Review of Rosters (Attachment Page 3)

### a. Membership Nominations

- Michael Quisenberry (Interest Category: National Board Certificate Holder) (Attachment Page 4)
- John Siefert (Interest Cagegory General Interest) (Attachment Page 9)

The SC discussed the nominees and a motion was made to approve the nominees as members of the

Repairs and Alteration SG. The motion was unanimously approved.

### b. Membership Reappointments

• Mr. Galanes, Mr. Boseo, Mr. Edwards, and Mr. Sekely all have memberships to SC R&A expiring on 8/30/2018. The members reaffirmed their commitment to participate on the Committee. A motion was made to reappoint all members. The motion was unanimously approved.

- Mr. Carter, Mr. Edwards, Mr. Galanes, Mr. Miletti, Mr. Pillow, Mr. Sekely, and Mr. Walker all have memberships to SG R&A expiring on 8/30/2018. The members reaffirmed their commitment to participate on the Subgroup. A motion was made to reappoint all members. The motion was unanimously approved.
- Mr Andrew Stupica and Greg Becherer were reappointed and Aaron Viet was elected Chair to SG Graphite. A motion was made to accept the reappointment of the members and the elected Chair to SG Graphite. The motion was unanimously approved.

### c. Officer Appointments

- Mr. Galanes's term as Chair expires 8/30/2018. Mr. Galanes stated that nominations for new membership on the Repair and Alteration SC will need to wait until the next meeting when the new Chair for the SC has been elected.
- Nominations were taken for the Repair and Alteration SC Chair. Mr. Robby Troutt and Mr. Benjamen Shaefer were nominated. The nominees addressed the Subcommittee as to why they would like to become Chair, and how their experience and knowledge would benefit the group. A motion was made to call a vote by ballot to elect the new Chair. The motion passed unanimously and written ballots were cast by the SC membership. Mr. Robby Troutt was elected as Chair of the SC Repairs and Alterations by majority vote.

### 7. Interpretations

Item Number: 17-143	<b>NBIC Location: Part 3</b>	No Attachment
General Description: Can an pressure boundary to complete	"R" stamp certified shop manufacture and us the repair of a boiler?	se parts for use on the
Subgroup: Locomotive Task Group: L. Moedinger (1	PM)	
	Progress Report: Mr. Moedinger gave a progwill be put out to Letter Ballot to Repair and	

Item Number: 18-30	NBIC Location: Part 3	Attachment Page 20
General Description: Interchange of Convection Sections from one OSTG to another OSTG		

**Subgroup:** Repairs and Alterations **Task Group:** Jamie Walker – PM

**July 2018 Meeting Action:** Mr. Jamie Walker proposed responding to the inquirer with the interpretations 07-06, 01-28, and 95-15 to answer their question. The SC discussed the need to address these issues within the NBIC, and a new action Item 18-65 was assigned. A motion was made to have the NBIC Secretary respond with the referenced interpretations and close this Item. The motion was unanimously approved.

Item Number: 18-31NBIC Location: Part 3, 2.5.2 a)Attachment Pages 21-22

General Description: Post-weld heat treatment of a full penetration groove pipe nozzle neck repair

**Subgroup:** Repairs and Alterations **Task Group:** Nathan Carter

**July 2018 Meeting Action:** The SC discussed if PWHT is not required, but is optionally performed on a vessel, do repairs require PWHT or Alternative Welding Methods. The proposed response was that the repair can be made without PWHT or using Alternative Welding Methods as long as the WPS is qualified without PWHT, Note: For Pressure Vessels, See Interpretation 95-14. A motion was made to accept the Committee's question and reply. The motion was approved with 1 abstention. The abstention was from a committee member who felt this was "consulting". Chair G. Galanes requested an Action Item be opened to better address PWHT and Pre-Heat requirements in Repairs and Alterations. Action Item 18-68 was created.

Item Number: 18-32 NBIC Location: Part 3 Attachment Page	Item Number: 18-32	<b>NBIC Location: Part 3</b>	Attachment Page 23
--	--------------------	------------------------------	--------------------

**General Description:** Interchange of convective box (economizers) in Once Through Steam Generators (OSTG)

**Subgroup:** Repairs and Alterations **Task Group:** Ben Schaefer

**July 2018 Meeting Action:** Mr. Benjamin Schaefer proposed responding in line with Item 18-30 with a response to the inquirer with the interpretations 07-06, 01-28, and 95-15 to answer their question. The SC discussed the need to address these issues within the NBIC, and this subject will be included within the newly opened Item 18-65 (see Item 18-30). A motion was made to have the NBIC Secretary respond with the referenced interpretations and close this Item. The motion was unanimously approved.

Item Number: 18-33	NBIC Location: Part 3, 3.4.4 c)	Attachment Page 24

**General Description:** Providing an additional stiffener ring to compensate for corrosion levels being above allowance

Subgroup: Repairs and Alterations Task Group: Kathy Moore – PM, Paul Shanks, David Martinez

**July 2018 Meeting Action:** Progress Report: The Repair and Alteration SG has reviewed this inquiry, and task group was created. The task group will come up with a proposal for the January 2019 meeting.

Task Group assigned: Kathy Moore – PM, Paul Shanks, David Martinez

Item Number: 18-34	NBIC Location: Part 3, 8.4	Attachment Page 25
General Description: Does	s an R certificate holder assume responsibility	for safety/integrity of a vessel
outside the scope of repair?		

**Subgroup:** Repairs and Alterations **Task Group:** Nathan Carter, Mike Quisenberry

**July 2018 Meeting Action:** The proposed response of "no" along with Interpretations 95-41 and 95-17 as reference was discussed. A motion was made to accept the interpretation with proposed committee question and reply and was unanimously approved.

Item Number: 18-35

### **NBIC Location: Part 3**

**Attachment Pages 26-27** 

**General Description:** Can a vessel built to an ASME Section VIII Division 2 construction code, prior to 2017, that required a PE for design, be altered to the 2017 ASME Section VIII Division 2 Code for Class 1 vessels?

**Subgroup:** Repairs and Alterations **Task Group:** Brian Moorelock

**July 2018 Meeting Action:** Mr. Moorelock presented the revised Committee's Question and Response. A motion was made to accept the interpretation with proposed committee question and reply and was unanimously approved.

Item Number: 18-37NBIC Location: Part 3, 2.5.3.6 e)Attachment Page 28General Description: Changing the consumables in subsection e in Part 3, 2.5.3.6

**Subgroup:** Repairs and Alterations **Task Group:** Ray Miletti – PM , George Galanes

**July 2018 Meeting Action:** Mr. Galanes presented the proposal. The Subgroup reviewed the proposed reply of "No" and a motion was made to accept the interpretation with proposed committee question and reply and was unanimously approved.

Item Number: 18-39	NBIC Location: Part 3, 2.5.3.6	Attachment Page 29
General Description: If the	he original welding procedures used for construction	on of the vessel are not
arrailable is it accountable t	to DW/UT the animal walds if the Departition to hal	dan an aliant aan

**General Description:** If the original welding procedures used for construction of the vessel are not available, is it acceptable to PWHT the original welds if the R-certificate holder or client can demonstrate with sufficient PQRs that the entire range of reasonably plausible essential variables are supported in the PWHT'd condition?

**Subgroup:** Repairs and Alterations **Task Group:** Tom White – PM, George Galanes

**July 2018 Meeting Action:** This inquiry was discussed and determined to be "Consulting". A motion was made to have the NBIC Secretary respond that this was considered "Consulting" and close this Item. The motion was unanimously approved.

Item Number: 18-42NBIC Location: Part 3Attachment Page 30General Description: Would reducing a pressure vessel shell overall length be considered an<br/>Alteration?Attachment Page 30

**Subgroup:** Repairs and Alterations **Task Group:** Rick Valdez – PM

**July 2018 Meeting Action:** This inquiry was discussed and it was determined that a change to a vessel's overall length would be considered an alteration per the definition of "alteration" in the 2017 NBIC, Part 3 and examples of alterations per paragraph 3.4.4. A motion was made to accept the interpretation with proposed committee question and reply and was unanimously approved.

Item Number: 18-53

### **NBIC Location: Part 3**

**Attachment Page 31** 

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

**Subgroup:** Repairs and Alterations **Task Group:** Brian Boseo

**July 2018 Meeting Action:** Progress Report: The Subgroup reviewed this inquiry and felt there was more information needed in order to draft a response. A motion was made to have the NBIC Secretary request more information from the inquirer. The motion was unanimously approved.

### 8. Action Items

Item Number: NB15-1602	NBIC Location: Part 3, S2.7.1	Attachment Pages 32-33

**General Description:** Revise material list for historical boiler reports to include bolts, studs, nuts and formed pressure parts

Subgroup: Historical Task Group: T. Dillon (PM), M. Wahl, G. Galanes

**July 2018 Meeting Action:** Mr. Joel Amato presented this Item that passed the Historical SG with unanimous approval. Mr. Moedinger discussed Locomotive material requirements are different than Historical material requirements and felt more guidance was necessary to reconcile the differences. A motion was made to approve this Item. The motion was approved with 1 disapproval vote. The disapproval was from a committee member who felt more guidance on reconciliing material specifications between Locomotive and Historical Subgroups was needed.

Item Number: NB15-2208NBIC Location: Part 3, S3No Attachment

General Description: Investigate repair options for graphite block heat exchangers

Subgroup: Graphite

Task Group: Greg Becherer (PM)

July 2018 Meeting Action: Progress Report: A progress report was given by Mr. M. Bost

Item Number: NB15-2210NBIC Location: Part 3Attachment Pages 34-43General Description: Reduce cementing requirements for plugging of tubes

Subgroup: Graphite

Task Group: C. Cary – PM, A. Viet, A. Stupica

**July 2018 Meeting Action:** Mr. Cary presented that this Item failed SC letter ballot due to lack of votes (9 approve votes, 2 abstentions, and 5 did not vote), but the comments from the letter ballot have been addressed and more detail regarding the "twist test" were added in the form of a diagram. A motion was made to approve this Item as edited. The motion was unanimously approved.

### Item Number: NB16-0303 NBIC Location: Part 3

**Attachment Page 44** 

General Description: Fillet welded patches

Subgroup: SG Repairs and Alterations

Task Group: B. Boseo – PM, B. Morelock, R Underwood, J. Walker

**July 2018 Meeting Action:** This Item failed the SG Repairs and Alterations with 9 Approvals, 11 Disapprovals, and 1 Abstention, but a second motion at the SG level was made to present this item to the Repair and Alteration SC. After discussion, a motion was made to close this item with no action. The motion was unanimously approved. Disapprovals were mainly due to concerns that this type of temporary repair would be unsafe and should not be included in the NBIC.

Item Number: NB16-0503	NBIC Location: Part 3, S2.13.13.4	Attachment Page 45

General Description: Add types of rivet heads

Subgroup: Historical Task Group: None Assigned.

**July 2018 Meeting Action:** This Item passed SC R&A via letter ballot on 02-23-2018 and is ready for consideration by the Main Committee. No action was taken on this Item.

Item Number: NB16-0608	NBIC Location: Part 3, 1.6.2	Attachment Pages 48-50
General Description: Address Nuclear QA program requirements for owner and certificate holder		

**Subgroup:** Repairs and Alterations **Task Group:** NR Task Group

**July 2018 Meeting Action:** Paul Edwards presented the item referencing the edition and addenda of NQA-1 that can be utilized within Table 1.6.2 and Table 1.6.2.1. A motion was made to accept and approve the revision. The motion was unanimously approved.

Item Number: NB16-1402	NBIC Location: Part 3	<b>Attachment Page 51</b>
General Description: Life extensi	ion for high pressure vessels above 20 years	

Subgroup: FRP

Task Group: M. Gorman (PM)

**July 2018 Meeting Action:** Progress Report: No information was received from FRP Subgroup at the time of this meeting. No action taken.

Item Number: NB16-1403	NBIC Location: Part 3, S4	No Attachment
$\mathbf{C}$		

General Description: Add information on repair of high pressure vessels

Subgroup: FRP

Task Group: N. Sirosh (PM)

**July 2018 Meeting Action:** Progress Report: No information was received from FRP Subgroup at the time of this meeting. No action taken.

### Item Number: NB16-1502 NBIC Location: Part 3

No Attachment

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

**Subgroup:** SG Repairs and Alterations **Task Group:** International Repair Supplement Task Group, Chuck Withers – PM

July 2018 Meeting Action: Progress Report: Mr. Withers was not present and could not present the item.

Item Number: NB16-1801NBIC Location: Part 3, S1Attachment Pages 56-57General Description: Review Part 3 S1 for revisions based on the publication of ASME Section 1, PartPL

Subgroup: Locomotive Task Group: L. Moedinger (PM)

**July 2018 Meeting Action:** Mr. Moedinger presented that this item failed the letter ballot to Main Committee in June due to a lack of votes. A motion was made to reaffirm and approve this item for consideration at the Main Committee. The motion was unanimously approved.

Item Number: NB16-2602	NBIC Location: Part 3, Section 9	No Attachment
General Description: Add def	initions for practicable and impracticable to glossary	

**Subgroup:** Repairs and Alterations **Task Group:** R. Underwood (PM), R. Milletti, J. Sekely

**July 2018 Meeting Action:** Mr. Robert Underwood stated that this definition was unnecessary and made a motion to close this Item with no action. The motion was unanimously approved.

Item Number: NB17-0602	NBIC Location: Part 3	No Attachment
General Description: Scope of 1	repair/new historical boiler with an R Stamp	

Subgroup: Historical Task Group: R. Underwood (PM), M. Wahl, J. Amato, D. Rose, M. Jordan

**July 2018 Meeting Action:** Mr. Underwood presented that this Item was deemed unnecessary and was voted to be closed with no action at the Historical SG. A motion was made for the SC to close with no action. The motion was unanimously approved.

Item Number: NB17-0701	<b>NBIC Location: Part 3</b>	Attachment Pages 58-59
General Description: Add reference	ces to Commercial Grade Dedication	(CGD) to 1.6.7.1 and 1.6.8.1

**Subgroup:** Repairs and Alterations **Task Group:** NR Task Group

**July 2018 Meeting Action**: Mr. Paul Edwards presented the Item and discussed that the NR TG recommended not referencing CGD in 1.6.7.1 or in 1.6.8.1, effectively closing this Item with no action. A motion to close with no action was made. The motion was unanimously approved.

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

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

**Subgroup:** Repairs and Alterations Task Group: P. Shanks (PM), Rob Troutt, Joel Amato, Kathy Moore, Paul Edwards

July 2018 Meeting Action: Progress Report: P. Shanks gave a progress report.

#### Item Number: 17-137 NBIC Location: Part 3, S4.18.2 **Attachment Pages 60-61** General Description: Remove "sand" blasting and replace with "abrasive" in Part 3, S4.18.2

Subgroup: FRP Task Group: Terry Cowley

July 2018 Meeting Action: Progress Report: No FRP members were present to present the item. History: Mr. Cowley submitted a new proposal to be letter balloted to SG FRP after their meeting in April. The item was approved via letter ballot in June.

Item Number: 17-139	NBIC Location: Part 3, 2.2.3	No Attachment
General Description: Perfor	mance qualification by independent qualifier	

**Subgroup:** Repairs and Alterations Task Group: Jim Pillow

July 2018 Meeting Action: Jim Pillow reported ASME Section IX is not going to act on a similar item and recommended closing this Item with no action. A motion to close with no action was made. The motion was unanimously approved.

Item Number: 17-155 **NBIC Location: Part 3, S1 Attachment Page 62** General Description: Throttle pipes, dry pipes, superheater headers, and front end steam pipes requirements

Subgroup: SG Locomotive Task Group: R. Stone (PM)

July 2018 Meeting Action: Mr. Moedinger presented that this item has been revised to address comments form the Main Committee letter ballot. A motion was made to approve this item as revised for consideration at the Main Committee. The motion was unanimously approved.

Item Number: 17-156	NBIC Location: Part 3, S1	Attachment Page 63
General Description · Weldin	g/brazing activities for Locomotive Boilers	

eral Description: Welding/brazing activities for Locomotive Boilers

Subgroup: SG Locomotive Task Group: G. M Ray (PM)

July 2018 Meeting Action: Mr. Moedinger presented that this item is being addressed by another Item (Item 18-40) and moved to close with no action. The motion was unanimously approved.

## Item Number: 17-160 NBIC Location: Part 3, S1

**Attachment Page 64** 

General Description: Partial knuckle replacement

**Subgroup:** SG Locomotive **Task Group:** R. Franzen (PM)

**July 2018 Meeting Action:** Progress Report: Mr. Moedinger presented that this Item was passed unanimously by SG Locomotive at their April 2018 meeting, and it also passed SC R&A letter ballot on June 15<sup>th</sup>. It will be on the Main Committee agenda for the July meeting. No action taken.

Item Number: 17-166	NBIC Location: Part 3, S3	No Attachment
General Description: Remove	e nozzle replacement and tube replacement from	n graphite routine repair
list		

**Subgroup:** SG Graphite **Task Group:** F. Brown (PM)

July 2018 Meeting Action: Progress Report: Task group is working on preparing a proposal.

Item Number: 17-167	NBIC Location: Part 3, S3	No Attachment
<b>General Description:</b> Clarify	repair inspection requirements for machined on	v graphite parts

Subgroup: SG Graphite

Task Group: A. Viet (PM)

July 2018 Meeting Action: Progress Report: Task group is working on preparing a proposal.

# Item Number: 17-179NBIC Location: Part 3, Section 5Attachment Pages 66-82General Description: R Form Guides

**Subgroup:** SG Repairs and Alterations **Task Group:** Tom White PM , Bill Vallance

**July 2018 Meeting Action:** Tom White presented the Item to revise the Report of Repair instructions and form field numbering. Discussion by the SG resulted in a new Action Item being created to move all Report Forms and their instructions to a supplement within Part 3 for the 2021 Edition of the NBIC (Item 18-66). A motion was made to approve this item. The motion was unanimously approved.

Item Number: 18-12	<b>NBIC Location: Part 3</b>	Attachment Pages 83-85
General Description: Adding	Weld Buildup to WM #6	

**Subgroup:** SG Repairs and Alterations **Task Group:** John Siefert PM, George Galanes

**July 2018 Meeting Action:** Progress Report: Mr. George Galanes presented that this Item was opened at the January 2018 meeting and the proposed revision to Welding Method 6 to limit weld build up to 100 square inches on only Grade 91 tubes is still being worked on.

Item	Numbe	er: 18-13			NBIC	Loca	ation	ı: Part	: 3		Attachment Pages 86-89
0	1.D	• .•	XX7 11X 6 1	1 7	1.11.1	C	1.	• •1	1.1	10	01

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

**Subgroup:** SG Repairs and Alterations **Task Group:** John Siefert PM, George Galanes

**July 2018 Meeting Action:** Progress Report: Mr. George Galanes presented that this Item was opened at the January 2018 meeting and the proposed revision to add a Welding Method 7 to allow for dissimilar metal welding on Grade 91 to austenitic steels and low allow steels.

### New Items:

Item Number: 18-5	NBIC Location: Part 3, S1.2.9.6	Attachment Page 90
<b>General Description:</b> Insta	llation of boiler flues	

Subgroup: SG Locomotive Task Group: L. Moedinger (PM)

**July 2018 Meeting Action:** Mr. Moedeinger presented that this item was passed unanimously by SG Locomotive at their April 2018 meeting. Editorial revision to address comments was made and a motion to reaffirm and approve the item for consideration at Main Committee was made. The motion was unanimously approved.

Item Number: NB18-7	NBIC Location: Part 3, S1.2.5.1	Attachment Page 92
Concerl Decovirtions Fillet	valdad stavbalts	

General Description: Fillet welded staybolts

**Subgroup:** SG Locomotive

Task Group: L. Moedinger (PM)

**July 2018 Meeting Action:** Item was passed unanimously by SG Locomotive at their April 2018 meeting, and it also passed SC R&A letter ballot on June 15<sup>th</sup>. Editorial revision to address comments was made and a motion to reaffirm and approve the item for consideration at Main Committee was made. The motion was unanimously approved.

Item Number: 18-14	<b>NBIC Location: Part 3</b>	<b>Attachment Pages 93-98</b>
<b>Ceneral Description:</b> SWPS	Revisions	

General Description: SWPS Revisions

**Subgroup:** SG Repairs and Alterations **Task Group:** Jim Sekely (PM).

**July 2018 Meeting Action:** Mr. Jim Sekely presented that this item passed both SG and SC R&A letter ballots on June 30<sup>th</sup>, and the comments have been addressed. A motion was made to reaffirm this Item as revised for presentation at the Main Committee. The motion was unanimously approved.

### Item Number: 18-38 NBIC Location: Part 3, 1.1 b) and c) A

Attachment Page 99

General Description: Add parts to Part 3, 1.1 b) and c) address "T/O" stamp

Subgroup: SG Repairs and Alterations

Task Group: Tom White - PM, Frank Hampton, Nathan Carter

**July 2018 Meeting Action:** Mr. Tom White presented the proposed Item. A motion was made to add the T/O testing only designation and reference to NB- publication and approve the Item as edited. The motion was unanimously approved.

Item Number: 18-40NBIC Location: Part 3, Section 3Attachment Pages 100-105General Description: Define that brazing should be done in accordance with ASME Section 9 in Part 3Section 3 of NBIC

**Subgroup:** SG Repairs and Alterations **Task Group:** J. Pillow (PM)

**July 2018 Meeting Action:** Mr. Jim Pillow presented that this Item was issued as a Review and Comment Ballot and all comments from the ballot had been addressed in the latest revision of the Item. A discussion by the SG yielded the creation of a new Action Item (Item 18-67) to align the definitions of brazing between ASME Section IX and NBIC. A motion was made to accept the Item. The motion was unanimously approved.

Item Number: 18-47NBIC Location: Part 3, Section 5Attachment Pages 106-135General Description: Remove the general instruction paragraph 5.12.4.1 in Part 3, for all Repair<br/>Reports, and the specific requirements in paragraphs 5.12.5.1 for "NR" forms and 5.12.6.1 for "NVR"<br/>form

**Subgroup:** SG Repairs and Alterations **Task Group:** Rick Valdez – PM, Marty Toth

**July 2018 Meeting Action:** Mr. Rick Valdez presented that this Item was intended to move all references to the Reports of Repair and their instructions to the National Board website. Per a discussion by the SG, and the approval of previous Action Item 17-179 to revise all Reports of Repair and their respective instructions within the NBIC, a motion to close this Item with no action was made. The motion was unanimously approved.

Item Number: 18-48NBIC Location: Part 3, 2.5.3 e)Attachment Pages 136-138General Description: Revise Part 3, 2.5.3 e) to exempt MT/PT of flush patches/window welds and to<br/>change reference to radiographic testing to volumetric testing

**Subgroup:** SG Repairs and Alterations **Task Group:** R. Underwood (PM)

**July 2018 Meeting Action:** Mr. Underwood presented the Item. After discussions regarding concerns over requiring volumetric examinations (shear-wave UT) where jurisdictional authority may have allowed alternative methods, a motion was made to approve the item. The motion was unanimously approved.

Item Number: 18-50NBIC Location: Part 3, Section 3Attachment Page 139General Description: Revision to Part 3, S2.11 a) to remove VT examination

**Subgroup:** SG Historical

Task Group: None assigned

**July 2018 Meeting Action**: Mr. Moedinger presented the NBIC Part 3 only allows the use of VT for routine repairs, (see NBIC Part 3, 4.4.1 e)). Section S2.10 does refer you to this paragraph, however says VT " as necessary to ensure satisfactory welded repairs have been accomplished. This item seeks to remove "VT" form the S2.11a). A motion was made to approve this for MC consideration. The motion was unanimously approved.

Item Number: 18-51NBIC Location: Part 3, Section 3Attachment Pages 140-141General Description: Adding controls in accordance with NBIC Part 3, 2.5.2 and 4.4.1e) to Part 3,<br/>Supp 6 when alternatives to PWHT and NDE are used

**Subgroup:** SG Repairs and Alterations **Task Group:** G. Galanes – PM, Walter Sperko

**July 2018 Meeting Action:** Mr. George Galanes presented the Item to require alternative welding methods referenced in Supplement 6 be done in accordance with 2.5.3 based on recommendations from NB staff. A motion was made to approve the item. The motion was unanimously approved.

Item Number: 18-52	NBIC Location: Part 3, Section 9	Attachment Page 142
<b>General Description:</b> Revis	se the definition of "Jurisdiction" in the NBIC glo	ossary

**Subgroup:** SG Repairs and Alterations **Task Group:** Rick Valdez – PM, Paul Shanks

**July 2018 Meeting Action:** Mr. Rick Valdez presented the revised definition of "Jurisdiction" A motion was made to approve the Item. The motion was unanimously approved.

Item Number: 18-54	NBIC Location: Part 3, Section 2, S2.7.2	Attachment Page 143		
<b>General Description:</b> Code Revision to NBIC Part 3, Supplement 2, paragraph S2.7.2 to delete the lass sentence that permits an "NR" Stamp holder to provide welded replacement parts for Historical Boiler.				

Subgroup: SG Historical Task Group: None assigned

**July 2018 Meeting Action:** Mr. Rob Underwood presented. This Item passed SG Historical with a unanimous vote. After discussion, a motion was made to approve the Item. The motion was unanimously approved.

Item Number: 18-65	em Number: 18-65 NBIC Location: Part 3, Section 3	
General Description: Draft 1	rules for "used" material in repairs and/or alterations.	

**Subgroup:** SG Repairs and Alterations

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

**July 2018 Meeting Action:** Progress Report: As a result of Interpretation Item 18-30, the Repair and Alteration SG decided to open this new Item to draft rules for "used" material utilized in repairs and/or alterations. A Task Group was formed: Jamie Walker – PM, Marty Toth, Pat Becker, Michael Quisenberry, Issac Osborn, Paul Shanks.

Item Number: 18-66NBIC Location: Part 3, Section 5No AttachmentGeneral Description: Move sample forms and the instructions/guides for completing Reports of Repair<br/>from Section 5 to a new Supplement.No Attachment

**Subgroup:** SG Repairs and Alterations **Task Group:** Marty Toth – PM, Ben Schaefer

**July 2018 Meeting Action:** Progress Report: As a result of Action Item 17-179, the Repair and Alteration SG decided to open this new Item to move the Reports of Repair and their instructions to a new Supplement. A Task Group was formed: Marty Toth – PM, Ben Schaefer

Item Number: 18-67NBIC Location: Part 3, Section 2&9No AttachmentGeneral Description: Align definition of "Brazing" with ASME Section IX and address non-metallic<br/>pre-heat requirements.No Attachment

**Subgroup:** SG Repairs and Alterations **Task Group:** Jim Pillow – PM, Paul Edwards, Walter Sperko

**July 2018 Meeting Action:** Progress Report: As a result of Action Item 18-40, the Repair and Alteration SG decided to address the term "Brazing" as defined by the NBIC and non-metallic pre-heat requirements. A Task Group was formed: Jim Pillow – PM, Paul Edwards, Walter Sperko

Item Number: 18-68	NBIC Location: Part 3, Section 2	No Attachment
General Description:	PWHT and Pre-Heat requirements for repairs and alterations	

**Subgroup:** SG Repairs and Alterations **Task Group:** George Galanes – PM, Paul Shanks, Rob Troutt, Philip Gilston

**July 2018 Meeting Action:** Progress Report: As a result of discussion on Interpretation Item 18-31, the Repair and Alteration SC decided to create new Action Item 18-68 to address PWHT and pre-heat requirements for repairs/alterations. A Task Group was formed: George Galanes – PM, Paul Shanks, Rob Troutt, Philip Gilston

### 9. Future Meetings

- January 14<sup>th</sup>-17<sup>th</sup> San Antonio, TX
- July, 2019 Kansas City or Minneapolis

### 10. Adjournment

A motion was made and unanimously approved to adjourn the meeting at 2:00 PM.

Respectfully submitted,

Hellen finence

Terrence Hellman SG Repairs and Alterations Secretary

·		T	· · · · · · · · · · · · · · · · · · ·	
Name	Company	Phone Number	Email	Signature
George Galanes	Diamond Technical Services	(815) 634-2727	ggalanes@diamondtechnicalservices.com	An Dar
James Pillow	Common Arc	(860) 688-2531	jpillow@commonarc.com	& Pillon
Villiam Vallance	National Board	(614) 888-8320	bvallance@nationalboard.org	$\square \square$
Joel Amato	State of Minnesota	(651) 284-5137	joel.amato@state.mn.us	Had Ching
Brian Boseo	Graycor Industrial Constructors	(630) 684-7300	brian_boseo@graycor.com	Th-Ease
Paul Edwards	STONE & COEBSTER	と17- 423-53 ( <del>617) 589-5677</del>	NG <del>DULedwords@cbi.com</del> ED4UAEDSPA @ AS NE. ORG-	Paul D. Edwards
Craig Hopkins Sauc Abor	Seattle Boiler Works	(206) 762-0737	chopkins@seattleboiler.com	Stoff
Wayne Jones	Arise	(251) 895-8826	wayne.jones@ariseinc.com	Maent Jours
Ray Milletti	Babcock & Wilcox	(330) 860-2589	<u>rlmiletti@babcock.com</u>	Tay Malth
Linn Moedinger	Strasburg Railroad	(717) 687-8421 7175754478	linnwm@supernet.com	Lung
Kathy Moore	Joe Moore & Company	(919) 832-1665	kathymoore@joemoorecompany.com	+ A. Mony
Brian Morelock	Eastman Chemical Company	(423) 229-1205	morelock@eastman.com	Prin Wordall
Benjamin Schaefer	AEP	614-2449-3715	bschaefer@aep.com	FM
James Sekely	Consultant	(412) 389-5567	isekely@comcast.net	Ju Dekely .
Rick Sturm	State of Utah	(801) 554-9600	<u>rsturm@utah.gov</u>	
Marty Toth	Botter Supply- -Company-	(615) 504-9064	Moth@beisco.com Briscotraininocrop	com inc.e.f
Rob Troutt	State of Texas	(512) 638-2727	rob.troutt@tdlr.texas.gov	Marca
2001 31020	GE BUR	860 997 2652	philip.gilstor@ge.com	AAD
	GE Bower	-2916	Tobert-b. Maguire & ge.com	Relance
-rank lamtak	LIOYD'S Register	1314 1314	Frank. hamtak@LR.org	frank Hamler
PAT BECKER	BW	330	pabecker@babcock.com	$c \rho$ , $c \rho$ ,

Name	Company	Phone Number	Email	Signature
BOB		618	robert_underwood@	0.1.1
NDERWOOD	HSR	5936231	hsb. com	1/1MClex /
Frank	Johnson	419		
Frank Johnson	Johnson Welding Inspection	386-8450	fjkeckzzeAol.com	Franktohner
AMIE	HATES	773.	JWALKERP)HAYES	
WALKER	MECHANICA	292.2707	<u> </u>	Alla
MICHAEL	ALLEN'S	804		I INAN 2 V
QUISENIZER		316-7174	michallallentriven	MULACE
Poru (	ONECTS	872	Paul Shouts Contis - Co	mar (
Shanks		3164249		
RALPH	HSP	630	ralph_rockwood@	10010
ROLKWOOD	HSB	955-5620	HSB. COM	bralphilkickanood
Michael	National	614-431-324.		
Pischke	Board		mpischke@nationalboard.org	mahallath
RICK		661	. 1	
Valdez	ARB LIC	331-10124	rvaldez e arbinc.con	her laker
10m		2021	$\Lambda \mathcal{O} = \mathcal{O}$	· m un · · · · ·
White	NRGENER	782	thomas white	FILLED MAN F.
TEM	SOUTHERN	17 12	THOMASION	· icomingues
LEBEAU	P. NINU	205 942 5396	tclebeauasouryEEROCO.com	VCC-
	ComPANY HSD	860 1	ROBERT_WIELGOSZINGA	
808. WIEICO	. 100	060 2	RODERT _ WIEGGO ZINOA	
Dave	SZINSKI	722 5064	(D) HSB, COM	PIVIelnozinski
Navtinez	FMGLOBAL	703-262- 6311	david.martinez@fmglobal.com	David marting
Monte	<b>h i</b>	937-620		A-AS IN
1009+	HSB	3676	Monte_bostehsb.com	(WIR) Fresh
Nathan			A a i adal	
Curto,	HSB	-5750	nathan-curto-ohst.com	
801	Na'L BOL			<u>&lt;</u>
italla ro			bibling a vallout	aliter hall
Vallance Rick	Strasburg	דור	biallance@ BOARL. Ong	REAL Jok
Nusser	Rail Road Co.	682-7589	rickerstresburg railroad.com	Kt Dr. in
10 200	hui hogy cut		The Contraction of the second	IST WWW
1				
I				

Last Name	First Name	Interest Category	Role	Exp. Date	More
Galanes	George	Users	Chair	08/30/2018	<u>Details</u>
Pillow	James	General Interest	Vice Chair	07/30/2019	<u>Details</u>
Vallance	William		Secretary	01/30/2099	<u>Details</u>
Amato	Joel	Jurisdictional Authorities	Member	01/30/2021	<u>Details</u>
Boseo	Brian	National Board Certificate Holders	Member	08/30/2018	<u>Details</u>
Edwards	Paul	National Board Certificate Holders	Member	08/30/2018	<u>Details</u>
Hopkins	Craig	National Board Certificate Holders	Member	01/30/2019	<u>Details</u>
Jones	Wayne	Authorized Inspection Agencies	Member	01/30/2021	<u>Details</u>
Miletti	Ray	Manufacturers	Member	07/30/2019	<u>Details</u>
Moedinger	Linn	Users	Member	01/30/2019	<u>Details</u>
Moore	Kathy	National Board Certificate Holders	Member	01/30/2021	<u>Details</u>
Morelock	Brian	Users	Member	03/30/2020	<u>Details</u>
Schaefer	Benjamin	National Board Certificate Holders	Member	01/30/2019	<u>Details</u>
Sekely	James	General Interest	Member	08/30/2018	<u>Details</u>
Sturm	Rick	Jurisdictional Authorities	Member	07/30/2020	<u>Details</u>
Toth	Marty	National Board Certificate Holders	Member	01/30/2019	<u>Details</u>
Troutt	Robby	Jurisdictional Authorities	Member	08/30/2020	<u>Details</u>

#### Subcommittee Repairs/Alterations

### Michael J. Quisenberry

806.316.7174

6117 Yale St., Amarillo, TX 79109

michael@allentri.com

Canyon, TX

College Station, TX

**Education:** 

- West Texas A&M University
- ~ Bachelors of Business Administration in Finance
- ~ Bachelors of Business Administration in Economics Pi Gamma Mu Honor Society (Economics) **Omnicron Delta Epsilon Honor Society (Finance)**

Texas A&M University

~ Masters of Business Administration Organizational Leadership

**Qualifications:** 

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

### **Experience**:

Allen's Tri-State Mechanical, Inc

Deputy Division Manager – Heavy Industrial

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

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

ASME /NBIC Code Welding Quality Control Manager

Managed crew of NBIC and ASME qualified code welders who repair and alter ASME rated pressure vessels. Developed from the ground up and implemented new quality control program with certified manual. Conducted and passed Joint Reviews from both the National Board of Boiler and Pressure Vessel Inspectors (NBIC) and the American Society of Mechanical Engineers (ASME). Currently a sitting committee member of the National Board Code Committee which develops and implements new legislation for construction, repair, and alteration of boilers and pressure vessels. (Youngest person to ever sit on this committee in it's 98 year history)

### Plains Plumbing Co., LLC

### Amarillo, TX

Purchasing Agent / Service Manager Nov. 2012 – February 2016 / May 2003 - 2008 Source and procure materials for construction and service jobs. Maintain relationships with numerous vendors in the manufacturing and building trades industries. Proactively search for best prices and anticipate needs of the company to perform upcoming work. Schedule work to be performed for customers and dispatch service technicians to jobsites. Ensure that projects meet deadlines and expected budgetary constraints.

#### Journeyman Licensed Plumber

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

#### Plumber's Apprentice

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

### Ruby Tequila's Mexican Kitchen

Amarillo, TX

Amarillo, TX

#### Assistant Manager

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

### Leal's Mexican Restaurant

Bar and Assistant Manager

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

### Michael J. Quisenberry

806.316.7174 1703 S Madison St. Amarillo, TX 79102 mosit21@gmail.com

### **<u>References</u>**:

### Howard E. Allen

President/CEO Allen's Tri-State Mechanical, Inc. 404 S. Hayden St. Amarillo, TX 79101 (806) 376-8345 Supervisor – 3 years

### **Gary Guinn**

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

### Dr. Anne Macy

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

#### Libby Leal

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

### Simmie Callahan

Service Manager Plains Plumbing Co. 1301 W. 7<sup>th</sup> St Amarillo, TX 79101 806-679-6450 Supervisor - 4 years

Attachment Page 7 of 145



TMPL # 38082

404 S. Hayden, AMARILLO, TEXAS 79101 Ph. 806.376.8345

**TACL # A26434C** 

February 20, 2018

National Board Code Committee Attn: Mr. George Galanes P.E. 4 Territorial Ct. Bollingbrook, IL 60440

Mr. Galanes,

This letter is to confirm my willingness to serve in an appointment to the National Board Inspection Code Committee Sub-Committee and Sub-Group for Repairs & Alterations. I have attended meetings for the last year and a half and have found them not only informative but personally edifying. I would be honored for the opportunity to become even more actively involved in the process of interpreting, refining, and adding to the Boiler and Pressure Vessel Code.

A little information about myself, I have worked in the power steam boiler industry for over 12 years now. I began my career as a plumber/pipefitter's apprentice where I learned to work on a variety of boilers and ancillary steam plant equipment as well as SMAW. While serving my apprenticeship I worked through college and graduated with two Bachelor's degrees one Bachelor's of Business Science – Economics, and another Bachelor's of Business Science – Finance. After graduation I found that I was unable to make a comparable financial living in a degree related fields as I was working in the trades and continued to work in the field until I was promoted to a Service Manager position at my last company. I left my former employer and moved to Allen's Tri-State Mechanical, Inc. where I was tasked with starting a new Quality Control program in order to obtain the NBIC R-Stamp.

Allen's Tri-State Mechanical, Inc. is a mechanical service and repair company located in Amarillo, TX. In business since 1946, Allen's has always taken pride in fielding the most knowledgeable and qualified craftsmen in their area. Allen's takes great pride in the longevity of their staff and employees and greatly attributes this to their dedication to train and provide opportunities to their employees for personal and professional growth.

This letter affirms Allen's Tri-State Mechanical, Inc's commitment to endorse and sponsor Michael Quisenberry's continued service on the National Board Inspection Code Committee.

President/CF

Howard E. Allen

Michael Quisenberry

Date

2/20/2018

Work Contact Information:

Charlotte, NC, 28262

(704) 595-2886

1300 West W. T. Harris Blvd.

John A. Siefert jsiefert@epri.com

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

### OBJECTIVE

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

### EDUCATION

The Ohio State University, Columbus, OH Bachelor of Science in Welding Engineering

**Loughborough University**, Leicestershire, United Kingdom Doctor of Philosophy through the Department of Materials *First year report approved July 2016 Second year report approved 2017*  Graduation Date: March 16, 2008 GPA upon Graduation: 3.24

Graduation Date: March 2019

### EXPERIENCE

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

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

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

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

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

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

### **Construction and Repair Code Activities**

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

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

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

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

### Awards and Recognition

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

Performance Recognition Award - 2011

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

<u>Performance Recognition Award</u> – 2012 For "Successful creation of the EPRI CSEF Welding App"

### Performance Recognition Award - 2013

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

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

### Performance Recognition Award - 2014

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

ASTM International Committee on Publications 2013 Award for Outstanding Article in the Journal of Testing and Evaluation – 2014

"For your outstanding manuscript JTE20120290, Optimization of Vickers Hardness Parameters for Micro- and Macro-Indentation of Grade 91 Steel"

EPRI Chauncey Award - 2016

"Development and Industry Implementation of Innovative Repairs for Advanced 9Cr Steels"

EPRI Chauncey Award - 2017

"Powder Metallurgy-Hot Isostatic Pressing Manufacturing Technology"

### SUMMARY OF PUBLICATIONS

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

### TRADE JOURNAL ARTICLES

- 1. J. P. Shingledecker, D. Purdy, J. A. Siefert, J. Tedesco and A. Szafarczyk. "Advantages of 3D Laser Scanning Confocal Microscopy." Advanced Materials and Processes 174 (10), 2016. pp. 22 to 25.
- 2. J. A. Siefert and J. D. Parker. "Improved Weld Repair Options for Grade 91 Steel." *Energy Tech Magazine*, September 2015.
- J. A. Siefert, D. W. Gandy, D. Purdy, J. P. Shingledecker, R. Smith, T. Lolla, S. S. Babu, L. Lherbier, and D. Novotnak. "Development of Hardfacing Alloys for Power Generation Applications." *Advanced Materials & Processes 172* (1), 2014. pp. 21-24.
- 4. J. A. Siefert and J. P. Shingledecker. "New Web-based App for Welding CSEF Steel." *Energy Tech Magazine*, 2013.
- 5. J. D. Parker, K. Coleman, J. A. Siefert and J. P. Shingledecker. "Challenges with NDE and Weld Repair of Creep-Strength Enhanced Ferritic Steels." *Advanced Materials & Processes 170* (10), 2012. pp. 20-23.
- D. W. Gandy, J. P. Shingledecker and J. A. Siefert. "Overcoming Barriers for Using PM/HIP Technology to Manufacture Large Power Generation Components." *Advanced Materials & Processes 170* (1), 2012. pp. 19-23.
- 7. W. F. Newell, J. P. Shingledecker, J. A. Siefert., and J. M. Tanzosh. "EPRI P87: A Promising New Filler Metal for Dissimilar Metal Welding." *Welding Journal 90* (3), 2011. pp. 30-37.

### **REFEREED CONFERENCE PUBLICATIONS**

- 1. Y. Takahashi, H. Shigeyama, J. A. Siefert and J. D. Parker. "Creep Deformation Analyses for Grade 91 Steels Considering Heat-to-Heat Variation." *Proceedings of the ASME 2018 Pressure Vessels and Piping Conference*, July 2018. PVP2018-85058.
- Y. Takahashi, H. Shigeyama, J. A. Siefert and J. D. Parker. "Effect of Simulated Heat Affected Zone Thermal Cycle on the Creep Deformation and Damage Response of Grade 91 Steel including Heat-to-Heat Variation." Proceedings of the ASME 2018 Pressure Vessels and Piping Conference, July 2018. PVP2018-85012.
- J. A. Siefert, J. D. Parker, R. C. Thomson. "Effect of PWHT on the Fracture Toughness and Burst Test Response of Grade 91 Tube Weldments." *Proceedings of the ASME 2018 Elevated Temperature Application and Materials Conference*, April 2018. ETAM2018-6714.
- 4. J. A. Siefert, J. D. Parker, R. C. Thomson. "Microstructure Features Contributing to Heat Affected Zone Damage in Grade 91 Steel Feature Type Cross-weld Tests." *Proceedings of the ASME 2018 Elevated Temperature Application and Materials Conference*, April 2018. ETAM2018-6709.
- J. A. Siefert, J. D. Parker, R. C. Thomson. "Factors Contributing to Heat Affected Zone Damage in Grade 91 Steel Feature Type Cross-weld Tests." *Proceedings to the 4<sup>th</sup> International ECCC Conference on Creep and Fracture*, September 2017.
- J. A. Siefert and J. D. Parker. "Best Practice Guidelines for Dissimilar Metal Welds between Grade 91 Steel and Austenitic Stainless Steel." *Proceedings to the 4<sup>th</sup> International ECCC Conference on Creep and Fracture*, September 2017.
- J. D. Parker and J. A. Siefert. "The Effect of Metallurgical Factors and Stress State on the Performance of High Energy Components Manufactured from Creep Strength Enhanced Steels." *Proceedings to the 4<sup>th</sup> International* ECCC Conference on Creep and Fracture, September 2017.
- 8. J. A. Siefert, J. D. Parker and R. C. Thomson. "Linking Performance of Parent Grade 91 Steel to the Cross-weld Creep Performance using Feature Type Tests." *Proceedings from the Eighth International Conference on Advances in Materials Technology for Fossil Power Plants*, ASM International, 2016. pp. 531 to 544.
- J. A. Siefert, J. D. Parker and T. Totemeier. "Complexities of In-service Failures in Dissimilar Metal Welds between Grade 91 and Austenitic Stainless Steels." *Proceedings of the 16<sup>th</sup> Pressure Vessels and Piping Conference*, July 17-20, Vancouver, BC, Canada. Paper PVP2016-63982.
- J. A. Siefert, C. Libby and J. P. Shingledecker. "Concentrating Solar Power (CSP) Power Cycle Improvements through Application of Advanced Materials." SOLARPACES 2015: International Conference on Concentrating Solar Power and Chemical Energy Systems 1734 (1).

- J. A. Siefert and J. D. Parker. "Well-Engineered Weld Repair of Grade 91 Steel." Proceedings to the 11<sup>th</sup> EPRI International Conference on Welding and Repair Technology for Power Plants. Naples, FL. June 25-27, 2014. EPRI, Palo Alto CA: 2014. Paper F5.
- S. J. Pawel and J. A. Siefert. "Stress Corrosion Cracking of Ferritic Materials for Fossil Power Generation Applications." Proceedings to the 11<sup>th</sup> EPRI International Conference on Welding and Repair Technology for Power Plants. Naples, FL. June 25-27, 2014. EPRI, Palo Alto CA: 2014. Paper F11.
- J. Galler, J. N. DuPont and J. A. Siefert. "Residual Stress Accumulation in High-Temperature Alloys Used for Energy Applications." *Proceedings to the 11<sup>th</sup> EPRI International Conference on Welding and Repair Technology* for Power Plants. Naples, FL. June 25-27, 2014. EPRI, Palo Alto CA: 2014. Paper F14.
- D. Purdy, J. P. Shingledecker and J. A. Siefert. "Experiences in Valve Hardfacing Disbonding." Proceedings to the 11<sup>th</sup> EPRI International Conference on Welding and Repair Technology for Power Plants. Naples, FL. June 25-27, 2014. EPRI, Palo Alto CA: 2014. Paper G8.
- D. W. Gandy, J. A. Siefert, R. Smith, T. Lolla, S. S. Babu, D. Novotnak and L. Lherbier. "Development and Application of and Advanced Co-free Hardfacing Alloy for Nuclear Applications." *Proceedings to the 11<sup>th</sup> EPRI International Conference on Welding and Repair Technology for Power Plants.* Naples, FL. June 25-27, 2014. EPRI, Palo Alto CA: 2014. Paper N20.
- D. W. Gandy, J. A. Siefert, L. Lherbier and D. Novotnak. "PM-HIP Research, Applications and Technology Gaps for the Electric Power Industry." *Proceedings of the 11<sup>th</sup> International Conference of Hot Isostatic Pressing*. June 9-13, 2014. Stockholm, Sweden.
- 17. J. A. Siefert and J. R. Foulds. "Cracking in Grade 23 Weldments at Elevated Temperatures." *Proceedings of the ASME Symposium on Elevated Temperature Application of Materials for Fossil, Nuclear and Petrochemical Industries.* March 25-27, 2014, Seattle, WA.
- J. A. Siefert and J. N. DuPont. "Material Behavior of T23 and T24." Proceedings from the Seventh International Conference on Advances in Materials Technology for Fossil Power Plants, ASM International, 2014. pp. 513 to 524.
- J. A. Siefert and J. R. Foulds. "Creep Crack Growth in T23." Proceedings from the Seventh International Conference on Advances in Materials Technology for Fossil Power Plants, ASM International, 2014. pp. 1372-1387.
- 20. J. A. Siefert and J. D. Parker. "Weld Repair of Grade 91 Steel." Metal 2013, Brno, Czech Republic, May, 2013.
- 21. J. P. Shingledecker, H. Hendrix, J. Phillips, J. A. Siefert, R. Purgert and P. Rawls. "U.S. Program on Advanced Ultrasupercritical Power Plant Materials – The Economy of Using Advanced Alloys." *Proceedings to the IEA Clean Coal Centre Workshop: Advanced ultrasupercritical coal-fired power plants.* Vienna, Austria, 19-20 Sept. 2012.
- 22. J. A. Siefert and J. P. Shingledecker. "Repair without PWHT of T91 Use of EPRI P87 and Temperbead Welding Approach." *Proceedings to IIW Conference.* July 11-13, 2012. Denver, CO, USA.
- J. A. Siefert and J. P. Shingledecker. "Repair without PWHT of T91 Use of EPRI P87 and Temperbead Welding Approach." *Proceedings to the EPRI International Conference on Welding and Repair Technology for Power Plants.* Marco Island, FL. June 27-29, 2012. EPRI, Palo Alto CA: 2012. Paper F13.
- S. R. Paterson, J. A. Siefert and J. P. Shingledecker. "Steam Turbine Casing and Valve Body Repair Guide." Proceedings to the EPRI International Conference on Welding and Repair Technology for Power Plants. Marco Island, FL. June 27-29, 2012. EPRI, Palo Alto CA: 2012. Paper G9.
- 25. J. A. Siefert and J. P. Shingledecker. "Temperbead Repair of T91 Using EPRI P87 Filler Metal." Proceedings of the 9<sup>th</sup> International Conference on Trends in Welding Research. Ed. T. DeRoy, S. A. David, T. Kosecki, and H. Basdeshia. ASM International, 2012. pp. 235-241.
- W. F. Newell, J. P. Shingledecker., J. A. Siefert, K. Coleman, and J. M. Tanzosh. "High-Temperature Performance of a New Nickel-Based Filler Metal for Power Generation Applications." *Proceedings: 9<sup>th</sup> Liege Conference: Materials for Advanced Power Engineering 2010. Ed. J. Lecomte-Beckers, Q. Contrepois, T. Beck, and B. Kuhn.* September 27-29, 2010. pp. 340-348.
- J. P. Shingledecker, J. A. Siefert, and J. M. Tanzosh. "Weldability of EPRI P87." Proceedings from the Sixth International Conference on Advances in Materials Technology for Fossil Power Plants, ASM International, 2011. pp. 995 to 1013.

- J. E. Ramirez, J. A. Siefert, and J. M. Tanzosh. "Weldability of INCONEL Alloy 740." Proceedings from the Sixth International Conference on Advances in Materials Technology for Fossil Power Plants, ASM International, 2011. pp. 1045 to 1066.
- B. T. Alexandrov, J. C. Lippold, J. M. Sanders, J. A. Siefert, and J. M. Tanzosh. "An Update of Phase Transformations during PWHT of Grade 91." *Materials Science and Technology 2009 Conference and Exhibition*, Pittsburgh, PA, October, 2009.
- 30. W. F. Newell, J. M. Sanders, J. P. Shingledecker, J. A. Siefert, and J. M. Tanzosh. "Development of EPRI P87 Solid Wire." *International Conference WELDS 2009*, Fort Myers, FL, June, 2009.
- B. T. Alexandrov, J. C. Lippold, J. M. Sanders, J. A. Siefert, and J. M. Tanzosh. "An Update of Phase Transformations during PWHT of Grade 91." EPRI Welding and Fabrication Technology for New Power Plants, 1<sup>st</sup> International Conference, Fort Myers, FL, June, 2009.
- J. A. Siefert, W. F. Newell, J. M. Sanders, J. P. Shingledecker, and J. M. Tanzosh. "Development of EPRI P87 Solid Wire." *EPRI Welding and Fabrication Technology for New Power Plants, 1<sup>st</sup> International Conference*, Fort Myers, FL, June, 2009.
- B. A. Baker, R. D. Gollihue, J. M. Sanders and J. A. Siefert. "Elimination of Fissures in Thick Section INCONEL Alloy 740 Welds." 34<sup>th</sup> International Technical Conference on Clean Coal and Fuel Systems, Clearwater, FL, June, 2009.
- 34. J. A. Siefert, B. T. Alexandrov, J. C. Lippold, J. M. Sanders, and J. M. Tanzosh. "An Examination of Phase Transformations during PWHT of Grade 91." *Proceedings of the IIW International Conference: Safety and Reliability of Welded Components in Energy and Processing Industry*, Graz University of Technology, 2008. pp. 75 to 80.
- 35. J. A. Siefert, B. T. Alexandrov, J. C. Lippold, J. M. Sanders, and J. M. Tanzosh. "An Examination of Phase Transformations during PWHT of Grade 91." Welding and Repair Technology for Power Plants, 8<sup>th</sup> International Conference EPRI Conference, Fort Myers, FL, June 2008.

### JOURNAL PUBLICATIONS

- 1. J. D. Parker and J. A. Siefert. "The Creep and Fracture Behaviour of Tempered Martensitic Steels." *Materials at High Temperatures*, published online October 19, 2017.
- X. X., G. West, J. A. Siefert, J. D. Parker and R. Thomson. "Microstructural Characterisation of the Heat Affected Zones in Grade 92 Steel Welds: Double Pass and Multi-Pass Welds." *Metallurgical and Materials Transactions A*, manuscript E-TP-16-1684-A submitted March 21, 2017.
- X. X., G. West, J. A. Siefert, J. D. Parker and R. Thomson. "The Influence of Thermal Cycles on the Microstructure of Grade 92 Steel." *Metallurgical and Materials Transactions A* 48A (11), 2017. pp. 5396 to 5414.
- P. Mayr, C. Schlacher, J. A. Siefert and J. D. Parker. "Microstructural Features, Mechanical Properties and High Temperature Failures of Ferritic to Ferritic Dissimilar Welds." *International Materials Review*, accepted for publication, manuscript YIMR 1410943.
- J. N. DuPont, J. A. Siefert and J. P. Shingledecker. "A Review of Microstructural Evolution and Mechanical Properties of Grades 23 and 24 Creep Strength Enhanced Ferritic Steels." *International Materials Review 62* (1), 2016. pp. 32 to 56.
- D. H. Bechetti, J. N. DuPont, J. A. Siefert and J. P. Shingledecker. "Microstructural Evolution and Creep-Rupture Behavior of A-USC Alloy Fusion Welds." *Metallurgical and Materials Transactions A* 47 (9), 2016. pp. 4502 to 4518.
- J. A. Siefert, J. P. Shingledecker, J. N. DuPont and S. A. David. "Weldability and Weld Performance of Candidate Nickel Base Superalloys for Advanced Ultrasupercritical Fossil Power Plants Part II: Weldability and Cross-weld Creep Performance." Science and Technology of Welding and Joining 21 (5), 2016. pp. 397 to 427.
- 8. J. D. Parker and **J. A. Siefert**. "Evaluation of the Creep Cavitation Behavior in Grade 91 Steels." *International Journal of Pressure Vessels and Piping* 138 (2), 2016. pp. 31 to 44.
- 9. J. D. Parker and **J. A. Siefert.** "Weld Repair of Grade 91 Piping and Components in Power Generation Applications, Creep Performance of Repair Welds." *Materials at High Temperatures* 33 (1), 2016. pp. 58 to 67.

- J. P. Galler, J. N. DuPont and J. A. Siefert. "Influence of Alloy Type, Peak Temperature and Constraint on Residual Stress Evolution in Satoh Test." *Science and Technology of Welding and Joining* 21 (2), 2016. pp. 106 to 113.
- S. A. David, J. A. Siefert, J. N. DuPont and J. P. Shingledecker. "Weldability and Weld Performance of Candidate Nickel Base Superalloys for Advanced Ultrasupercritical Fossil Power Plants Part I: Fundamentals." Science and Technology of Welding and Joining 20 (7), 2015. pp. 532 to 552.
- 12. J. A. Siefert, B. M. Leister and J. N. DuPont. "Considerations in the Development of CCT Diagrams for Complex Ferritic Materials." *Materials Science and Technology*, 31 (6), 2015. pp. 651 to 660.
- 13. J. A. Siefert and S. S. Babu. "Experimental Observations of Wear in Specimens Tested to ASTM G98." *Wear 320* (1-2), 2014. pp. 111 to 119.
- T. Lolla, J. A. Siefert, S. S. Babu and D. Gandy. "Delamination Failures of Stellite Hardfacing in Power Plants: A Microstructural Characterisation Study." Science and Technology of Welding and Joining 19 (6), 2014. pp. 476 to 486.
- J. A. Siefert and S. A. David. "Weldability and Weld Performance of Candidate Austenitic Alloys for Advanced Ultrasupercritical Fossil Power Plants." *Science and Technology of Welding and Joining 19* (4), 2014. pp. 271 to 294.
- 16. J. A. Siefert, K. Coleman, and J. D. Parker. "Assessment of the Tempering Behavior of Grade 91 steel." *Materials Performance and Characterization 2* (1), 2013.
- S. A. David, J. A. Siefert, and Z. Feng. "Welding and Weldability of Candidate Ferritic Alloys for Future Advanced Ultrasupercritical Fossil Power Plants." Science and Technology of Welding and Joining 18 (8), 2013. pp. 631 to 651.
- 18. J. A. Siefert and J. D. Parker. "Evaluation of Options for Weld Repair of Grade 91 Piping and Components: Metallographic Characterization." *Science and Technology of Welding and Joining* 18 (6), 2013. pp. 507 to 517.
- 19. J. A. Siefert, J. P. Shingledecker and J. D. Parker. "Optimization of Vickers Hardness Parameters for Micro and Macro Indentation of Grade 91 Steel." *Journal of Testing and Evaluation 41* (5), 2013. pp. 778 to 787.
- 20. J. A. Siefert, J. M. Sanders, J. M. Tanzosh, W. F. Newell, J. P. Shingledecker. "Development of EPRI P87 solid wire." *Materials at High Temperature* 27 (3), 2010. pp. 243 to 252.

### EPRI REPORTS [Primary Author or Significant Contributions]

- 1. Repair Methods for Dissimilar Metal Welds—Development, Weldability, and Properties of EPRI P87 Solid Wire Filler Metal. EPRI, Palo Alto, CA: 2011. 1019786.
- Literature Review of Temperbead Welding Techniques and Considerations for Grade 91 Components. EPRI, Palo Alto, CA: 2012.1026505.
- 3. Program on Technology Innovation: Manufacture of Large Nuclear and Fossil Components Using Powder Metallurgy and Hot Isostatic Processing Technologies. EPRI, Palo Alto, CA: 2012. 1025491.
- 4. Creep Strength–Enhanced Ferritic (CSEF) Steel Welding Guide. EPRI, Palo Alto, CA: 2013. 1026584.
- 5. Program on Technology Innovation: Galling and Sliding Wear Test Results for Candidate Hardfacing Alloys Manufactured by PM/HIP. EPRI, Palo Alto, CA: 2013. 3002001737.
- 6. Assessment of the Flux-Cored Arc Welding (FCAW) Process for Productivity and Proper Utilization. EPRI, Palo Alto, CA: 2013. 3002001471.
- 7. State of Knowledge for Advanced Bainitic Creep-Strength-Enhanced Ferritic Steel Grades 23 and 24. EPRI, Palo Alto, CA: 2013. 3002002303
- 8. Steam Turbine Casing and Valve Body Repair Guidelines. EPRI, Palo Alto, CA: 2013. 3002001473.
- 9. Well-Engineered Weld Repairs of Grade 91 Steel: Results for 2.25Cr Type Filler Materials. EPRI, Palo Alto, CA: 2014. 3002003834.
- 10. Well-Engineered Weld Repairs of Grade 91 Steel: Results for 9Cr Type Filler Materials. EPRI, Palo Alto, CA: 2014. 3002003835.

- 11. Well-Engineered Weld Repairs of Grade 91 Steel: Results for Nickel-Base Type Filler Materials. EPRI, Palo Alto, CA: 2014. 3002003837.
- 12. Well-Engineered Weld Repair of Grade 91 Steel: Results for Through-thickness Repair Welds. EPRI, Palo Alto, CA: 2014. 3002004476.
- 13. The Benefits of Improved Control of Composition of Creep-Strength-Enhanced Ferritic Steel Grade 91. EPRI, Palo Alto, CA: 2014. 3002003472.
- 14. The Influence of Steel Making and Processing Variables on the Microstructure and Properties of Creep-Strength-Enhanced Ferritic (CSEF) Steel Grade 91. EPRI, Palo Alto, CA: 2014. 3002004370.
- 15. Well-Engineered Weld Repair of Grade 91 Steel Using the Flux Cored Arc Welding (FCAW) Process. EPRI, Palo Alto, CA: 2014. 3002004419.
- 16. Well-Engineered Weld Repair of Grade 91 Steel Results of T91 Weld Repair Using EPRI P87 Filler Metal. EPRI, Palo Alto, CA: 2014. 3002003363.
- Program on Technology Innovation: Galling and Sliding Wear Test Results for Candidate Hardfacing Alloys Manufactured by Powder Metallurgy and Hot Isostatic Processing: Phase 2 Test Results. EPRI, Palo Alto, CA: 2014. 3002003923.
- 18. Cracking in Thick-section Dissimilar Metal Welds Case Studies. EPRI, Palo Alto, CA: 2014. 3002004189.
- 19. Best Practice Guideline for Well-Engineered Weld Repair of Grade 91 Steel. EPRI, Palo Alto, CA: 2014. 3002003833.
- 20. Alternative Well-Engineered Weld Repair Options for Grade 91 Steel: An Executive Summary of Results from 2010 to 2014. EPRI. Palo Alto, CA: May 2015. 3002006403.
- 21. A Well-Engineered Approach for Establishing the Minimum Allowable Post Weld Heat Treatment for Power Generation Applications of Grade 91 Steel. EPRI, Palo Alto, CA: 2015. 3002005350.
- A Perspective on the Selection of Preheat, Interpass and Post-weld Cool Temperatures Using Grade 91 Steel as an Example. EPRI, Palo Alto, CA: 2015. 3002005351.
- 23. Guidelines and Specifications for High-Reliability Fossil Power Plants, 2<sup>nd</sup> Edition: Best Practice Guideline for Manufacturing and Construction of Grade 91 Steel Components. EPRI, Palo Alto, CA: 2015. 3002006390.
- 24. Analysis of the Performance of 9Cr-1Mo (E8015-B8) Filler Metal. EPRI, Palo Alto, CA: 2015. 3002004478.
- 25. Supporting Data for Reducing the Minimum Allowable Post Weld Heat Treatment for Power Generation Applications of Grade 91 Steel. EPRI, Palo Alto, CA: 2015. 3002006757.
- 26. Well-Engineered Weld Repair of Grade 91 Steel: Results for Minor Repair Welds, Part I: Excavation on One Side of the Original Weld. EPRI, Palo Alto, CA: 2016. 3002004477.
- 27. Well-Engineered Weld Repair of Grade 91 Steel: Results for Partial Repair Welds, Part II: Excavation of the Original Weld to 25% or 50% Thickness. EPRI, Palo Alto, CA: 2016. 3002004483.
- 28. Well-Engineered Weld Repair of Grade 91 Steel: Performance of Repair Welds Manufactured in an Ex-service Grade 91 Steel Header. EPRI, Palo Alto, CA: 2016. 3002004479.
- 29. Well-Engineered Weld Repair of Grade 91 Steel: Welding Procedure Qualification to ASME B&PV Code Section IX and Supporting Data for Alternative Weld Repair Procedures. EPRI, Palo Alto, CA: 2016. 3002004482.
- 30. Well-Engineered Weld Repair of Grade 91 Steel: Welding Procedure Qualification to ASME Boiler and Pressure Vessel Code Section IX, Part II. EPRI, Palo Alto, CA: 2016. 3002007233.
- 31. Well-Engineered Weld Repair of Grade 91 Steel: Analysis of the Effect of Welding Geometry on Creep Performance and a Summary of Lessons Learned. EPRI, Palo Alto, CA: 2016. 3002004484.
- 32. Factors Affecting Performance of Dissimilar Metal Welds: Creep Performance of Screening Dissimilar Metal Welds Between Grade 91 Steel and Stainless Steel 347H. EPRI, Palo Alto, CA: 2016. 3002007216.
- 33. Factors Affecting Performance of Dissimilar Metal Welds: Residual Stress Analysis of Welds Between Grade 91 Steel and Stainless Steel 347H. EPRI, Palo Alto, CA: 2016. 3002007217.

- Factors Affecting Performance of Dissimilar Metal Welds: Fabrication and Metallurgical Assessment of Screening Dissimilar Metal Welds Between Grade 91 Steel and Stainless Steel 347H. EPRI, Palo Alto, CA: 2016. 3002007218. EPRI, Palo Alto, CA: 2016. 3002007218.
- 35. An Informed Perspective on the use of Hardness Testing in an Integrated Approach to the Life Management of Grade 91 Steel Components. EPRI, Palo Alto, CA: 2016. 3002007320.
- 36. Alternative Well-Engineered Weld Repair Options for Grade 91 Steel Girth Welds in Piping Systems and Thick-Walled Components. EPRI, Palo Alto, CA: 2016. 3002007322.
- Alternative Well-Engineered Weld Repair Options for Grade 91 Steel Fabricated Fittings and Laterals in Thickwalled Piping Systems. EPRI, Palo Alto, CA: 2016. 3002007323.
- 38. 30-Plus Years of Long-seam Weld Failures in the Power Generation Industry Perspective and Continuing Challenges with Life Management. EPRI, Palo Alto, CA: 2017. 3002011587.
- 39. Life Management of 9%Cr Steels Evaluation of Metallurgical Risk Factors in Grade 91 Steel Parent Metal. EPRI, Palo Alto, CA: 2017. 3002009678.
- 40. Creep Performance of Screening Dissimilar Metal Welds between Grade 91 Steel and Stainless Steel 347H: 2017 Update. EPRI, Palo Alto, CA: 2017. 3002007219
- 41. Guidelines and Specifications for High-Reliability Fossil Power Plants: Best Practice Guideline for Manufacturing and Construction of Grade 91 to Austenitic Stainless Steel Dissimilar Metal Welds. EPRI, Palo Alto, CA: 2017. 3002007221.
- 42. Life Management of 9%Cr Steels Guidelines for the Assessment of Composition using Scoop or Bulk Samples. EPRI, Palo Alto, CA: 2017. 3002009682.
- 43. Alternative Well-Engineered Weld Repair Options for Grade 91 Steel Small Bore Welds. EPRI, Palo Alto, CA: 2017. 3002009688.
- 44. Alternative Well-Engineered Weld Repair Options for Grade 91 Steel Tube to Tube, Tube Attachment and Tube Pad Repairs. EPRI, Palo Alto, CA: 2017. 3002009689.

### EPRI REPORTS [Contributing Author or Managed]

- 1. Cold Weld Repair of Ferritic Components Case Studies of UK Power Stations. EPRI, Palo Alto, CA: 2015. 3002006758.
- 2. Evaluation of the Resistance of Creep Strength Enhanced Ferritic Steels (CSEF) to Stress Corrosion Cracking (SCC) in Various Environments. EPRI, Palo Alto, CA: 2013. 3002001470.
- 3. Evaluation of an Ex-service Ferritic to Ferritic Dissimilar Metal Weld between Grade 22 and Grade 91. EPRI, Palo Alto, CA: 2015. 3002006227.
- 4. Cracking in Thick-section Dissimilar Metal Welds Case Studies. EPRI, Palo Alto, CA: 2015. 3002006759.
- 5. Evaluation of the Resistance of Creep Strength Enhanced Ferritic Steels to Stress Corrosion Cracking in Various Environments: Follow-On Studies Using the Jones Test. EPRI, Palo Alto, CA: 2015. 3002006755.
- 6. Program on Technology Innovation: Mechanical Analysis of Dissimilar Metal Welds, Part I: Insight into Potential Failure Modes. EPRI, Palo Alto, CA: 2016. 3002007215.
- Factors Affecting Performance of Dissimilar Metal Welds: Microstructural Characterization and Modeling of In-Service Failures Involving Welds Between Grade 91 Steel and Austenitic Stainless Steel. EPRI, Palo Alto, CA: 2016. 3002007222.
- Life Management of 9Cr Steels Basic Approach to Risk Ranking Systems of Components. EPRI, Palo Alto, CA: 2016. 3002009231.
- Life Management of 9Cr Steels Development of a Creep Continuum Damage Mechanics Constitutive Model for Creep Strength Enhanced Ferritic Steels. EPRI, Palo Alto, CA: 2016. 3002009232.
- 10. Service Experience of Fabricated Wyes, Laterals, Branches and Seam Welded Components Manufactured from Grade 91 Steel. EPRI, Palo Alto, CA: 2016. 3002007882.

- 11. Life Management of 9%Cr Steels Assessment of Grade 91 Steel Parent Metal and Simulated Heat Affected Zone Behavior in Creep. EPRI, Palo Alto, CA: 2017. 3002009679.
- 12. Grade 23 Handbook. EPRI, Palo Alto, CA: 2017. 3002009201.
- 13. Life Management of 9%Cr Steels Assessment of Damage in Ex-service Grade 91 Steel Stub to Header Welds. EPRI, Palo Alto, CA: 2017. 3002009234.
- 14. Life Management of 9%Cr Steels Damage Tolerance Assessment of Header End Cap Geometries. EPRI, Palo Alto, CA: 2017. 3002011049.
- 15. Life Management of 9%Cr Steels Damage Tolerance Assessment of Novel Step Weld Geometry for Girth Welds in Thick-section Components. EPRI, Palo Alto, CA: 2017. 3002011053.

### EPRI SUCCESS STORIES [Managed]

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



March 23, 2018

The National Board of Boiler & Pressure Vessel Inspectors 1055 Crupper Avenue Columbus, OH, 43229-1183

Subject: Support & Sponsorship for Participation of John Siefert on the NBIC Subgroup and Subcommittee Repairs and Alterations

Dear Jonathan Ellis:

John Siefert has attended the National Board Inspection Code regularly since 2012. He has the full support of the Electric Power Research Institute to continue this participation as a member on the Subgroup and Subcommittee and Repairs and Alterations. If you need any additional information EPRI will be happy to provide. Please find John's attached resume to this letter.

Sincerely,

Neva Espinoza Director, Generation, EPRI

1 Attachement; John A. Siefert resume cc. Brian Boseo and George Galanes

#### Together . . . Shaping the Future of Electricity

CHARLOTTE OFFICE

1300 West W.T. Harris Boulevard, Charlotte, NC 28262-8550 USA • 704.595.2000 • Fax 704.595.2860 Customer Service 800.313.3774 • www.epri.com

### Action Item 18-30: Inquiry (Original)

### Inquirer: Veera Kommisetti veera\_kommisetti@oxy.com

**Question:** Does the NBIC prohibit interchanging the convection section of one OSTG with another OSTG?

**Background information:** Occidental of Oman has installed about 85 Nos OTSG (Once through steam generator) in one of oil concession. All OTSG are of similar configuration and they comprise of two main parts i.e. Radiant section and Convection section. Now, OTSGs have aged and Occidental intends to replace a few tubes of the convection section, which require dismantling of the convection section and shipping to repair shop ("R" stamp holder) for repair. We have shipped two convection sections of OTSG 100 and OTSG 200 to a fabrication shop and after repair we intend to use convection sections of OTSG 100 on OTSG 200 due to operational constraints.

### **Proposed Inquiry:**

### Question:

Does the NBIC allow for replacement parts of like construction originally installed in an inservice PRI to be used in a PRI having like materials of similar construction?

### Reply:

Yes, provided the replacement parts are installed in accordance with the requirements of the NBIC, and if applicable, with concurrence from the Jurisdiction and the Authorized Inspection Agency.

### Justification:

Ref. Interpretation 07-06, 01-28, 95-15

### **PROPOSED INTERPRETATION**

Inquiry No.	18-31							
Source	Roderick Kaiser <u>rjk834@cox.net</u>							
Subject	PART 3, Paragraph 2.5.2, POSTWELD HEAT TREATMENT							
Edition	2017							
Question	<ul> <li>Question 1: A full penetration groove weld repair was made on a 1" schedule 160 (0.250") flanged nozzle pipe section. When the vessel was originally fabricated it received PWHT per ASME BPVC. SECT. 1 PW-39-1 for P-No. 1 Group No. 1, 2, 3. Due to the nozzle thickness of 0.250" it was exempt from PWHT, but it went through the PWHT cycle with the vessel. Would the new full penetration groove pipe nozzle neck repair weld require PWHT?</li> <li>Question 2: Would the repair to the nozzle pipe require the Preheat requirements of Method 1?</li> </ul>							
	Question 3: Would	I the repair to the	nozzle pipe be ex	kempted from PV	WHT?			
Reply	None							
Committee's Question	In the original construction of a Section I Boiler, a full penetration groove weld, exempt from PostWeld Heat Treatment (PWHT) by the original Code of construction, was subjected to PWHT meeting the requirements of ASME BPV Section I, PW-39. May the repair of this weld be performed in accordance with the NBIC, Part 3 without PWHT or acceptable alternative to PWHT?							
Committee's Reply	Yes, as long as the WPS is qualified without PWHT. Note: For Pressure Vessels, see Interpretation 95-14.							
Rationale	performed, be rep having the MDR a PWHT, received	oorted on the M and/or Namepla a PWHT cycle"l exempt from P	DR. For Section the would not ne R" Certificate Ho WHT by PW-39	n I repairs, a "R cessarily know, older"R" Certific	me and temperature, if "Certificate Holder only , if a weld exempt from ate Holder anyway. As a Certificate Holder is not			
SC Vote		No. Affirmative	No. Negative	No. Abstain	No. Not Voting			
NBIC Vote		No. Affirmative	No. Negative	No. Abstain	No. Not Voting			
Negative Vote Comments								

### **BACKGROUND INFORMATION ONLY**

### **INTERPRETATION 95-14**

Subject: R-202 Alteration

1992 Edition with the 1994 Addendum

Question: May a welded repair to a pressure vessel be performed without postweld heat treatment or acceptable alternative to postweld heat treatment, when the pressure vessel as reported on the data report was postweld heat treated during construction?

Reply: No.

Back to Index

### Action Item 18-32: Inquiry

Inquirer: Melwin Dsouza melwin@uesoman.com

Purpose	Code Interpretation – Interchange of convective box (Economizers) in Once through steam Generators (OTSG).
Background Information	During the repair of Convictive box of Once through steam Generators, to meet the site requirement user would like to use Convictive box of other OTSG.
Inquiry	Is the interchange of Convective Box on the OTSG is allowed if we record the same on the R Form?
NBIC Reply	

## Action Item 18-33: Inquiry Inquirer: Mohammed Sirajudeen <u>sirajudeenin@gmail.com</u>

Subject: 3.4.4 c) Alteration of corroded Pressure Vessel

Edition: 2017 edition

Inquiry

1) The entire vessel corroded its corrosion allowance given data report. However by providing additional external stiffener ring the vessel meets design condition as per original code of construction. Is it considered as an alteration ?

2) if answer "yes" for the question 1 New corrosion allowance other than the one given in original data report can be considered if proposed by owner ?

**Background:** The vessel is governed by external pressure. Thickness survey carried out for complete vessel. Even in corroded condition still the vessel has required thickness plus corrosion allowance for internal pressure. By providing external stiffener ring vessel meets original design condition.

Inquiry No.	18-34				
Source	James Barlow jbarlow@performancepulsation.com				
Subject	Scope of Work				
 Edition	2017				
Question	Part 3. During th for the "R" Certifi for the requested completion of the side, that I am on what we are send with balancing wa customer who ma scope of work.	is work a discusticate Holder. C I repair. That o e requested rep I, feels we have ding back into s anting to ensur	ssion was started one side of the te our scope of work pair meets the re a responsibility ervice is safe. As re the vessel inte	d concerning th eam said we sho k is defined by t equirements of to inspect the s a licensed Eng grity is sound v	epair was performed per e scope of responsibility ould only be responsible the owner/user and NBIC Part 3. The other vessel to ensure that gineer I am struggling with the wants of a not just what was in our
		oility for the int		•	oes the Certificate Holder If the vessel outside the
Reply	No				
Committee's Question		r assume respo	nsibility for the i	ntegrity or con	retaining item, does the dition of the rest of the
Committee's Reply	No	-			
Rationale					
SC Vote		No. Affirmative	No. Negative	No. Abstain	No. Not Voting
NBIC Vote		No. Affirmative	No. Negative	No. Abstain	No. Not Voting
Negative Vote Comments					

#### **PROPOSED INTERPRETATION**

### **Interpretation IN18-35**

#### PROPOSED INTERPRETATION

Inquiry No.	IN18-35, Altering Pre-2017 ASME Section VIII-2 Vessel to 2017 ASME Section VIII Division 2 Code for Class 1 vessels
Source	No background information.
Subject	ASME Section VIII, Division 2, Class 1 Vessels.
Edition	2017
INQUIRY QUESTION 1:	Can a vessel built to an ASME Section VIII Division 2 construction code, prior to 2017, that required a PE for design, be altered to the 2017 ASME Section VIII Division 2 Code for Class 1 vessels?
Inquirer's PROPOSED REPLY 1:	
Committee's Question-1	May a vessel built to an ASME Section VIII Division 2 construction Code between 2007 and 2017 be altered to the 2017 ASME Section VIII Division 2 Code for Class 1 vessels?
Committee's Reply-1	No.
Rationale Q-1	The 2007 Edition of ASME Section VIII, Division 2 incorporated a new design margin of 2.4. A 2017 ASME Section VIII, Division 2, Class 1 vessel would have a design margin of 3.0.
Committee's Question-2	May a vessel built to an ASME Section VIII Division 2 construction Code, prior to 2007, that required a PE for design, be altered to the 2017 ASME Section VIII Division 2 Code for Class 1 vessels, provided the User's Design Specification (UDS) and Manufacturer's Design Report (MDR) are available and the ASME Section VIII, Division 2 vessel that was built prior to 2007 has no fatigue analysis or design-by-analysis to determine materials thicknesses?
Committee's Reply-2	Yes.
Rationale Q-2	Prior to the 2007 Edition of ASME Section VIII, Division 2, the design margin was 3.0 which is identical to the 2017 ASME Section VIII, Division 2, Class 1 design margin. If the original UDS and MDR for the ASME Section VIII, Division 2 vessel that was
	built prior to 2017 shows that a fatigue analysis was performed or design-by-analysis was performed to determine materials thicknesses, the requirement for review by a registered professional engineer would still apply.
SC Vote	
NBIC Vote	
Negative Vote Comments	

Background from 2017 ASME Section VIII, Division 2:

#### **1-B.2 DEFINITION OF TERMS**

**1-B.2.9** Class 1 Vessel – a vessel that is designed using the allowable stresses from Section II, Part D, Subpart 1, Table 2A or Table 2B.

**1-B.2.10** Class 2 Vessel – a vessel that is designed using the allowable stresses from Section II, Part D, Subpart 1, Table 5A or Table 5B.

#### 2.2.2 USER'S DESIGN SPECIFICATION

**2.2.2.1** The User's Design Specification shall include but not necessarily be limited to the following:

**2.2.1.1 Class 1.** The User's Design Specification shall be certified by an individual or individuals meeting the requirements described in Annex 2-A when the user provides the data required by 2.2.2.1(f)(1) and 2.2.2.1(f)(2) to perform a fatigue analysis.

2.2.1.2 Class 2. The User's Design Specification shall be certified in accordance with Annex 2-A.

(f) Design Fatigue Life

(1) Cyclic operating conditions and whether or not a fatigue analysis of the vessel as required shall be determined in accordance with 4.1.1.4. When a fatigue analysis is required, provide information in sufficient detail so that an analysis of the cyclic operation can be carried out in accordance with 5.5.

(2) When a vessel is designed for cyclic conditions, the number of design cycles per year and the required vessel design life in years shall be stated.

#### 2.3.3 MANUFACTURER'S DESIGN REPORT

2.3.3.1 See below.

(a) Class 1. The Manufacturer's Design Report shall be certified in accordance with Annex 2-B when either of the following are performed:

(1) fatigue analysis

(2) use of Part 5 to determine thickness of pressure parts when design rules are not provided in Part 4

(b) Class 2. The Manufacturer's Design Report shall be certified in accordance with Annex 2-B.

Inquiry No.	18-37			
Source	Mr. Rob Cox / Matrix Service Company			
Subject	NBIC Part 3, 2.5.3.6 e) Changing of Welding Consumables			
Edition	2017			
Question:	Since this is specific to Grade 91 material, shouldn't the required filler metal (Fno4 or Fno6) be a closer metallurgical match? (i.e. E9015-B9, E9018-B9 or ER90S-B9)			
Background:	The below referenced welding method is specific to Grade 91 material:			
	Subsection e) States: 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.			
Reply:	None			
Committee's Question:	For Welding Method 6 in 2.5.3.6 (e), Part 3 of the NBIC 2017 Edition, may welding consumables E9015-B9, E9018-B9 and ER90S-B9 also be used for weld repair of Grade 91 material?			
Committee's reply:	No			

#### Item 18-39

Item Number: 18-39NBIC Location: Part 3,<br/>2.5.3.6Attachment Page 25<br/>2.5.3.6General Description: If the original welding procedures used for construction of the<br/>vessel are not available, is it acceptable to PWHT the original welds if the R-certificate<br/>holder or client can demonstrate with sufficient PQRs that the entire range of reasonably<br/>plausible essential variables are supported in the PWHT'd condition?Subgroup: Repairs and Alterations CONSULTING. It is up to the Certificate holder and<br/>owner/user and possibly the Jurisdiction to decide on what demonstration is required to<br/>ensure PWHT does not adversely affect the performance of the vessel welds after PWHT.Task Group: None Assigned.

Inquiry No.	NB18-42
Source	Kevin Kurtz
Subject	NBIC Part 3 3.3.4
Edition	2017
Question:	Would reducing a pressure vessel shell overall length be considered an Alteration?
Background:	A pressure vessel shell overall length was reduced from 16'-6" down to 15'-10" (8" length reduction). All other requirements of the Original Code of Construction were met including Spot RT on the Cat. B joint.
Reply:	No, provided all other requirements of the original Code of Construction were met.
Committee's Question:	Is changing a pressure vessel shell overall length considered an Alteration?
Committee's reply:	Yes
Rationale:	The definition of Alteration is a change in the item described on the original Manufacturer's Data Report which affects the pressure containing capability of the pressure-retaining item. 3.4.4 Examples of Alterations d) A change in dimensions or contour of a pressure-retaining item.

#### Action Item 18-53: Interpretation Request

Inquirer: Angel Rodriguez <u>AGRodriguez@dow.com</u>

#### Subject:

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

#### Question:

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

#### NB15-1602 (Metzmaier - 180716)

#### S2.7.1 MATERIAL LIST FOR HISTORICAL BOILERS REPAIRS

Table S2.7.1 is intended as a basic guideline only and covers just the basic carbon steel and some alloy steel material specifications. Other alloy materials may be available for these applications if necessary.

Note: See ASME Section II for Other Acceptable Section I Materials.

#### **TABLE S2.7.1**

MATERIALS LIST FOR HISTORIC BOILERS

Application	Specification
Boiler Tubes & Flues	SA-178 Grade A, SA-192, SA-210
Boiler & Firebox Plate	SA-285 Grade C, SA-515, SA-516
Staybolts <u>&amp; Patch Bolts</u>	SA-675, SA-36, ASTM A-31
Boiler Braces	SA-675, SA-36
Rivets	SA-675,SA-31
Forged Parts & Fittings	SA-105, SA-217
Hollow Cylindrical Pressure Retaining	Parts SA-105 Forgings SA-675 Bar Stock,
Pipe Flanges	SA-181, SA-105
Flange Bolts, Studs & Nuts	<u>SA-193-B7, SA-194-2H</u>
Bronze Castings & Washout Plugs	SB-61, SB-62

**REFERENCE:** 

#### S1.1.3.1 MATERIAL LIST FOR STEAM LOCOMOTIVE BOILERS

### TABLE \$1.1.3.1

Application	Specification	
Boiler Tubes & Flues, Arch Tubes Superheater Units	SA-178 Grade A, SA-192, SA-210	
Boiler & Firebox Plate, Pressure Retaining Plate	SA-285 Grade C, SA-515, SA-516, SA-203, SA-204	
Welded Staybolts	SA-675, SA-36, SA-31	
Threaded Staybolts and Patch Bolts	SA-31 Grade A SA-675 with a tensile strength of 47,000 psi to 65,000 psi inclusive	
Staybolt Sleeves and Caps	SA-105 Forging, SA-675, SA-696	
Boiler Braces	SA-675, SA-36	
Rivets	SA-675, SA-31	
Forged Parts & Fittings	SA-105, SA-181	
Pressure-Retaining Steel Castings	SA-216, A-217	
Hollow Cylindrical Pressure-Retaining Parts	SA-105 Forgings, SA-675 Bar Stock, SA-696	
Superheater Unit Bolts & Nuts	Bolts - SA-193, Nuts - SA-194	
Pipe Flanges	SA-181, SA-105	
Bolts & Studs	SA-307 Grades A&B	
Pipe	SA-106, SA-53 seamless	
Bronze Castings & Washout Plugs	SB-61, SB-62, SB-148, SA-696	

### SUPPLEMENT 3 REPAIR AND ALTERATION OF GRAPHITE PRESSURE EQUIPMENT

### S3.1 SCOPE

- a) This supplement provides requirements and guidelines for repairs to graphite pressure equipment require the use of certified impregnated graphite and cement. The determining factor in establishing the desired material properties is the resin impregnation cycle. If the resin impregnation cycle is not controlled, it is not possible to meet the minimum design values.
  - b) The letter "G" shall be included on the "R" *Certificate of Authorization* for those organizations authorized to perform repairs/alterations of graphite pressure equipment except as permitted by Part 3, S3.5.4 f).

#### S3.2 REPAIRS

The requirements provided in this supplement shall apply, insofar as they are applicable to graphite pressure equipment. Graphite specific requirements include:

- a) When the original code of construction is other than ASME, replacement parts subject to internal or external pressure shall be manufactured by an organization certified as required by the original code of construction. The item shall be inspected and stamped as required by the original code of construction. Certification to the original code of construction as required by the original code of construction or equivalent shall be supplied with the item. When this is not possible or practicable, the organization fabricating the part shall have a National Board *Certificate of Authorization*; replacement parts shall be documented on Form R-3 and the "R" Symbol Stamp applied as described in NBIC Part 3, Section 5
- b) When the standard governing the original construction is not the ASME Code, repairs or alterations shall conform to the edition of the original construction standard or specification most applicable to the work. Where the original code of construction is unknown, the edition and addenda of the ASME Code most appropriate for the work shall be used, provided the "R" Certificate Holder has the concurrence of the Inspector and the Jurisdiction where the pressure-retaining item is installed.
- c) The materials used in making repairs or alterations shall conform to the requirements of the original code of construction except as provided in NBIC Part 3, S3.2 j). The "R" Certificate Holder is responsible for verifying identification of existing materials from original data, drawings, or unit records and identification of the materials to be installed.
- d) When ASME is the original code of construction, replacement parts subject to internal or external pressure, which require shop inspection by an Authorized Inspector, shall be fabricated by an organization having an appropriate ASME *Certificate of Authorization*. The item shall be inspected and stamped as required by the applicable section of the ASME Code. A completed ASME *Manufacturer's Partial Data Report* shall be supplied by the manufacturer. Further, all impregnated graphite material subject to internal or external pressure shall be fabricated by an organization having the appropriate ASME *Certificate of Authorization*. The impregnated graphite material subject to internal or external pressure shall be fabricated by an organization having the appropriate ASME *Certificate of Authorization*. The impregnated graphite material shall be inspected and stamped as required by the applicable section of the ASME Code. A completed ASME *Manufacturer's Partial Data Report* with supplementary U1B shall be supplied by the impregnated graphite material manufacturer.
- e) When the original code of construction is other than ASME, replacement parts subject to internal or external pressure shall be manufactured by an organization certified as required by the original code of construction. The item shall be inspected and stamped as required by the original code of construction. Certification to the original code of construction as required by the original code of construction or equivalent shall be supplied with the item. When this is not possible or practicable, the organization fabricating the part may have a National Board *Certificate of Authorization*; replacement parts shall be documented on Form R-3 and the "R" Symbol Stamp applied as described in NBIC Part 3, Section 5.

(17)

(17)

### For Committee Use Only

- e) Redrill a 7/8 in. (22 mm) hole at every other pilot hole. Holes must be drilled the full depth of the crack. The depth and direction of the crack can be checked with hydrophilic solvent.
- f) A 7/8 in. (22 mm) diameter reamer may be used to true the drilled holes.
- g) Dry fit a plug into the holes. There should be 0.005 in. to 0.010 in. (0.13 mm to 0.25 mm) clearance for the cement joint. At no time should there be a force fit of plugs into any drilled hole. Provisions shall be provided for venting trapped air.
- h) Sand the outside surface of the plugs. Thoroughly clean all the surfaces of the repair, plugs, and drilled holes with hydrophilic solvent.
- i) Apply graphite cement to both plugs and holes. All surfaces of plugs and holes to be joined are to be wetted with cement.
- j) Insert the cemented plugs into the holes allowing 1/16 in. (1.5 mm) of the plug to extend beyond the surface of the graphite part.
- k) Cure the graphite cement according to the cement manufacturer's instruction.
- At this point, half of the plug stitch repair is completed. A row of plugs has been installed with 1/4 in. (6 mm) pilot holes between them.
- m) Redrill the remaining pilot holes to 7/8 in. (22 mm) diameter. The drill will remove part of the plugs that were installed. It is important to have the plugs replace all of the fracture. If the new holes do not cut into the installed plugs, it will be necessary to repeat the procedure between these holes and plug locations to ensure that all of the crack has been repaired. The line of fracture is completely removed by the overlapping effect of the graphite plugs.
- n) After the second set of holes have been drilled, repeat the plug cementing procedures.
- Contour the plugs to provide a smooth transition into the adjoining surface area. The finished repair may be coated with a wash coat for appearance.

#### S3.5.3.2 FIGURES — TYPICAL PLUG STITCHING PROCEDURE

- a) Step one: Layout hole centers.
- b) Step two: Drilling pilot holes.
- c) Step three: Drilling the first set of holes.
- d) Step four: Cementing and curing the first set of plugs.
- e) Step five: Drilling the second set of holes.
- f) Step six: Plug stitching repair completed.

# S3.5.4 REIMPREGNATION OF GRAPHITE PARTS (TUBESHEETS, HEADS, AND BLOCKS)

a) As a function of time, temperature, and chemical exposure, the resin used to impregnate graphite may shrink and/or degrade. As such, it is possible for voids to develop in impregnated graphite that has been in chemical service for a period of time. The resin loss can vary from slight to almost complete loss of impregnation. There is no practical way to determine the amount of resin remaining in the pores. However, a pressure test will determine if the graphite has continuous porosity.

- b) Reimpregnation of a graphite component may be used to reduce porosity in an existing graphite component, which in turn will improve the performance and expected life of the existing graphite components. A written re-impregnation procedure acceptable to the Inspector is required. The reimpregnation procedure shall include as a minimum:
  - 1) Decontamination and drying of the graphite component
  - 2) Subjecting the component to a vacuum
  - 3) Introducing resin under pressure
  - 4) Curing the resin at a specified temperature and time
  - 5) Leak test

#### S3.5.4.1 CONTROL OF IMPREGNATION MATERIAL

- a) Impregnation material shall be the same as that specified in the Reimpregnation Procedure. Each impregnation material shall be traceable by the name of its manufacturer and the trade name or number of that manufacturer.
- b) The impregnation material manufacturer shall supply the Certificate Holder a Certificate of Analysis for each material. It shall include the following:
  - 1) Impregnation material identification
  - 2) Batch number(s)
  - 3) Date of manufacture
  - 4) Shelf life
  - Viscosity per ASTM D 2393
  - 6) Specific gravity
- c) Prior to reimpregnation, and at subsequent intervals not to exceed 14 days, the Certificate Holder shall test each batch of impregnation material to assure that the characteristics of the material have not changed from values specified in the Reimpregnation Procedure. The values obtained for viscosity and specific gravity for the impregnation material shall be within the limits specified by the manufacturer and as listed in the Reimpregnation Procedure. The test values shall be made available to the Inspector.

#### S3.5.4.2 FINISHING THE REPAIR

- a) The parts should be held in place to prevent movement while curing the cemented joint to achieve a proper repair. The repair firm should take care to ensure that the cement joint thickness is within the range recommended by the cement manufacturer. Care spent in precisely aligning the parts while clamping will avoid many finishing and machining operations later. Particular attention should be given to gasket and other bearing surfaces.
- b) Gasket and bearing surfaces may have to be machined, filed, or sanded before the job is completed. Gasket serrations must be clean and continuous. Serrations can be easily re-cut into graphite and any repair plugs that cross the gasket surface.

## For Committee Use Only

2017 NATIONAL BOARD INSPECTION CODE

#### S3.5.4

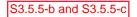
#### PLUGGING OF LEAKING OR DAMAGED TUBES S3.5.5 (17)

- a) The material used for plugging tubes shall comply with the requirements of the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, Part UIG.
- b) The point(s) of leakage shall be verified, and the corresponding leak site(s) shall be marked/labeled on the tubesheet, and recorded.
- c) A plug shall be used to plug each end of the tube(s) in guestion and each plug shall have a minimum length of 1 in. (25 mm). Multiple plugs may be used.
- d) The tube(s) shall be prepared for plugging by enlarging the inside of the tube(s) with a suitable drill bit or reamer.
  - 1) To ensure a sound cement joint between the tube sidewall and the plug, a slightly smaller diameter plug shall be selected. The maximum clearance between the tube inside diameter and the outside diameter of the plug shall not exceed 3/32 in. (2.4 mm).
  - 2) As an alternative to d)1) a mandrel with an abrasive, such as sandpaper, may be used, as long as the maximum tube I.D. to plug O.D. clearance of 3/32 in. (2.4 mm) is not exceeded.
  - 3) The minimum plug insertion depth of the prepared hole(s) shall meet the minimum combined plug length requirements of "c". When the minimum plug length of "c" is exceeded, the total insertion depth of the plugs may exceed the combined length of the plugs; however, the longer plugs shall not project outside the face of the tube(s) being plugged.
- e) Plugging of leaking or damaged tubes shall be performed by certified cementing technicians, using qualified cementing procedures, in accordance with the requirements of the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, Part UIG. See below for new S3.5.4 f)
- The cement shall be prepared per the cement manufacturer's instructions. g) <del>f)</del>
- h) g) When cementing the plugs, 100% of individual plugs, as well as the inside diameter of the tube opening(s), shall be coated with cement. The plugs shall then be inserted one by one, against each other, into each end of the tube(s) being plugged.
- i) h) Once the plugging is completed, and before the cement cures, the endplugs may need to be held in place, as newly cemented plugs may exhibit a tendency to dislodge from the plugged tube(s) prior to final curing of the cement.
- j) i) Curing time is dependent upon the cement manufacturer's instructions, and is considered complete when the cement is hardened to the point that it cannot be indented with pressure from a flat screwdriver or other similar instrument.
- After the cement is completely cured, the plugged, cemented area(s) on the tubesheet face may be k) <del>j)</del> dressed with sandpaper or other suitable abrasive.
- Repaired tubes shall be tested in accordance with this code, using a method acceptable to the <del>k)</del> II) | Inspector, with a written procedure as approved by the manufacturer's internal quality system, to ensure leaks have been repaired.
- [m] <del>| }</del> The scope of the work completed shall be described and reported on a Form R-1. See below for new Figure S3.5.4 S3.5.5

#### S3.5.6 **TUBE REPLACEMENT**

Tube replacement should be performed with the unit preferably in the horizontal position. Avoid replacing adjacent tubes simultaneously because the replacement areas may overlap or reduce the ligament between holes and possibly damage the tubesheet. The general steps used in horizontal tube replacement follow below.

- a) The material used for tube replacement shall comply with the requirements of the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, Part UIG.
- b) Tube replacement shall be performed by qualified cementing technicians, using qualified cementing procedures, in accordance with the requirements of the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, Part UIG-79 and UIG-80.
- c) Determine the thickness of each tubesheet and inside distance between the tubesheets to obtain tube and sleeve length.
- d) Access each tubesheet face, clearly identify and mark each tube hole on each tubesheet of the tubes to be replaced.
- e) Prepare/clean the existing tube hole in preparation for extracting the damaged tube. Some holes may contain plugs which require removal. A boring tool slightly larger than the outside diameter of the tube being replaced is required.
- f) Drill/bore out the tube hole in each tubesheet to release the tube from the tubesheet. Exercise caution when centering and align cutting to the common axis of the tube.
- g) The damaged tube should disengage and become loose. Using guides, remove the damaged tube. Ensure that no debris is trapped in the space where the tube was removed (Fig. S3.5.6 a). [S3.5.5-a]
- h) Replacement tube shall have sleeves at the ends cemented in the bored holes to replace the material in the tubesheet that was bored out to access the damaged tube (Fig. S3.5.6 b and S3.5.6 c).
  - 1) Dry-fit a new tube and sleeve.



- 2) The sleeve length may vary.
- 3) Prior to applying cement, prepare and clean all surfaces to be cemented.
- i) Cement the ID of the prepared bore in the floating tubesheet and the tube end OD at the fixed tubesheet. (Fig. S3.5.6 b). [S3.5.5-b]
- j) Insert the tube through the fixed tubesheet and through the floating tubesheet cemented bore so that it protrudes. Cement the ID of the fixed tubesheet bore as shown in (Fig. S3.5.6-c). The use of alignment dowels can assist/guide in tube handling.
- k) Cement the OD of the tube end protruding from the floating tubesheet. Cement the ID of the mating sleeve end, fit it to the cemented tube end and push the assembly part-way into the floating tubesheet. Cement the remainder of the OD of the floating tube end sleeve. Push this cemented assembly the rest of the way into the floating tubesheet (Fig <u>\$3.5.6-e</u>).
- Cement the ID and OD of the sleeve for the fixed tubesheet and insert it until it mates with the tube end inside. Push together cemented tube/sleeve assemblies. (Fig <del>S3.5.6 d</del>). Clean/wipe away any excess cement.
- m) Apply slight pressure on the sleeves to seat the joints. Remove excess cement.
- n) Maintain pressure and cure both ends of the cemented assembly according to the cement manufacturer's instructions.
- o) Sleeves may be trimmed after curing.

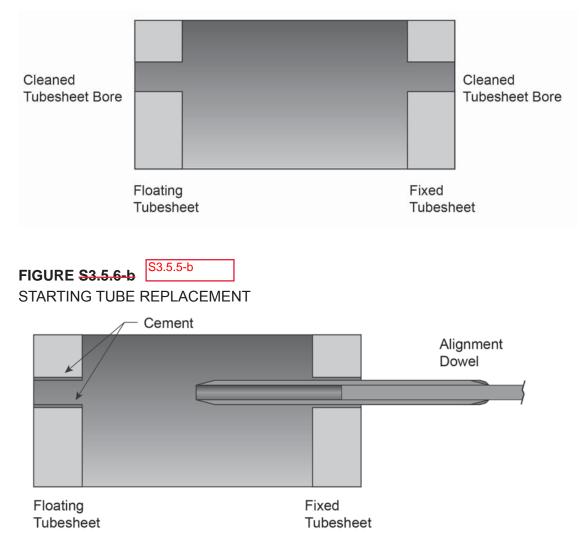
SUPPL. 3

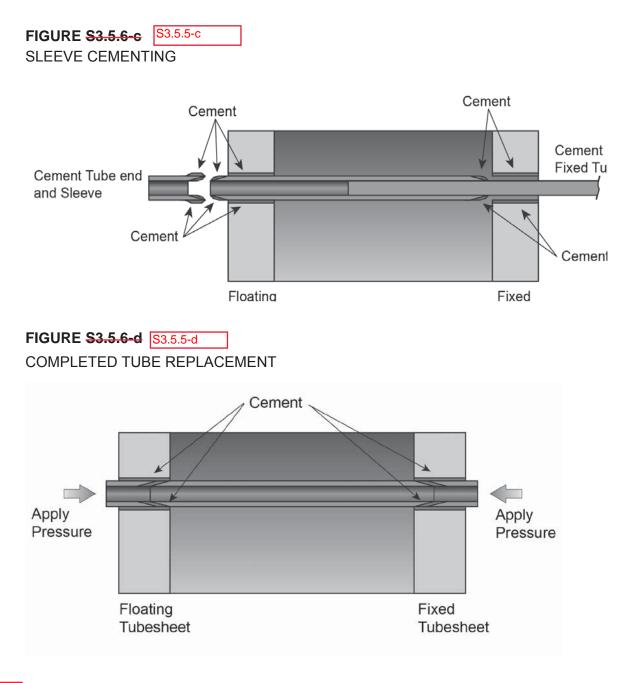
## For Committee Use Only

- p) Replaced tubes shall be tested in accordance with this code per a written procedure acceptable to the Inspector.
- q) The scope of work completed shall be described and reported on a Form R-1.

### FIGURE <u>\$3.5.6-a</u> S3.5.5-a

CLEANED AND PREPARED TUBESHEETS





# S3.5.6 S3.5.7 REIMPREGNATION OF GRAPHITE PARTS (TUBESHEETS, HEADS, AND BLOCKS)

- a) As a function of time, temperature, and chemical exposure, the resin used to impregnate graphite may shrink and/or degrade. As such, it is possible for voids to develop in impregnated graphite that has been in chemical service for a period of time. The resin loss can vary from slight to almost complete loss of impregnation. There is no practical way to determine the amount of resin remaining in the pores. However a pressure test will determine if the graphite has continuous porosity.
- b) Reimpregnation of a graphite component may be used to reduce porosity in an existing graphite component, which in turn will improve the performance and expected life of the existing graphite components. A written re-impregnation procedure acceptable to the Inspector is required. The reimpregnation procedure shall include as a minimum:

(17)

### For Committee Use Only

- 1) Decontamination and drying of the graphite component
- 2) Subjecting the component to a vacuum
- 3) Introducing resin under pressure
- 4) Curing the resin at a specified temperature and time
- 5) Leak test

## S3.5.6.1 (17) S3.5.7.1 CONTROL OF IMPREGNATION MATERIAL

- a) Impregnation material shall be the same as that specified in the Reimpregnation Procedure. Each impregnation material shall be traceable by the name of its manufacturer and the trade name or number of that manufacturer.
- b) The impregnation material manufacturer shall supply the Certificate Holder with a Certificate of Analysis for each material. It shall include the following:
  - 1) Impregnation material identification
  - 2) Batch number(s)
  - 3) Date of manufacture
  - 4) Shelf life
  - 5) Viscosity per ASTM D 2393
  - 6) Specific gravity
- c) Prior to reimpregnation, and at subsequent intervals not to exceed 14 days, the Certificate Holder shall test each batch of impregnation material to assure that the characteristics of the material have not changed from values specified in the Reimpregnation Procedure. The values obtained for viscosity and specific gravity for the impregnation material shall be within the limits specified by the manufacturer and as listed in the Reimpregnation Procedure. The test values shall be made available to the Inspector.

New \$3.5.4 f)

f) As an alternative to e) any R Certificate Holder, with or without the letter "G" included on the "R" Certificate of Authorization, may install graphite tube plugs provided the following conditions are met. The R Certificate Holder shall gain the concurrence of the Inspector, and shall utilize a tube plugging kit provided by an ASME Certificate Holder authorized to use the G designator. The kit shall include the following items:

1. Certified graphite plugs and certified cement ingredients, both accompanied by the appropriate documentation (Partial Data Report).

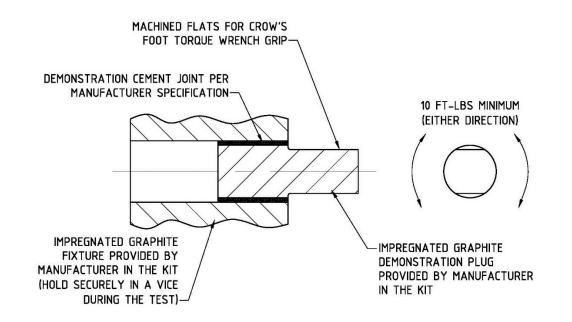
2. The qualified cementing procedure of the ASME Certificate Holder authorized to use the G designator, and a step-by-step procedural checklist that shall be followed explicitly. The procedure shall address the entire tube plugging process including plug configuration, tube hole cleaning and preparation, mixing and applying of the cement, application of the plugs, securing the plugs during the curing process, controlling the curing process, and leak testing, thereby meeting S3.3.

3. Additional materials and procedure shall be provided and used to prepare a demonstration plug joint prior to performing the repair. This demonstration plug joint shall be tested by a twist (torsional) test designed to demonstrate acceptable application and curing of the cement (Fig. S3.5.4). The test procedure shall include acceptance criteria, which may be based on a principle of breakage of part of the test piece. A successful twist test, in conjunction with the completed procedural checklist, shall serve as a valid cement technician certification for a single repair operation. The twist test shall be witnessed by the Inspector.

The R Certificate Holder shall review the material certifications including verification that the shelf life of the cement has not been exceeded, and assure that the certified cement technician has completed the qualification demonstration, and has access to the procedure and checklist. The Inspector shall review and verify that the procedure and the other elements of the certified kit, as provided by the authorized G-designated ASME Certificate Holder, have been administered and completed prior to his acceptance. The R-certificate Holder shall note on Line 8 of the R-1 Form the installation of cemented graphite tube plugs in accordance with this section. The letter "G" shall not be applied to the vessel when performing this alternative repair. The R Certificate Holder shall identify and document the location of the plugged tubes on the R Form.

FIGURE S3.5.4

#### DEMONSTRATION PLUG JOINT TWIST TEST



NOTE: THIS DEMONSTRATION APPLIES TO PLUGS OF ALL DIAMETERS AND LENGTHS.

#### Item NB16-0303, add Fillet Welded Patch as a method of Repairing a Pressure Retaining Item (PRI)

#### All New 3.4.4 Paragraph PROPOSED:

#### 3.4.<u>4</u> FILLET WELDED PATCH

A <u>fillet welded patch</u> is a repair method used to maintain the pressure retaining capability of <u>shells, heads,</u> <u>drums and</u> pipe by providing a pressure containing boundary over the <u>area exhibiting damage</u> in the form of a "fillet welded patch" as described by ASME PCC-2, <u>Article 2.7 or Article 2.12</u>.

- a) Except as required in 3.4.<u>4</u> c)(1), ASME PCC-2 should shall be used as a guideline for the design of the <u>fillet welded patch</u> and shall be in accordance with the original code of construction, when practicable. Design of the fillet welded patch shall consider original design conditions, taking in to account current service conditions and damage mechanisms. Use of this method shall be acceptable to the inspector and when required, the jurisdiction and shall be limited to pressure containing equipment owned and operated by an Owner-User.-
  - 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 vessel was built. The minimum required thickness shall be at least equal to the thickness stated on the original *Manufacturer's Data Report*.
- b) The "R" Certificate Holder responsible for the design of the <u>fillet welded patch</u> shall ensure a Fitness for Service Assessment (FFSA) has been performed on the portion of the item being patched in accordance with NBIC, Part 2, 4.4.1, supporting the continued service of the item. The <u>fillet welded patch</u> repair method shall not remain in place beyond the calculated remaining life of the <u>covered</u> portion of the pressure retaining item.
  - The remaining life of the pressure retaining item shall be documented on the Report of FFSA in the Remarks section. The Report of FFSA Form shall be affixed to the Form R-2 and identified in the Remarks section.
  - The thinned or leaking area shall be fully <u>covered</u>, 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 <u>fillet welded patch</u> method shall not be used where cracks are present unless the cracks have been removed and repaired in accordance with Part 3, Paragraph 3.3.4.2 a); the condition that led to the crack formation and propagation have been eliminated.
- 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 <u>a fillet welded patch</u>, the requirements and limitations described within ASME PCC-2, Part-1 shall be used in conjunction with ASME PCC-2, Part-2, Article 2.10.
  - 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, Paragraph 4.4.1 e).
- e) Completion of the FORM R-1 shall follow the requirements for PREPARATION, DISTRIBUTION, and REGISTRATION as described in Part 3, Section 5.

#### Additional actions required by accepting this item:

Revise the succeeding paragraph numbering order (ref.2017-edition) to:

#### 3.4.5 EXAMPLES OF Repairs

I) The installation of a *fillet* welded patch.

#### NB16-0503

Part 3

S2.13.13.4

Current wording:

c) Rivets shall be of sufficient length to completely fill the rivet holes and form heads at least equal in strength to the bodies of the rivets. Forms of finished rivet heads that will be acceptable are shown in NBIC Part 3, Figure S2.13.13.4-a and S2.13.13.4-b.

Replace with:

b) Rivets shall be of sufficient length to completely fill the rivet holes and form heads at least equal in strength to the bodies of the rivets. Common Forms of finished rivet heads that will be acceptable are shown in NBIC Part 3, Figure S2.13.13.4-a, S2.13.13.4-b and S2.13.13.4-c.

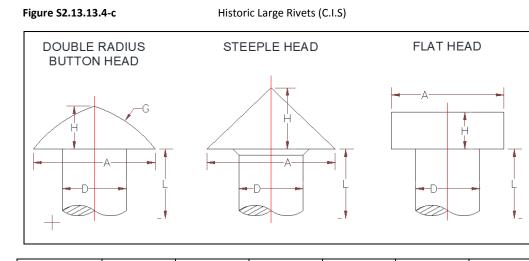
c) For rivet head designs not shown in Figure S2.13.13.4-a, S2.13.13.4-b and S2.13.13.4-c, the strength of the rivet head design may be calculated to demonstrate strength equivalent to the body of the rivet. Formulas for calculation are permitted at the discretion of the inspector.

#### Part 2

#### S2.10.2.1 RIVET HEAD TYPES

Common finished rivet heads are shown in NBIC Part 3, Figure S2.13.13.4-<u>a, S2.13.13.4-b and S2.13.13.4-c</u>. Note that a riveted seam may have more than one type of rivet-te, for example, to provide necessary clearance during operation, or for provision for equipment assembly and maintenance.

Formatted: Underline, Font color: Red Formatted: Underline, Font color: Red Formatted: Underline, Font color: Red Formatted: Font color: Red



Nom. Body Dia. D	Head Dia. A	Height H	Head Dia. A	Height H	Head Dia. A	Height H
	Double Radius Button Head		Steeple	e Head	Flat I	Head
1/2	0.950	0.350	1.000	0.500	0.875	0.250
5/8	1.188	0.438	1.250	0.625	1.094	0.313
3/4	1.425	0.525	1.500	0.750	1.313	0.375
7/8	1.663	0.613	1.750	0.875	1.531	0.438
1	1.900	0.700	2.000	1.000	1.750	0.500
1-1/8	2.138	0.788	2.250	1.125	1.969	0.563
1-1/4	2.375	0.875	2.500	1.250	2.188	0.625
1-3/8	2.613	0.963	2.750	1.375	2.406	0.688
1-1/2	2.850	1.050	3.000	1.500	2.625	0.750
1-5/8	3.088	1.138	3.250	1.625	2.844	0.813
1-3/4	3.325	1.225	3.500	1.750	3.063	0.875

All Dimensions are given in inches.

Tolerance for diameter of body is plus and minus 10% of nominal (shank diameter).

The following formulas give basic dimensions for manufactured shapes:

Double Radius Button Head, A=1.900D; H=0.700D; G=2.000D.

Steeple Head, A=2.000D; H=1.000D.

Flat Head, A=1.750D;

H=0.500D.

Length L is measured parallel to the rivet axis, from the etreme end to the bearing surface plane for flat bearing surface head-type rivets, or to the intersection of the head top surface with the head diameter for countersunk head-type rivets.

### **TABLE 1.6.2**

### "NR" QUALITY ASSURANCE PROGRAM (QAP) REQUIREMENTS

Category of Activity	Owner	Organizations other than Owner
Category 1	10 CFR Part 50 Appendix B <sup>1, 2</sup> and ASME Section III NCA-4000 <u>&amp; NQA-1 Part 1</u>	10 CFR Part 50 Appendix B <sup>1, 2</sup> and ASME Section III NCA-4000 <u>&amp; NQA-1, Part 1</u>
Category 2	10 CFR Part 50, Appendix B <sup>1, 2</sup> or NQA-1 <sup>3</sup> , Part 1 and ASME Section XI, IWA-4142	10 CFR Part 50, Appendix B <sup>1, 2</sup> supplemented as needed with Owner's QA program; or ASME NQA-1 <sup>3</sup> , Part 1; or ASME Section III, NCA-4000
Category 3	ASME NQA-1 <sup>3</sup> , <u>Parts 1</u> , or Specify the Standard to which certification is desired	ASME NQA-1 <sup>3</sup> , <u>Parts 1</u> , or Specify the Standard to which certification is desired

#### Note 1:

Code of Federal Regulations (CFR) – rules and regulations published by the executive departments and agencies of the federal government of the United States.

#### Note 2:

10 CFR 50 Appendix B – Title 10 of the Code of Federal Regulations Part 50 Appendix B describes the quality assurance criteria for nuclear plants and fuel reprocessing plants.

#### Note 3:

The Edition (and Addenda, as applicable) of NQA-1 to be utilized shall be the latest endorsed by the Regulatory Authority, or as specified in the Owner's QA Program descriptions reviewed and approved by the Regulatory Authority.

### (17) **1.6.2.1 DEFINITIONS**

The NBIC terms and definitions shall be supplemented, as applicable, by the terms and definitions of ASME Section III, Section XI, NQA-1, or other standards specified by the Regulatory Authority.

The following terms are as defined in the NBIC Glossary of Terms Section 9:

- a) Authorized Inspection Agency
- b) Authorized Nuclear Inspection Agency
- c) Jurisdiction
- d) "NR" Certificate Holder

SECTION 1

ASME	American Society of Mechanical Engineers
Applicant	An Organization applying for "NR" <i>Certificate of Authorization</i> (new or renewal)
CFR	Code of Federal Regulations
Code	ASME Code of Construction, Section III, Division I, (NCA, NB, NC, ND, NE, NF, NG, and NH) or ASME Section XI Rules for Inservice Inspection of Nuclear Power Plant Components as applicable.
Jurisdiction	Enforcement Authority
NB	National Board of Boiler and Pressure Vessel Inspectors
NBIC	National Board Inspection Code
NB-263, RCI-1	Rules for Commissioned Inspectors
NCA	ASME Section III, Subsection NCA, General Requirements for Division 1 and Division 2
NQA-1*	ASME Quality Assurance Requirements for Nuclear Facility Applications
NR	Nuclear Repair
"NR" CH	"NR" Certificate Holder
QA	Quality Assurance
QAI-1	ASME Qualifications for Authorized Inspection
QAM	Quality Assurance Manual
QAP	Quality Assurance Program
QC	Quality Control
WA	ASME Section III, Division 3, Subsection WA, General Requirements

#### Note:

\* Latest-Edition(s) endorsed by the Regulatory Authority

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

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

- a) Have and maintain an inspection agreement with an Authorized Nuclear Inspection Agency accepted in accordance with NB-360, Criteria for Acceptance of Authorized Inspection Agencies for New Construction or accredited in accordance with NB-369, Qualifications and Duties for Authorized Inspection Agencies (AIAs) Performing Inservice Inspection Activities and Qualification of Inspectors of Boilers and Pressure Vessels.
- b) Have a written Quality Assurance Program that complies with the requirements of this section and address all controls for the intended category and scope of activities.
- c) Have a current edition of the NBIC.

#### s) Authorized Nuclear Inspector

Measures shall be taken to reference the commissioned rules for National Board Authorized Nuclear

(17)

Inspector, in accordance with NB-263, RCI-1 *Rules for Commissioned Inspectors*. The "NR" Certificate Holder shall ensure that the latest documents including the Quality Assurance Manual, procedures and instructions are made available to the Authorized Nuclear Inspector. The Authorized Nuclear Inspector shall be consulted prior to the issuance of a repair/replacement plan by the "NR" Certificate Holder in order that the Authorized Nuclear Inspector may select any in-process inspection or hold points when performing repair/replacement activities. The "NR" Certificate Holder shall keep the Authorized Nuclear Inspector informed of progress of the repair/replacement activity so that inspections may be performed. The Authorized Nuclear Inspector shall not sign Form NR-1 or Form NVR-1, as applicable, unless satisfied that all work carried out is in accordance with this Section. The Authorized Nuclear Inspector and Authorized Nuclear Inspector Supervisor shall have access to areas where work is being performed including subcontractors facilities in order to perform their required duties. The ANI shall be involved in dispositions and verification for non-conformances and corrective actions involving quality or code requirements.

#### t) Exhibits

Forms and exhibits referenced in the Quality Assurance Manual shall be explained in the text and included as part of the referencing document or as an appendix to the Quality Assurance Manual. Forms shall be controlled and identified to show the latest approved revision, name, and other corresponding references as stated in the Quality Assurance Manual.

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

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

### <u>S14.1 Scope</u>

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

### S14.2 General

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

### S 14.3 Life Extension Procedure

- a) New vessel fatigue life testing data shall be obtained from the Manufacturer's Design Report (MDR) and the number of cycles in a lifetime shall be determined from the MDR. The type of vessel under consideration for life extension shall have been shown through testing to be capable of sustaining at least three lifetimes of cycles to developed fill pressure followed by a subsequent burst test at a pressure greater than minimum design burst pressure.
- b) An evaluation of the service the vessel has seen should take into account any operational conditions that may have differed from those used in the design testing and analysis. Such conditions include for example exposure to more severe weather than expected, more cycles

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

- <u>c)</u> Data and records for all vessels considered for life extension shall be kept and made readily available to inspectors or examination personnel. This includes an operating log, number of operating cycles since the previous examination, total number of operating cycles, examinations, examination techniques and results, maximum operating pressure and any unexpected pressures, temperatures, temperature cycles, damage events or other significant events that were outside the intended operating parameters or conditions.
- <u>d) A life extension test program shall be carried out for each type of vessel under consideration.</u>
   <u>Type of vessel means the particular manufacturer, materials (fiber and resin), water volume and design. If the type of vessel passes all requirements, then that type shall be eligible for life extension testing. If such a vessel passes the life extension MAE test its lifetime can be extended for one additional lifetime in five-year increments. In order to maintain life extension a vessel must be requalified every five years using the MAE test.</u>

### S14.4 Life Extension Test Program

- a) The type of vessel under consideration for LE shall be noted. Manufacturer, place of manufacture and manufacturing date shall be recorded. The vessel dimensions shall be recorded. The specific fiber, matrix and winding pattern shall be recorded. If the fiber, matrix and winding pattern are not available from the manufacturer, then a vessel of the type under consideration shall be used to verify the winding pattern (hoop and helical angles and number of plies) through destructive testing.
- b) Ten out-of-life vessels of the particular type shall be tested in the manner described herein.
   MAE techniques shall be applied to every vessel tested. Analysis of the MAE data is described herein. Two strain gages, one in the 0-degree and one in the 90-degree direction, shall be applied to every vessel pressure tested under this program. The purpose of strain gage data is to compute the 0 and 90 modulus values and to confirm that the modulus values of the material do not vary during the fatigue cycling required herein. Strain data shall be recorded and analyzed as described later on.
- c) The LE test program proceeds by Steps. If the Step 1 is not successful, then there is no need to proceed to Step 2, and so forth.

### S14.5 Life Extension Test Program Steps

<u>S14.5.1 Step 1</u>

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

- a) No BEO greater than 2 times the quiescent energy (see Supplement 10) shall be observed up to test pressure or during pressure holds.
- b) No fiber break event energy shall be greater than 24 x 10<sup>3</sup> x U<sub>FB</sub> (see Supplement 10) during the second pressurization cycle.
- c) No single event shall have an energy greater than 24 x 10<sup>5</sup> x U<sub>FB</sub> during the second pressurization cycle.

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

- d) At least two sensors shall remain on each vessel all the way to burst in order to establish the BEO pressure for this type of vessel.
- e) Plots of stress versus strain shall show linear behavior up to 90% of burst pressure.
- f) The burst pressures of all three vessels shall be greater than the minimum design burst pressure.
- g) If the burst pressure of any one of the three vessels is not greater than the minimum design burst pressure, then these vessels shall not be eligible for life extension and there is no need to proceed with Step 2 below.

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

### <u>S14.5.2 Step 2</u>

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

- a) Prior to testing, the vessels shall be inspected for visible damage, i.e., cuts, scrapes, discolored areas, and the vessel appearance shall be documented with photographs.
- b) Prior to fatigue testing, MAE testing as specified in Step 1 shall be done in conjunction with the fatigue testing, hereinafter called the MAE test or MAE testing, in order to determine the suitability of the vessels for fatigue testing, i.e., that they pass the MAE test.
- <u>c)</u> Next, the vessels shall be subjected to fatigue cycles. Pressure shall be 100 psi +0, -50% to at least 1.05 x working pressure. Vessels shall survive one and one-half (1.5) additional lifetimes. If they survive then they shall be tested by an MAE test as was done prior to fatigue cycling.

- <u>d)</u> Provided they pass the MAE test, they shall be burst tested. At least two sensors shall remain on each vessel all the way to burst in order to establish that the BEO (background energy oscillation) pressure for the fatigued vessels is consistent, i.e., is the same percentage of ultimate, with that of the vessels tested in Step 1.
- e) Plots of stress versus strain shall show linear behavior up to 90% of burst pressure.
- <u>f)</u> The burst pressures at the end of the fatigue testing shall be greater than or equal to the minimum design burst. If the burst pressure of any one of the three vessels is not greater than the minimum design burst pressure, then these vessels shall not be eligible for life extension.

### <u>S14.5.3 Step 3</u>

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

- a) Prior to testing, the vessels shall be inspected for visible damage, i.e., cuts, scrapes, discolored areas, and the vessel appearance shall be documented with photographs. Prior to impact testing, MAE testing shall be done in order to determine the suitability of the vessels for impact testing, i.e., that they pass the MAE test.
- <u>b)</u> Two vessels shall be subjected to an ISO 11119.2 drop test and then subjected to the MAE test.
   <u>If they pass the MAE test, then one vessel shall be burst tested.</u> At least two sensors shall
   <u>remain on the vessel all the way to burst in order to establish that the BEO (background energy oscillation) pressure for the fatigued vessels is consistent, i.e., is the same percentage of ultimate, with that of the vessels tested in Step 1.
  </u>
- c) Plots of stress versus strain shall show linear behavior up to 90% of burst pressure.
- d) If the burst pressure is not greater than the minimum design burst pressure, then these vessels shall not be eligible for life extension.
- e) If the first vessel passes the burst test, the other dropped vessel shall be fatigue cycled and subsequently subjected to the MAE test and, if it passes, shall be burst tested under the same conditions as before. If the vessel fails during fatigue cycling, i.e., bursts or leaks, then these vessels shall not be eligible for life extension.
- f) If the modulus changes by more than 10%, then these vessels shall not be eligible for life extension. The strain gages should be mounted in a location that is away from the impact zone.
- g) The burst pressure at the end of the fatigue testing of the dropped vessel shall be greater than or equal to the minimum design burst. The vessels shall have MAE testing applied during burst testing as before and the BEO shall be consistent with the previously established percent of burst ±10%.

### <u>S14.5.4 Step 4</u>

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

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

- b) Two vessels shall be subjected to an ISO 11119.2 cut test and then subjected to the MAE test. If they pass, then one shall be burst tested under all the conditions and procedures delineated in Step 2. If the burst pressure is not greater than the minimum design burst pressure, then these vessels shall not be eligible for life extension.
- <u>c)</u> If the cut vessel passes, then the other cut vessel shall be fatigue cycled as described in Step 2 and subsequently subjected to the MAE test and then burst tested with at least two MAE sensors remaining on and monitoring the vessel as before. If it does not survive fatigue cycling, then these vessels shall not be eligible for life extension.
- d) The burst pressure at the end of the fatigue testing of the cut vessel shall be greater than or equal to the minimum burst pressure specified by ISO 11119.2.

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

NB16-1801 approved April 2018 by SGL

Materials -

NBIC S1.1.3.1-d); Maximum staybolt *tensile strength* shall be 7,500 psi? Errata. Should be tensile stress

Bolts and Studs; NBIC Table S1.1.3.1; SA-307 A and B. Add <u>SA-675 grade 60, 65, 70</u>

Threaded Staybolts; NBIC Table S1.1.3.1; SA-31 Gr. A, SA-675 <del>47 ksi to 65 ksi inclusive</del>. Remove 47ksi to 65 ksi inclusive. Add <u>grade 45, 50, and 55</u>

Staybolt Sleeves and Caps; NBIC Table S1.1.3.1; SA-105, SA-675, and SA-696. Add <u>SA-216 WCA and SA-217 WC1</u>

Threaded Staybolts -

NBIC S1.2.2 a); The thread pitch shall be either 11 or 12.

Current wording:

All threaded staybolts shall have either 11- or 12-thread pitch. Staybolt threads shall have a good close fit in sheets. Changing the staybolt thread pitch from 11 to 12 or the reverse shall be considered a repair.

Proposed wording:

<u>All threaded staybolts shall have a pitch between 10 and 13 threads per inch inclusive, (2 mm to 2.5 mm). Staybolt threads shall have a good close fit in sheets. Changing the staybolt thread pitch from any pitch within the allowed range to another pitch within the allowed range shall be considered a repair.</u>

NBIC S1.2.2 h)

Current wording:

Installation of larger diameter staybolts shall be considered a repair.

Proposed wording:

<u>Installation of different diameter staybolts shall be considered a repair provided the stay stress does</u> <u>not exceed 7500 psi (52.5 MPa).</u> Cautionary Note: Larger diameter staybolts will transfer stresses to <u>other structures and will be subject to higher extreme fiber stresses.</u>

NBIC S1.2.5 d) Current wording: Installation of different diameter staybolts shall be considered a repair. Proposed wording: Installation of different diameter staybolts shall be considered a repair prov

Installation of different diameter staybolts shall be considered a repair provided the stay stress does not exceed 7500 psi (52.5 MPa). Cautionary Note: Larger diameter staybolts will transfer stresses to other structures and will be subject to higher extreme fiber stresses.

Arch tubes – NBIC S1.2.9.3; Current wording:

The minimum wall thickness of replacement arch tubes shall be as shown in Table S1.2.9.3. Proposed wording:

<u>The minimum wall thickness of replacement arch tubes shall be as determined by the following formulas.</u>

(U.S. Customary Units)

 $t = \frac{PD}{16,000} + 0.125$ 

<u>(SI Units)</u>

 $t = \frac{PD}{111} + 3.175$ 

<u>where</u>

D = outside diameter of tube, in. (mm)

<u>P = maximum allowable working pressure, psi (MPa)</u>

t = thickness of tube wall, in. (mm)

#### Delete Table S1.2.9.3

Thermic Syphons – NBIC S1.2.9.4 b); Current wording: All weld repairs to the unstayed sections of the syphon neck and body shall be radiographically examined. Proposed wording: <u>Except for the attachment weld to the throat sheet, welds on the thermic syphon unit shall be full</u> <u>penetration, and the unit shall be stress relieved in accordance with ASME, Section I, PW-39.</u>

Volumetric examination is not required.

Water Gage Connection – NBIC S1.2.13.1 a); Current wording: <del>Water gage glasses shall be applied so that the lowest water reading in the water glass gage glass of a</del> horizontal firetube boiler on level track shall be at least 3 inches above the highest point of the *tubes, flues, or crownsheet*". Proposed wording:

NBIC S1.2.13.1 a); Water gage glasses shall be applied so that the lowest water reading in the water glass gage glass of a horizontal firetube boiler on level track shall be not less than 3 inches (75 mm) above the highest point of the crownsheet.

# Proposal NB17-0701 – Hellman – 7-16-18

NOTE: 7/16/18 - TG NR has voted to not add the originally proposed verbiage in 1.6.7.1 and 1.6.8.1, effectively closing Item NB17-0701 with no action.

#### 1.6.7 QUALITY ASSURANCE PROGRAM REQUIREMENTS FOR CATEGORY 2 ACTIVITIES

#### 1.6.7.1 SCOPE

Owners or organizations other than owners shall have a written Quality Assurance Program meeting one of the criteria specified in Table 1.6.2 of this section. Organizations applying for a Category 2 "NR" Certificate of Authorization shall specify in their written Quality Assurance Program which program criteria their Quality Assurance Program follows. Owners shall have a Quality Assurance Program meeting the requirements of either 10 CFR 50, Appendix B or NQA-1 Part 1 and shall include the additional requirements specified in ASME Section XI, IWA-4142 when applicable. Organizations other than the owner shall comply with requirements specified in either 10 CFR 50, Appendix B supplemented as needed with the owner's QAP; NQA-1 Part 1; or NCA-4000. Organizations may elect to choose to follow all the rules specified in one of the allowed QAP criteria specified in Table 1.6.2 or they may elect to combine or supplement requirements from other specified QAP's. When organizations elect to combine QAP requirements, it shall be clearly specified and understood in the QAM which QAP requirement is being followed for each activity specified in their QAM. The following quality elements shall be specified and described within the QAM. When Commercial Grade Dedication (CGD) is utilized, it shall be performed in accordance with NQA-1, Subpart 2.14.

#### 1.6.7.2 QUALITY PROGRAM ELEMENTS

a) Organization

The authority and responsibility for individuals involved in activities affecting quality shall be clearly established and documented throughout the Quality Assurance Program and identified on a functional organizational chart contained within the QA Manual.

- b) Quality Assurance Program (QAP)
  - 1) Qualification of non-destructive examination personnel shall be as required by the code or as specified in the owner's Quality Assurance Program.

(17)

#### 1.6.8 QUALITY ASSURANCE PROGRAM REQUIREMENTS FOR CATEGORY 3 ACTIVITIES

#### 1.6.8.1 SCOPE

Organizations requesting a Category 3 "NR" *Certificate of Authorization* may elect to follow the requirements specified in ASME NQA-1 Part 1 or follow specific Quality Assurance Program requirements outlined in other specified standards as required by the owner, Regulatory Authority or Jurisdiction. Organizations shall specify in the QAM what QAP requirements are followed. When standards other than ASME NQA-1 are followed, the organization shall have available a copy of that standard for review by the NB Survey Team and the ANIA, as applicable. Each organization shall, as a minimum, include in their written QAM the specified elements listed in Category 1 and/or 2 (1.6.6, 1.6.7) QAP requirements. Additional requirements, as specified within NBIC Part 3, 1.6.8 and 1.6.9 shall be included within the QAP. Also, limitations or additions to ASME NQA-1, as specified for Category 1 or 2 may be incorporated and referenced within the QAM. <u>When Commercial Grade Dedication (CGD) is</u> utilized, it shall be performed in accordance with NQA-1, Subpart 2,14

#### (17) 1.6.8.2 QUALITY PROGRAM ELEMENTS

a) Organization

Persons and organization shall have authority and freedom to identify quality problems; initiate, recommend or provide solutions and verify implementation of solutions.

b) QAP

Shall account for special controls, processes, test equipment, tools and skills to obtain quality and for verification of quality by inspections and tests. Indoctrination, training and maintaining proficiency of personnel effecting quality shall be described. The status and adequacy of the QAP shall be regularly reviewed. The scope shall be included within the written QAM. The "NR" Certificate Holder shall make a current controlled copy of the Quality Assurance Manual available to the Authorized Nuclear Inspector and Authorized Nuclear Inspector Supervisor. The "NR" Certificate Holder shall address in their QAM the requirements for interfacing with the owner specified in 1.6.9 of this section.

c) Design Control

Established measures to assure approximate quality standards are specified and included in design documents. Any deviations shall be identified and controlled.

d) Document Control

Documents for procurement of material, equipment and services shall ensure regulatory requirements, design bases and other quality requirements and are included or referenced. Procurement documents shall require contractors or subcontractors provide a Quality Assurance Program consistent with the provisions specified in this NBIC Part 3, 1.6.8.

e) Instructions, Procedures and Drawings

Activities affecting quality shall be accomplished in accordance with prescribed instructions, procedures or drawings and shall include approximate quantitative or qualified acceptance criteria to determine activities are satisfactorily accomplished.

f) Document Control

Shall define measures to control the preparation, issuance, use, approval, revisions and distribution of all documents related to quality.

#### Item 18-41 Part 3, S4.18.2.1 2) d. 2. and 4.

- 1) ...
- 2) Applying Test Patches to Verify Adequate Surface Preparation
  - a. Test patches should be applied to any substrate that will require a secondary bond to determine the integrity of the primer bond prior to the application of the laminate.
  - b. The subsequent steps shall be followed:
    - 1. Apply the primer (0,003 -0.005 in. (0.08 to 0.13 mm)) to the prepared surface, and allow primer to cure.
    - Coat the primed surface with the same resin to be used in the laminate repair. Apply 4 in. (100 mm) x 14 in. (360 mm) piece of polyester, such as Mylar®, strip to one edge of primed area. Allow the polyester film to protrude from beneath the patch.
    - 3. Apply two layers of 1-1/2 oz/sq. ft (0.46 kg/sq. m) chopped strand mat saturated with the same resin that will be used for the repair. Mat shall be 12 in. (305 mm) x 12 in. (305 mm) square.
    - 4. Allow the mat layers to cure completely, this may be verified by checking the hardness of the laminate.
    - 5. Pry patch from surface using a screwdriver, chisel, or pry bar.
    - 6. A clean separation indicates a poor bond.
    - 7. Torn patch laminate or pulled substrate indicates that the bond is acceptable.
  - c. If the bond is not adequate, go back to step a) and repeat the procedure.

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

- d. As a last resort, if the previous procedure does not provide an adequate bond, the permeated laminate must be handled differently using the following procedure:
  - 1. Hot water wash the equipment.
  - 2. Abrasive blast with #3 sand, or equal to achieve a 0.003 to 0.005 in. (0.08 to 0.12 mm) anchor pattern, and allow to completely dry.
  - 3. Prime with the recommended primer, an area 12 in. (305 mm) x 12 in. (305 mm) and apply a test patch.
  - 4. Prime a second spot 12 in. (305 mm) x 12 in. (305 mm) and prime with a recommended epoxy resin alternate primer.
  - 5. Allow this primer to cure.

#### Part 3, S4.18.2.2 2)

- 1) ...
- 2) Note that any cracks, delaminations, or permeated surfaces must be removed. If the damage is deeper than the corrosion barrier and the material removed reaches the structural laminate, the vessel is not repairable. An adequate size abrasive or proper sanding disc must be used to obtain a 0.003 to 0.005 0.002 to 0.003 in (0.05 to 0.08 mm) anchor pattern to the area that requires the repair.
- 3) Preparation of any surface requires that basic rules, common to all substrates, be followed. These rules are as outlined below:
  - a. Surface must be free of contaminants;
  - b. Surface must be structurally sound;
  - c. Surface must have adequate anchor pattern;
  - d. Surface must be dry;
  - e. Surface must be primed with recommended primer.

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

#### <u>NB17-155</u>

#### Approved by SGL April 2018

#### S1.2.14 Throttle Pipes, Dry Pipes, Superheater Headers & Front End Steam Pipes

<u>1) Cracks in throttle pipes, dry pipes, superheater headers, and front end steam pipes made from steel may be</u> repaired by welding. All welded repairs shall be done in accordance with NBIC Part 3.

2) Throttle castings, dry pipes, super heater headers, and front end steam pipes constructed of cast iron may be repaired by brazing provided the components are internal to the boiler shell or smokebox shell. Brazing shall be done in accordance with NBIC Part 3, appropriate to the type of repair, and shall be acceptable to the Inspector and the jurisdiction if applicable. Cast iron shall not be fusion welded.

3) Weld build-up may be used for repair of steel components in accordance with NBIC Part 3.

<u>4) Throttle pipes, dry pipes and superheater headers, should be supported by hangers, brackets or other structural methods as needed.</u>

#### NB17-156

#### Approved by SGL April 2018

#### S1.1.2 REQUIREMENTS FOR WELDING AND BRAZING ACTIVITIES

a) Before performing any welding activities, consideration shall be given to ensure the weldability of locomotive boiler materials.

b) Special jurisdictional approval may be required prior to starting welding activity on locomotive boilers.

c) Performance of welded repairs on locomotive boilers shall meet the requirements of NBIC Part 3.

d) Performance of brazed repairs on locomotive boilers shall meet the requirements of ASME Section IX.

Action Item-Rivet Joint to One Piece Welded Joint NB17-160

#### S1.2.11.5 REPAIR OF FIREBOX AND TUBESHEET KNUCKLES S1.2.11.5 Repair of Firebox, Wrapper, and Tubesheet Knuckles

a) Welds within the points of tangency of a knuckle are permitted. Welds with angles of less than 45 degrees to the longitudinal axis of the knuckle shall be radiographically examined. (See NBIC Part 3, Figures S1.2.11.5-a through S1.2.11.5-g).

b) Any patch not supported by means other than the weld, such as rivets, staybolts, tubes, or other forms of construction, shall have all weld seams radiographically examined.

c) Patches shall be formed to proper shape and curvature.

d) Wasted sections of knuckles that have not wasted below 60% of the minimum required thickness may be repaired by weld buildup provided the strength of the structure will not be impaired. Where weld buildup is employed, the Inspector may require an appropriate method of NDE for the repair.

e) Wasted sections of knuckles that have wasted below 60% of the minimum required thickness shall be replaced.

f) Flanges shall be made so as to avoid stress intensifiers such as abrupt ridges and grooves.

g) Flanges shall be made smooth and free of ridges, valleys and grooves.

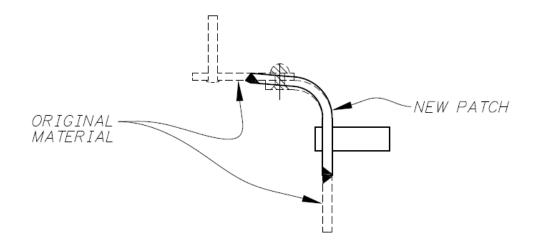
h) Flanges may be welded in accordance with this section and all applicable sections of this code.

i) For one-piece flange knuckle joint patches in portions of a riveted lap joint or in mud ring corners with a lap joint in the firebox, the knuckle patch shall be supported on at least one of the two planes adjacent to the flange, by means other than the weld. See Figure S1.2.11.5-c1. The weld shall be at least the full thickness of the new plate being installed. Volumetric examination is not required. This type of repair shall be considered a repair.

<u>Cautionary note: Where a double-riveted lap joint is replaced with a seamless plate,</u> <u>stay pitch and stress must be considered since the doubling effect of the lap seam is</u> <u>being eliminated.</u>

Add Figure S1.2.11.5-c1

Figure S1.2.11.5-c1



VIEW SHOWING NEW PATCH ALIGNMENT WITH ORIGINAL MATERIAL

## 17-179

## PART 3, SECTION 5 REPAIRS AND ALTERATIONS — CERTIFICATION/DOCUMENTATION AND STAMPING

#### 5.1 SCOPE

This section provides requirements for certification, stamping, and documentation of repairs and alterations to pressure-retaining items. Applicable forms are provided in this section for reference. Forms may be obtained from the National Board website.

#### 5.2 DOCUMENTATION

- a) Repairs that have been performed in accordance with the NBIC shall be documented on a Form R-1, *Report of Repair*, as shown in this section. A Form R-4, *Report Supplementary*-Sheet, shall be used as needed to record additional data when the space provided on Form R-1 is not sufficient.
- b) Alterations performed in accordance with the NBIC shall be documented on a Form R-2, Report of Alteration, as shown in this section. A Form R-4, Report Supplementary-Sheet, shall be used as needed to record additional data when the space provided on Form R-2 is not sufficient.
- c) The organization performing repairs and alterations shall retain a copy of the completed Form "R" Report on file and all records and documentation substantiating the summary of work as described throughout Section 5, and as identified in the "R" Certificate Holder's Quality System Manual.

#### 5.2.1 PREPARATION OF FORM R-1 (REPAIRS) REPORT OF REPAIR

- a) Using the instructions found at NBIC Part 3, 5.12.4.1 preparation of Form R-1 shall be the responsibility of the "R" Certificate Holder performing the repair.
- b) Information describing the scope of work used to repair a pressure-retaining item (PRI) shall be documented on a Form R-1 and extended to a Form R-4 as needed to fully describe the repair activities completed per the instructions at NBIC Part 3, 5.12.4.1.
- c) An Inspector shall indicate acceptance by signing Form R-1, and Form R-4, if attached.
- d) The Form R-3, <u>Report of Parts Fabricated by Welding</u>, Manufacturer's Data Reports, and Certificates of Compliance described in this section shall be a part of the completed Form R-1 and shall be attached thereto.

#### 5.2.2 PREPARATION OF FORM R-2 (ALTERATIONS) REPORT OF ALTERATION

- a) Using the instructions found at NBIC Part 3, 5.12.4.2, initial preparation of Form R-2 shall be the responsibility of the "R" Certificate Holder responsible for the design portion of the alteration. The design organization shall complete and sign the "Design Certification" section of the Form R-2. An Inspector shall indicate acceptance of the design by signing the "Certificate of Design Change Review" section of the Form R-2.
- b) The information describing an alteration to a pressure-retaining item shall be identified on Form R-2 with a complete description of the scope of work for physical or non-physical changes. When the scope of work represents a change that will increase the Minimum Required Relieving Capacity (MRRC) of a pressure-retaining item, such as a change in heating surface, Maximum Designed Steaming Capacity (MDSC), or BTU/hr (W) heating capacity, the new MRRC shall be documented on Form R-2 and indicated on the appropriate nameplate of NBIC Part 3, Figure 5.7.5-b or NBIC Part 3, Figure 5.7.5-c.

- c) Final preparation of Form R-2, including gathering and attaching supporting reports, shall be the responsibility of the "R" Certificate Holder that performed the construction portion of the alteration. The construction organization shall complete the Form R-2 provided by the design organization, including the "Construction Certification" section of the form. An Inspector shall indicate that the work complies with the applicable requirements of this code by completing and signing the "Certificate of Inspection" section of the form. When no construction work is performed (e.g., a re-rating with no physical changes), the "R" Certificate Holder responsible for the design shall prepare the Form R-2, including gathering and attaching of supporting reports documentation.
- d) The following shall be attached to and become a part of completed Form R-2:
  - 1) For ASME boilers and pressure vessels, a copy of the original Manufacturer's Data Report, when available;
  - 2) Form R-3, Report of <u>Parts</u> Fabricated <u>Parts</u> by Welding, Manufacturer's Partial Data Reports, or Certificates of Compliance, <u>if applicable</u>; and
  - 3) For other than ASME, the manufacturer's reports (i.e., reports required by the original code of construction, etc.), when available.

#### 5.2.3 PREPARATION OF FORM R-3 REPORT OF PARTS FABRICATED BY WELDING

a) Using the instructions found at NBIC Part 3, 5.12.4.3 preparation of Form R-3 shall be the responsibility of the "R" Certificate Holder responsible for performing the work.

#### 5.2.4 PREPARATION OF FORM R-4 REPORT SUPPLEMENT SHEET

a) Using the instructions found at NBIC Part 3, 5.12.4.4 preparation of Form R-4 shall be the responsibility of the "R" Certificate Holder responsible for performing the work.

## SKIP 5.3 through 5.11

# 5.12 REPAIR AND ALTERATION FORMS AND INSTRUCTIONS FOR COMPLETING FORMS

The following forms may be used for documenting specific requirements as indicated on the top of each form.

- 5.12.1 FORM R-1, *REPORT OF REPAIR*, NB-66
- 5.12.2 FORM R-2, REPORT OF ALTERATIONS, NB-229
- 5.12.3 FORM R-3, REPORT OF PARTS FABRICATED BY WELDING, NB-230
- 5.12.4 FORM R-4, REPORT SUPPLEMENTARY SHEET, NB-231

#### 5.12.4.1 INSTRUCTIONS FOR COMPLETING NATIONAL BOARD FORM "R" REPORTS R-1

These instructions are to be used when completing the National Board Form <u>"R" Reports R-1, Report of Repair.</u> When computer generated, the format of the form shall replicate the type and relative location of the information depicted on the Form <u>"R" Reports R-1 shown in NBIC Part 3, 5.12.1</u> through 5.12.4. The

numbers below correspond to the "circled" numbers shown on the Form R-1. Note that a fillable version of the Form R-1 (NB-66,) is available on the National Board website, www.nationalboard.org.

INFO NOTE: DELETE NUMBERS 1 THROUGH 55 and INSERT 1 THROUGH 40 LISTED BELOW ALONG WITH 5.12.4.2, 5.12.4.3, and 5.12.4.4

- 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.
- <u>4) If applicable, document the unique purchase order, job, or tracking number assigned by organization performing work.</u>
- 5) The name and address of the National Board "R" Certificate Holder performing the work as it appears on the "Certificate of Authorization".
- 6) Name and address of the owner of the pressure-retaining item.
- 7) Name and address of plant or facility where the pressure-retaining item is installed.
- 8) Description of the pressure-retaining item, such as boiler or pressure vessel, or piping. Include the applicable unit identification.
- 9) Name of the original manufacturer of the pressure-retaining item. If the original manufacturer is unknown, indicate by, "unknown."
- 10) Document the serial number of the pressure-retaining item if assigned by the original manufacturer. If there is no serial number assigned or is unknown, indicate "unknown."

11) When the pressure-retaining item is registered with the National Board, document the applicable registration number. If the pressure-retaining item is installed in Canada, indicate the Canadian design registration number (CRN), and list the drawing number under "other." If the item is not registered, indicate, "none."

- 12) Indicate the jurisdiction number assigned to the pressure retaining item, if available.
- <u>13) Indicate any other unique identifying nomenclature assigned to the pressure retaining item by the owner</u> <u>or user.</u>
- 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.
- 17) Indicate the name, section, division, edition, and addenda (if applicable) of the construction code used for the work being performed. If code cases are used, they shall be identified in the "Remarks" section.

18) Check the repair type performed on the pressure retaining item.

- 19) Provide a detailed summary describing the scope of work that was completed to a pressure retaining item (PRI). The information to be considered when describing the scope of work should include such items as, the nature of the repair (i.e. welding, bonding, cementing), the specific location of the work performed to the PRI, the steps taken to remove a defect or as allowed by 3.3.4.8 to remain in place, the method of repair described as listed in the examples of Part 3, Section 3 or supplemental section if applicable, and the acceptance testing and or examination method used in accordance with the NBIC. When additional space is required to describe the scope of work, a Form R-4 shall be used and attached (check box). If a FITNESS FOR SERVICE Form (NB-403) is part of the Form R-1 repair package, check box and attach the form. Information determined to be of a proprietary nature need not be included, but shall be stated on the form.
- 20) Indicate type of pressure test applied (Liquid, Pneumatic, Vacuum, Leak). If no pressure test applied, indicate "none."
- 21) Indicate test pressure applied.
- 22) Indicate maximum allowable working pressure (MAWP) for the pressure retaining item, if known.
- 23) As applicable, identify what Replacement Parts manufactured by welding or bonding were introduced as needed to complete the scope of work. Indicate part, item number, manufacturer's name, stamped identification, and data report type or Certificate of Compliance.
- 24) Indicate any additional information pertaining to the work involved (e.g., routine repairs, code cases).

25) When registering a Form R-1 Report with the National Board, this line is solely designated for a unique sequential number assigned by the "R" Certificate Holder. When the "R" Form is not to be registered, indicate so by "N/A". As described in NBIC Part 3, 5.6, a log shall be maintained identifying sequentially, any Form "R" registered with the National Board.

- 26) If applicable, document the unique purchase order, job, or tracking number assigned by organization performing work.
- 27) Type or print name of authorized representative of the "R" Certificate Holder attesting to accuracy of the work described.
- 28) Indicate National Board "R" Certificate or Authorization number.
- 29) Indicate month, day, and year that the "R" Certificate or Authorization expires.
- 30) Record name of "R" Certificate Holder who performed the described work, using full name as shown on the Certificate of Authorization or an abbreviation acceptable to the National Board.
- 31) Signature of "R" Certificate Holder authorized representative.
- 32) Enter month, day, and year repair certified.
- 33) Type or print name of Inspector.
- 34) Indicate Inspector's Jurisdiction.
- 35) Indicate Inspector's employer.
- 36) Indicate address of Inspector's employer (city and state or province).

37) Indicate month, day, and year of final inspection by Inspector. For routine repairs this shall be the month, day, and year the Inspector reviews the completed routine repair package.

- 38) Inspectors National Board commission number and endorsement that qualifies the Inspector to sign this report, and when required by the Jurisdiction, the applicable State or Provincial numbers.
- 39) Signature of Inspector.
- 40) Indicate month, day, and year of Inspector signature.

#### 5.12.4.2 INSTRUCTIONS FOR COMPLETING NATIONAL BOARD FORM R-2 REPORT

#### INFO NOTE: THE FORM R-2 ON PAGE 91 DOES NOT HAVE THE "BUBBLED' NUMBERS. USE (INSERT) TEMPLATE FROM THE R-2 GUIDE FOR NUMBERING

These instructions are to be used when completing the National Board Form R-2, Report of Alteration. The numbers below correspond to the "circled" numbers depicted on Form R-2 in NBIC Part 3, 5.12.2. When computer generated, the format of the form shall replicate the type and relative location of the information depicted on the Form R-2 Report of Alteration. Note that a fillable version of the Form R-2 (NB-229) is available on the National Board website.

- 1) Initials of the National Board "R" Certificate of Authorization 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.
- <u>4) If applicable, document the unique purchase order, job, or tracking number assigned by organization performing work.</u>
- 5) The name and address of the National Board "R" Certificate of Authorization holder performing the design as it appears on the "Certificate of Authorization".
- 6) The name and address of the National Board "R" Certificate of Authorization holder performing the construction activity as it appears on the "Certificate of Authorization."
- 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.

- <u>14) Indicate any other unique identifying nomenclature assigned to the pressure retaining item by the owner</u> or user.
- 15) Identify the year in which fabrication/construction of the pressure retaining item was completed.
- 16) Indicate edition and addenda of the NBIC under which this work is being performed, as applicable.
- <u>17) Indicate the name, section, division, edition, and addenda (if applicable) of the original code of construction for the pressure-retaining item.</u>
- 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.
- <u>19) Provide a detailed summary of the scope of design that was performed. When additional space is</u> 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 3.3.4.8 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.

- 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" Certificate of Authorization authorized representative responsible for design certification.
- 29) Indicate National Board "R" Certificate or Authorization number.

<sup>23)</sup> Indicate maximum allowable working pressure (MAWP) for the pressure retaining item. (As altered)

- 30) Indicate month, day, and year that the "R" Certificate or Authorization expires.
- 31) Indicate month, day, and year the alteration was certified.
- 32) Record the name of National Board "R" Certificate of Authorization holder who performed the design portion of the work, using full name as shown on the "Certificate of Authorization" or an abbreviation acceptable to the National Board.
- 33) Signature of National Board "R" Certificate of Authorization authorized representative for the design change.
- 34) Type or print the name of Inspector certifying the design review.
- 35) Indicate Inspector's Jurisdiction.
- 36) Indicate Inspector's employer.
- 37) Indicate address of Inspector's employer (city and state or province).
- 38) Indicate the month, day and year of the design certification by the Inspector.
- 39) Signature of the Inspector certifying the design review.
- <u>40) Inspectors National Board commission number and endorsement that qualifies the Inspector to sign this</u> report, and when required by the Jurisdiction, the applicable State or Provincial numbers.
- 41) Type or print name of the National Board "R" Certificate of Authorization authorized representative responsible for any construction.
- 42) Indicate the National Board "R" Certificate or Authorization number.
- 43) Indicate month, day, and year the National Board "R" Certificate of Authorization expires.
- 44) Indicate the date the alteration was certified.
- <u>45) Record the name of National Board "R" Certificate of Authorization holder who performed the</u> <u>construction portion of the described work, using full name as shown on the Certificate of Authorization</u> <u>or an abbreviation acceptable to the National Board.</u>
- 46) Signature of National Board "R" Certificate of Authorization authorized representative.
- 47) Type or print the name of Inspector certifying the construction inspection.
- 48) Indicate the Inspector's Jurisdiction.
- 49) Indicate Inspector's employer.
- 50) Indicate address of Inspector's employer (city and state or province).
- 51) Indicate the month, day and year of the final inspection by the Inspector.
- 52) Indicate the month, day and year the completed Form R-2 was signed by the Inspector.
- 53) Signature of the Inspector certifying the construction inspection.

54) Inspectors National Board commission number and endorsement that qualifies the Inspector to sign this report, and when required by the Jurisdiction, the applicable State or Provincial numbers.

#### 5.12.4.3 INSTRUCTIONS FOR COMPLETING NATIONAL BOARD FORM R-3 REPORT

This guide is to be used when completing the National Board Form R-3, Report of Parts Fabricated by Welding. The numbers below correspond to the "circled" numbers shown on the Form R-3 in NBIC Part 3, 5.12.3. When computer generated, the format of the form shall replicate the type and relative location of the information depicted on the Form R-3 Report of Parts Fabricated by Welding. Note that a fillable version of the Form R-3 (NB-230) is available on the National Board website.

- 1) Initials of the National Board "R" Certificate of Authorization authorized representative who registers the Form R-3.
- 2) Initials of the Inspector who certified the completed Form R-3 for registration.
- 3) When registering a Form R-3 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, indicated so by "N/A". 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.
- 4) The name and address of the National Board "R" Certificate Holder who manufactured the welded parts as it appears on the "Certificate of Authorization".
- 5) If applicable, document the unique purchase order, job, or tracking number assigned by organization performing work.
- 6) Document name and address of organization that purchased the parts for incorporation into the repair or alteration. If the part's origin is unknown or the part was built for stock, so state.
- 7) Document name of organization responsible for specifying the code design conditions, if known. If origin of design conditions are not known, state "unknown."
- 8) Document name of organization responsible for performing the code design, if known. If code design organization is not known, state "unknown."
- 9) Name, section, and division of the design code, if known. If the design is not known, state "unknown."
- 10) Indicate code edition year used for fabrication.
- 11) Indicate code addenda date used for fabrication, if applicable.
- 12) Indicate the code paragraph reference for formula used to establish the MAWP, if known. If the code reference of the formula is not known, state "unknown."
- 13) If available, identify component by part's original name, function, or use the original equipment manufacturers "mark or item number."
- 14) Indicate quantity of named parts.
- 15) Match line number of part references for Identification of Parts in item 5 and the Description of Parts in item 6.
- 16) Indicate manufacturer's serial number or identification number for the named part.
- 17) Indicate drawing number for the named part.

- 18) Indicate maximum allowable working pressure (MAWP) for the part, if known.
- 19) Indicate test pressure, if applied.
- 20) Identify the year in which fabrication/construction of the item was completed.
- 21) Use inside diameter for size: indicate shape as square, round, etc.
- 22) Indicate the complete material specification number and grade.
- 23) Indicate nominal thickness of plate and minimum thickness after forming.
- 24) Indicate shape as flat, dished, ellipsoidal, or hemispherical.
- 25) Indicate minimum thickness after forming.
- 26) Indicate the complete material specification number and grade for the head or end.
- 27) Indicate outside diameter.
- 28) Indicate minimum thickness of tubes.
- 29) Indicate the complete material specification number and grade for tubes.
- 30) Indicate any additional information pertaining to the work involved (e.g. code cases). The part manufacturer is to indicate the extent he has performed any or all of the design function. If only a portion of the design, state which portion.
- 31) When registering a Form R-3 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, indicated so by "N/A". 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.
- 32) If applicable, document the unique purchase order, job, or tracking number assigned by organization performing work.
- <u>33) Type or print name of authorized representative of the "R" Certificate Holder attesting to accuracy of the work described.</u>
- 34) Indicate National Board "R" Certificate of Authorization number.
- 35) Indicate month, day, and year that the "R" Certificate of Authorization expires.
- 36) Indicate the date the repair was certified.
- <u>37) Record name of "R" Certificate Holder who performed the described work, using full name as shown on the Certificate of Authorization or an abbreviation acceptable to the National Board.</u>
- 38) Signature of National Board "R" Certificate of Authorization authorized representative.
- 39) Type or print name of Inspector.
- 40) Indicate Inspector's Jurisdiction.
- 41) Indicate Inspector's employer.
- 42) Indicate address of Inspector's employer (city and state or province).
- 43) Indicate month, day, and year of final inspection by Inspector.

44) Indicate the month, day and year the completed Form "R" was signed by the Inspector.

- 45) Signature of Inspector.
- 46) Inspectors National Board commission number and endorsement that qualifies the Inspector to sign this report, and when required by the Jurisdiction, the applicable State or Provincial numbers.

#### 5.12.4.4 INSTRUCTIONS FOR COMPLETING NATIONAL BOARD FORM R-4 REPORT

This guide is to be used when completing the National Board Form R-4, Report Supplement Sheet. The numbers below correspond to the "circled" numbers shown on the Form R-4 in NBIC Part 3, 5.12.4. When computer generated, the format of the form shall replicate the type and relative location of the information depicted on the Form R-4, Report Supplement Sheet. Note that a fillable version of the Form R-4 (NB-231) is available on the National Board website.

- 1) When registering a Form "R" 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, Paragraph 5.6, a log shall be maintained identifying unique and sequentially numbered Form "R" reports that are registered with the National Board. Complete information identical to that shown on the Form "R" to which this sheet is a supplement.
- 2) If applicable, document the unique purchase order, job, or tracking number, assigned by the organization performing work.
- 3) The name and address of the Certificate Holder performing the work as it appears on the "Certificate of <u>Authorization".</u>
- 4) Name and address of the owner of the pressure-retaining item.
- 5) Name and address of plant or facility where the pressure-retaining item is installed.
- 6) Indicate the Form "R" type to which this report is supplementary. Example: Form R-1, Form R-2, Form R-3.
- 7) Indicate the reference line number from the Form "R" to which this report is supplementary.
- 8) Complete information for which there was insufficient space on the reference Form "R".
- 9) Indicate the date certified.
- 10) Signature of the repair organizations authorized representative.
- <u>11) Record name of "R" Certificate Holder who performed the described work, using full name as shown on</u> <u>the Certificate of Authorization or an abbreviation acceptable to the National Board.</u>
- 12) Indicate the date the form was completed by the Inspector.
- 13) Signature of the Inspector.
- 14) Inspectors National Board commission number and endorsement that qualifies the Inspector to sign this report, and when required by the Jurisdiction, the applicable State or Province numbers.



NB-66, Rev. 15, (03/10/18)

	FOR in accordance with	M R-1 REPOR provisions of the /			(Inspec	1 rized Rep. initials) 2 tors initials) 3
1.	WORK PERFORMED BY:	5				R" Registration no.) 4
2.	(address) DWNER:	6				
3.	(address) LOCATION OF INSTALLATION:	7				
4.	(address) ITEM IDENTIFICATION:8		AL MANUFACTUR	ER:	9	
5.	(boiler, pressure vessel, or piping) IDENTIFYING NOS:	11	<u> </u>	12	13	14
6.	(mfg. serial no.) NBIC EDITION/ADDENDA:	(National Board no.)	(jurisdict	ion no.)	(other)	(year built)
	(edition) Original Code of Construction for Item:	ction / division)			(edition / addenda)	
7.	Construction Code Used for Repair Performed: 18 REPAIR TYPE: U welded Graphite press	(name / section / division	□ FRP pressure e	quipment	(edition / addenda)	
8.	DESCRIPTION OF WORK: Form R-4, Report (use Form R-4, of neccessary))	Supplementary Shee	t is attached	FFSA Form	(NB-403) is attache	d
	ν.	19				
9.	20 (Liquid, Pneumatic, Vacuum, Leak) REPLACEMENT PARTS: (Attached are Manufacturer's F	Partial Data Reports or F	prin R-3's properly co	MAWP	22 ollowing items of this	psi
	(name of part, item number, data report type or certificate of C	ompliance, mfg's. name an 23	d identifying stamp)			
)	REMARKS:	24				



NB-66, Rev. 15, (03/10/18)

25 (Form "R" Reaistration no.) 26

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

	CERTIFICATE OF COMPLIANCE		
I,27 correct and that all material, construction, and w "R" Certificate of Authorization No	, certify that to the best of my knowle workmanship on this Repair conforms 28 Exp	to the National Board Inspection Co	ode. National Board
Repair Organization:	30		
Signed: 31			
(authorized representative) Date:32	_		
	CERTIFICATE OF INSPECTION		
l, 33	, holding a valid commission issued b	y the National Board of Boiler and	Pressure Vessel
Inspectors and certificate of competency, where 35 have inspected the work described in this report	e required, issued by the Jurisdiction of	34 36	and employed by
have inspected the work described in this repor	t on 37,	37	and state
that to the best of my knowledge and belief, thi	s work complies with the applicable re	quirements of the National Board	Inspection Code. By
signing this certificate, neither the undersigned in this report. Furthermore, neither the undersig	nor my employer makes any warranty, aned nor my employer shall be liable in	expressed or implied, concerning	I the work described
or loss of any kind arising from or connected wi		rany manner for any personaring	iry, property damage,
Commissions:	38		
(National Board and Jurisdiction no. in Signed:	cluding endorsement)		7
(inspector)	- Hereiten auf der Bertraussen auf der		
Date: 40	-		



NB-229, Rev. 8, (12/07/16)

		<b>-2 REPORT OF AL</b> rovisions of the National		(Authorized Rep. initials) (Inspectors initials) 3
1a.	DESIGN PERFORMED BY:	5 ponsible for design)		(Form "R" Registration no.) 4 (P.O. no., job no., etc.)
1b.	(address) CONSTRUCTION PERFORMED BY:	6 on responsible for construction)		
2.	(address) OWNER OF PRESSURE RETAINING ITEM:	7		
3.	(address) LOCATION OF INSTALLATION:	8		
4.	(address) ITEM IDENTIFICATION: (boiler, pressure vessel, or piping)	NAME OF ORIGINAL MANU	JFACTURER:	10
$\bigcirc$	IDENTIFYING NOS: <u>11</u> (mfg. serial no.)	12 (National Board no.)	13 (jurisdiction no.) 16	(other) (year built)
6.	(edition) Original Code of Construction for Item:	ion / division)		17 (edition / addenda) 18 (edition / addenda)
7a.	DESCRIPTION OF DESIGN SCOPE: Form R-4, Re	eport Supplementary Sheet i 19	s attached	
7b.		rm R-4, Report Supplementa 20	ry Sheet is attached	

22

\_ psi

MAWP \_

Pressure Test, if applied \_\_\_\_\_

21

\_ psi

23



NB-229, Rev. 8, (12/07/16)

(Form "R" Registration no.) 26 (P.O. no., job no., etc.)

8.	REPLACEMENT PARTS: (Attached are Manufacturer's Partial Data Reports or Form R-3's properly completed for the following items of this report):
	(name of part, item number, data report type or Certificate of Compliance, mfg's, name and identifying stamp)

	(name of part, item number, data report type or Certificate of Compliance, migs, name and identifying stamp)
	26
9.	REMARKS:
	27
	21
	DESIGN CERTIFICATION
	28 certify that to the best of my knowledge and belief the statements in this report are correct and that the
1/_	, certify that to the best of my knowledge and belief the statements in this report are correct and that the
De	sign Change described in this report conforms to the National Board Inspection Code. National Board "R" Certificate of Authorization No. 29 expires on 30
Da	
24	(name of design organization) (authorized representative)
	CERTIFICATE OF DESIGN CHANGE REVIEW
I,	34, holding a valid Commission issued by The National Board of Boiler and Pressure Vessel
Ins	pector and certificate of competency, where required, issued by the jurisdiction of <u>35</u> and employed by
	36 of 37
ha	ve reviewed the design change as described in this report and state that to the best of my knowledge and belief such change complies with
	applicable requirements of the National Board Inspection Code.
By	signing this certificate, neither the undersigned nor my employer makes any warranty, expressed or implied, concerning the work described
in t	this report. Furthermore, neither the undersigned nor my employer shall be liable in any manner for any personal injury, property damage or
los	s of any kind arising from or connected with this inspection.
Da	
	(inspector) (National Board and jurisdiction no. including endorsement)
	CONSTRUCTION CERTIFICATION
ĩ	41 certify that to the best of my knowledge and belief the statements in this report are correct and that all
1,	41, certify that to the best of my knowledge and belief the statements in this report are correct and that all Iterial, construction, and workmanship on this Alteration conforms to the National Board Inspection Code. National Board "R" Certificate of
Da	10
Du	(name of alteration organization) (authorized representative)
_	
	CERTIFICATE OF INSPECTION
2	
4	, notaing a valid commission issued by the National Board of Boller and Plessure vessel
In	spectors and certificate of competency, where required, issued by the Jurisdiction of48and employed by
	49 of 50
	ave inspected the work described in this report on <u>51</u> and state
	nat to the best of my knowledge and belief, this work complies with the applicable requirements of the National Board Inspection Code. By
in	gning this certificate, neither the undersigned nor my employer makes any warranty, expressed or implied, concerning the work described this report. Furthermore, neither the undersigned nor my employer shall be liable in any manner for any personal injury, property damage
0	r loss of any kind arising from or connected with this inspe <u>ction</u> .
	ate 52 Signed 53 54
0	(inspector) (National Board and jurisdiction no. including endorsement)



NB-230, Rev. 4 (12/08/16)

			PORT OF PARTS FAB with provisions of the Nation	RICATED BY WELDING nal Board Inspection Code	G (Authorized Rep. initials) (Inspectors initials) 3
1.	MANUFACTURED BY:	(name of "R" certificate hold			(Form "R-3" Registration no.) 5 (P.O. no., job no., etc.)
2.	(address) MANUFACTURED FOR: (name)		6		
	(address)		_		
3.	DESIGN CONDITION SP	ECIFIED BY:	7	CODE DESIGN BY:	8
4.	DESIGN CODE:	9	10	11	12

#### 5. REPAIR/ALTERATION/MODIFICATION ACTIVITIES

Name of Part	Qty.	Line No.	Manufacturer's Identifying No.	Manufacturer's Drawing No.	MAWP	Shop Hydro PSI	Year Built
13	14	15	16	17	18	19	20
					_		

#### 6. DESCRIPTION OF PARTS

	(a) Conne	ections other t	han tubes		Heads or Ends	;		(b) Tubes	
Line No.	Size and Shape	Material Spec. No.	Thickness (in.)	Shape	Thickness (in.)	Material Spec. No.	Diameter (in.)	Thickness (in.)	Material Spec. No
	21	22	23	24	25	26	27	28	<mark>29</mark>
	1								
	-								

7 REMARKS:

Attachment Page 81 of 145



NB-230, Rev. 4 (12/08/16)

(Form "R-3" Registration no.) 32 (P.O. no., job no., etc.)

	CERTIFICATE OF COMI	PLIANCE			
I,, cer correct and that all material, fabrication, construction <i>Code</i> and the standards of construction cited.			e statements made in this report are is to the <i>National Board Inspection</i>		
National Board "R" Certificate of Authorization No.	34	expires on:	35		
Date 36	37	Signed	38		
	(name of "R" Certificate		(Authorized Representative)		
Inspectors and certificate of competency, where requ	ired, issued by the Jurisc	issued by the National Boa liction of of	42		
have inspected the part described in this report on and state that to the best of my knowledge and belief the parts comply with the applicable requirements of the <i>National Board Inspection Code</i> .					
By signing this certificate, neither the undersigned no described in this report. Furthermore, neither the und property damage, or loss of any kind arising from or o	dersigned nor my employ	ver shall be liable in any ma			
Date Signed	45	Commissions	46		
(inspecto	or)	(National Board	and jurisdiction No. including endorsement)		



NB-231, Rev. 3, (12/08/16)

(form "R" referenced)

#### FORM R-4 REPORT SUPPLEMENT SHEET

in accordance with provisions of the National Board Inspection Code

INVORK PERFORMED BY:       (name)         (name)       (name)			
indefense           2. OWNER:           innemed           indefensel           3. LOCATION OF INSTALLATION:           (runne)			(P.O. no., job no., etc.)
indetexal         2       OWNER:         (redress)         3.       LOCATION OF INSTALLATION:         indetexal         indetexal <t< th=""><th>1. WORK PER</th><th></th><th></th></t<>	1. WORK PER		
2. OWNER:		(name)	
2. OWNER:	(addross)		
(rame)  [pddress)  . LOCATION OF INSTALLATION:			
iaddress)         3. LOCATION OF INSTALLATION:         iaddress)         REFERENCE         LINE NO.       CONTINUED FROM FORM R	2. OWNER:	name)	
3. LOCATION OF INSTALLATION:	· · · · ·		
(adress)         REFERENCE         LINE NO.       CONTINUED FROM FORM R	(address)		
(adress)         REFERENCE         LINE NO.       CONTINUED FROM FORM R	3. LOCATION	OF INSTALLATION:	
REFERENCE       CONTINUED FROM FORM R		(name)	
REFERENCE       CONTINUED FROM FORM R	(		
LINE NO. CONTINUED FROM FORM R	(address)		
LINE NO. CONTINUED FROM FORM R			
Date     Signed     Image: Constraint of the second	LINE NO.	CONTINUED FROM FORM R	
Date     Signed     Image: Constraint of the second			
Date     Signed     Image: Constraint of the second			
Date     Signed     Image: Constraint of the second			
Date     Signed     Image: Constraint of the second			
Date     Signed     Image: Constraint of the second			
Date     Signed     Image: Constraint of the second			
Date     Signed     Image: Constraint of the second			
Date     Signed     Image: Constraint of the second			
Date     Signed     Image: Constraint of the second			
Date     Signed     Image: Constraint of the second			
Date     Signed     Image: Constraint of the second			
Date     Signed     Image: Constraint of the second			
Date     Signed     Image: Constraint of the second			
Date     Signed     Image: Constraint of the second			
Date     Signed     Image: Constraint of the second			
Date     Signed     Image: Constraint of the second			
Date     Signed     Image: Constraint of the second			
Date     Signed     Image: Constraint of the second			
Date     Signed     Image: Constraint of the second			
Date     Signed     Image: Constraint of the second			
Date     Signed     Image: Constraint of the second			
Date     Signed     Image: Constraint of the second			
Date     Signed     Image: Constraint of the second			
Date     Signed     Image: Constraint of the second			
Date     Signed     Image: Constraint of the second		10	
Date Signed 13 Commissions	Date	Signed	
Date Signed Commissions			(Name of " <b>R</b> " certificate holder)
(inspector) (National Board and jurisdiction no. including endorsement)	Date	Signed	
		(inspector)	(National Board and jurisdiction no. including endorsement)

SubjectCode Revision to Part 3, 2.5.3.6File NumberNB18-12Prop. on Pg.2ProposedRevisionThe revision is to Welding Method 6 to allow for weld build-upStatement ofThe revision is to Welding Method 6 to allow for weld build-upNeedThe revision or mechanical damage.

**Project Manager** 

John Siefert/G. Galanes

#### SG Meeting Date

## <u>SubGroup</u> <u>Negatives</u>

Background;

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

#### <u>Item 18-12</u> 2.5.3.6 WELDING METHOD 6

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

a) This method is limited to butt welds or weld build-up repairs limited to 100 square inches (64,500 square mm) or less in size in tubing NPS 5 (DN 125) or less in diameter and ½ in. (13 mm) or less in wall thickness for which the applicable rules of the original code of construction did not require notch toughness testing;

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

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

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

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

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

4) Qualification thickness limits of base metal and weld deposit thickness shall be in accordance with ASME Section IX, QW-451.
5) The Welding Procedure Specification (WPS) shall be qualified in accordance with the requirements of ASME Section IX. No postweld heat treatment shall be applied to the test coupon. Additionally, the WPS shall include the following requirements:

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

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

c. Regardless of the welding process (SMAW and/or

GTAW), only the use of stringer beads shall be permitted.

d. The filler metal shall be limited to an austenitic, nickelbase filler metal having a designation F-No. 43 and limited to the following consumables: ERNiCr-3, ENiCrFe-3, ENiCrFe2, ASME B&PV Code Cases 2733 and 2734 (e.g. EPRI P87); or

e. A martensitic, iron-base filler metal having a designation F-No. 4 or F-No. 6 and limited to the following consumables: E8015-B8, E8018-B8 or ER80S-B8.

f. For weld build-up repairs due to wastage, the filler metal shall be limited to an austenitic, nickel-base filler metal having a designation F-No. 43. There is not a limit on the consumable for this repair application. SubjectCode Revision to Part 3, 2.5.3.6File NumberNB18-13Prop. on Pg.2ProposedRevisionThe revision is to add a new Welding Method 7 to allow for<br/>dissimilar metal welding of Grade 91 to austenitic steels and low<br/>alloy steels in a boiler setting and limited to butt welds, in<br/>accordance with approved welding method 6.

Project Manager Joh

John Siefert/G. Galanes

#### SG Meeting Date

<u>SubGroup</u> <u>Negatives</u>

Background;

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

## <u>NB Item 18-13</u> 2.5.3.7 WELDING METHOD 7

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

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

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

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

For DMW of Grade 91 to austenitic steel steel tubing:

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

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

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

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

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

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

<u>The maximum interpass temperature shall be 550°F</u> (290°C).

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

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

<u>d). 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 (e.g., Filler Metal 82), ENiCrFe-3 (e.g., INCONEL Welding Electrode 182), ENiCrFe-2 (e.g., INCO-WELD A), ASME B&PV Code Cases 2733 and 2734 (e.g. EPRI P87); e. A martensitic, iron-base filler metal having a designation F-No. 4 or F-No. 6 and limited to the following consumables: E8015-B8, E8018-B8 or ER80S-B8.
</u>

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

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

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

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

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

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

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

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

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

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

(d). The filler metal shall be limited to 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.

#### NB18-5 replaces NB13-1401

#### S1.2.9.6 RE-ROLLING OF FLUE-TUBES AFTER SEAL WELDING

All flues and tubes that are installed by rolling and seal welding shall be re-rolled after seal welding is complete.

#### S1.2.9.6 INSTALLATION OF BOILER FLUES

Maximum allowable working pressure and nominal wall thickness for flues shall be determined using TABLE S1.2.9.1 and TABLE S1.2.9.1M

Except as otherwise specified in this Part, flues shall be attached as illustrated in Figure S1.2.9.6 (a thru e). Flues shall not be attached by welding alone.

All flues smaller than 3 in. (75 mm) O.D. shall be expanded and beaded, with or without seal welding, or expanded and welded on the firebox end. At least 1 in 10 distributed evenly on the front flue sheet shall be expanded and beaded or expanded and welded. All flues 3 in. (75 mm) O.D. and larger shall be expanded and beaded, with or without seal welding, or expanded and welded at both ends. All adjacent flues smaller than 3 in. (75 mm) O.D. that are within the area occupied by the larger superheater flues shall be expanded and beaded or expanded and welded at both ends. At least 1 in 10 of the remaining flues smaller than 3 in.(75 mm) O.D. shall be beaded and/or welded on the front flue sheet, in addition to expanding. Where less than all flues are welded or beaded on the front flue sheet, those welded or beaded shall be distributed as evenly as practicable throughout the flue pack.

<u>Flues shall be re-expanded upon completion of seal welding or beading, or both.</u> The new reduced wall thickness of the enlarged flue end shall be reviewed to confirm that upon completion of the flue expansion process the new wall thickness will be sufficient for the MAWP.

When stipulated by the original design, the ends of boiler flues may be swaged to a smaller or larger diameter as required to fit the tube sheet holes. The swaging shall create smooth surfaces, smooth curves, and a uniform diameter reduction across the entire swaged length. Swaging or not swaging is considered a repair.

When flues are applied by expanding and seal welding, the seal weld shall protrude beyond the sheet a distance of 1/8 in. to 1/4 in. (3 mm to 6 mm) inclusive [see Figure S1.2.9.1-b] and the end of the flue shall not protrude past the weld. The end of the flue shall be ground or polished to eliminate any sharp edges.

Prior to welding, beading, or both, ensure that the flue is satisfactorily seated in the sheet. Seal welding may be done with water in the boiler, provided the water is heated to between 100°F and 120°F (38°C and 50°C).

<u>Ferrous or nonferrous ferrules may be used on either or both ends of flues. When seal welding over</u> <u>ferrous ferrules used in straight-expanded and seal-welded flues, the weld shall attach to the sheet and</u>

# not just to the ferrule. Care shall be taken to avoid contamination of seal welds when nonferrous ferrules are used.

#### Cautionary Note:

Boiler flues shall be cut to or made to the correct length required for installation when the boiler and flues are at equal temperature. The use of heating or stretching the flue during installation to obtain the required length by thermal or mechanical expansion is prohibited.

#### S1.2.9.8 FLUES SMALLER THAN 3 INCHES

All flues smaller than 3 in. (76 mm) OD shall be rolled and beaded or rolled and seal welded on the firebox end, and at least one in ten at the front flue sheet end. All flues 3 in. (76 mm) OD and larger shall be rolled and beaded or rolled and seal welded at both ends and all adjacent flues smaller than 3 in. (76 mm) OD that are within the large flue pack shall be rolled and beaded or rolled and seal welded at both ends. At least one in ten of the remaining flues smaller than 3 in. (76 mm) OD shall be beaded or seal welded on the front flue sheet, in addition to rolling. Where less than all flues are seal welded or beaded on the front flue sheet, those seal welded or beaded shall be distributed as evenly as practicable throughout the flue pack. This shall be considered a repair.

# NB18-7

# Fillet Welded Staybolts

NBIC Part 3, S1.2.5.1;

<u>The replacement of threaded staybolts with fillet welded staybolts is permissible. The work</u> <u>shall be done in accordance with the ASME BPVC, Section I, Part PL-30 and Figure PL-30.4.2-1.</u> <u>When replacing a threaded staybolt with a fillet welded staybolt, the existing threads in the</u> <u>sheets must be removed prior to installation. Cautionary Note: Larger minimum diameter</u> <u>staybolts will transfer stresses to other structures and will be subject to higher extreme fiber</u> <u>stresses.</u>

# Repairs to un-threaded fillet welded staybolts shall be performed in accordance with the original code of construction. If the original code of construction is not known, repairs shall be performed as follows in accordance with an appropriate code of construction that allows fillet welded staybolts:

- a) The replacement of un-threaded fillet welded staybolts is permissible.
- b) Existing un-threaded fillet welded staybolts that leak shall be repaired by re-welding after mechanically removing the entire weld. Only the leaking stays are to be re-welded.
- c) Minor leakages (sweat pores) may be repaired by gently caulking the fillet weld. <u>However, identifiable cracks shall be removed before re-welding.</u>

#### NB Item # 18-14, Update NBIC Part 3, Clause 2.3 and Table 2.3

Revise Clause 2.3 to recognize Re-affirmed, Amended and Revised SWPS confirming that suitability is as listed in Table 2.3

#### EXISTING TEXT

# 2.3 STANDARD WELDING PROCEDURE SPECIFICATIONS

a) One or more SWPSs from NBIC Part 3, Table 2.3 may be used as an alternative to one or more WPS documents qualified by the organization making the repair or alteration, provided the organization accepts by certification (contained therein) full responsibility for the application of the SWPS in conformance with the application as stated in the SWPS. When using SWPSs, all variables listed on the Standard Welding Procedure are considered essential and, therefore, the repair organization cannot deviate, modify, amend, or revise any SWPSs. US Customary Units or metric units may be used for all SWPSs in NBIC Part 3, Table 2.3, but one system shall be used for application of the entire SWPS

in accordance with the metric conversation table contained in the SWPS. The user may issue supplementary instructions as allowed by the SWPS. Standard Welding Procedures Specifications shall not be used in the same product joint together with the other Standard Welding Procedure Specifications or other welding procedure specifications qualified by the organization.

b) The AWS reaffirms SWPSs in accordance with ANSI procedures. When reaffirmation occurs without revision to the SWPS, the letter "R" is added to the SWPS designation prior to the year. Such designation is considered to be identical with the previously published version and may be used pending incorporation herein, on the same basis as the version listed in NBIC Part 3, Table 2.3.

#### PROPOSED REVISION

# **2.3 STANDARD WELDING PROCEDURE SPECIFICATIONS**

a) One or more SWPSs from NBIC Part 3, Table 2.3 may be used as an alternative to one or more WPS documents qualified by the organization making the repair or alteration, provided the organization accepts by certification (contained therein) full responsibility for the application of the SWPS in conformance with the application as stated in the SWPS. When using SWPSs, all variables listed on the Standard Welding Procedure are considered essential and. therefore, the repair organization cannot deviate, modify, amend, or revise any SWPSs. US Customary Units or metric units may be used for all SWPSs in NBIC Part 3, Table 2.3, but one system shall be used for application of the entire SWPS in accordance with the metric conversation table contained in the SWPS. The user may issue supplementary instructions as allowed by the SWPS. Standard Welding Procedures Specifications shall not be used in the same product joint together with the other Standard Welding Procedure Specifications or other welding procedure specifications qualified by the organization. b) The AWS reaffirms, amends or revises SWPSs in accordance with ANSI procedures.

- <u>Reaffirmed SWPSs: When reaffirmation occurs without</u> revision to the SWPS, the letter R is added to the SWPS <u>designation</u>.
- <u>Amended SWPSs: When an amendment occurs the</u> <u>initials AMD1 is added to the SWPS designation</u> <u>Amendments are issued when essential for the prompt</u> <u>correction of an error that could be misleading.</u> <u>Amendments are incorporated into the existing text of</u> <u>the SWPS, which is reprinted and clearly marked as</u> <u>incorporating an amendment(s), and which is identified</u> in the revised Foreword of the amended SWPS.
- Revised SWPSs: When a revision to a published SWPS
  occurs, the publication date is added to the SWPS
  designation. The date of the superseded SWPS is also
  noted on the cover page. Previous versions of the
  superseded SWPS may be used at the option of the R
  Certificate holder.

#### See the addition of 5 amended SWPS Highlighted in Red Type and 1 SWPS correction also Highlighted in Red; Type

#### Carbon Steel — (P1 Materials)

SMAW — Shielded Metal Arc Welding	
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel, (M-1/P-1, Group 1 or 2), 3/16 in. (5 mm) through 3/4 in. (19 mm), in the As-Welded Condition, With Backing.	B2.1.001-90 and B2.1-1-001: 90(R2006)
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, E7018, As-Welded or PWHT Condition.	B2.1-1-016-94 and B2.1-1-016-94R
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, E6010, As-Welded or PWHT Condition.	B2.1-1-017-94 and B2.1-1-017-94R
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, E6010 (Vertical Uphill) followed by E7018, As-Welded or PWHT Condition.	B2.1-1-022-94 and B2.1-1-022-94R
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, E6010 (Vertical Downhill) followed by E7018, As-Welded or PWHT Condition.	B2.1-1-026-94 and B2.1-1-026-94R
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 3/4 in. (19 mm) Thick, E6010 (Vertical Uphill) followed by E7018, (Vertical Uphill) As-Welded Condition, Primarily Pipe Applications.	B2.1-1-201-96, and B2.1-1-201- 96(R2007)
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 3/4 in. (19 mm) thick, E6010 (Vertical Downhill) followed by E7018 (Vertical Uphill), As-Welded Condition, Primarily Pipe Applications.	B2.1-1-202- 96(R2007)
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 3/4 in. (19 mm) Thick, E6010 (Vertical Uphill), As-Welded Condition, Primarily Pipe Applications.	B2.1-1-203-96 and B2.1-1-203- 96(R2007)
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 3/4 in. (19 mm) Thick, E6010 (Vertical downhill root with balance vertical uphill), As-Welded Condition, Primarily Pipe Applications.	B2.1-1-204-96 and B2.1-1-204- 96(R2007)
itandard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 nm) through 1 ½ in. (38 mm) Thick, E6010 (Vertical Uphill) followed by E7018 (Vertical Uphill), As-Welded or PWHT Condition, Primarily Pipe Applications.	
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 3/4 in. (19 mm) Thick, E6010 (Vertical Downhill) followed by E7018 (Vertical Uphill), As-Welded or PWHT Condition, Primarily Pipe Applications.	B2.1-1-206-96 and B2.1-1-206- 96(R2007)
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 3/4 in. (19 mm) Thick, E7018, As-Welded or PWHT Condition, Primarily Pipe Applications.	B2.1-1-208-96
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through1 ½ in. (38 mm) Thick, E7018, As-Welded or PWHT Condition, Primarily Pipe Applications.	B2.1-1-208- 96(R2007)
GTAW — Gas Tungsten Arc Welding	
Standard Welding Procedure Specification for Gas Tungsten Arc Welding of Carbon Steel, (M-1/P-1, Group 1 or 2), 3/16 in. (5 mm) through 7/8 in. (22 mm) Thick, in the As-Welded Condition, With or Without Backing.	B2.1-002-90, B2.1- 002-90(R2006) and B2.1-1-002-90R
Standard Welding Procedure Specification for Gas Tungsten Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 3/4 in. (19 mm) Thick, ER70S-2, As-Welded or PWHT Condition, Primarily Pipe Application.	B2.1-1-207-96

Standard Welding Procedure Specification for Gas Tungsten Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 1 ½in. (38 mm) Thick, ER70S-2, As-Welded or PWHT Condition, Primarily Pipe Application.	B2.1-1-207-96 (R2007)	
Standard Welding Procedure Specification for Gas Tungsten Arc Welding (Consumable Insert) of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 3/4 in. (19 mm) Thick, INMs1 and ER70S-2, As-Welded or PWHT Condition, Primarily Pipe Application.		
Standard Welding Procedure Specification for Gas Tungsten Arc Welding with Consumable Insert Root of Carbon Steel (M-1/P-1/S- 1, Group 1 or 2), 1/8 in. (3.2 mm) through 1-1/2 in. (38 mm) Thick, INMs-1, ER70S-2, As-Welded or PWHT Condition, Primarily Pipe Applications.		
FCAW — Flux Core Arc Welding		
Standard Welding Procedure Specification for Self-Shielded Flux Cored Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, E71T-8, As-Welded Condition.	B2.1-1-018-94 and B2.1-1.018-94R	
Standard Welding Procedure Specification for CO2 Shielded Flux Cored Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, E70T-1 and E71T-1, As-Welded Condition.	B2.1-1-019-94, B2.1-1-019-94R and B2.1-1-94 AMD1	
Standard Welding Procedure Specification for 75% Ar/25% CO2 Shielded Flux Cored Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 1-1/2 in. (38 mm) Thick, E70T-1M and E71T-1M, As-Welded or PWHT Condition.	B2.1-1-020-94, B2.1-1-020-94R and B2.1-1-020 94- <u>AMD1</u>	
Standard Welding Procedure for Self-Shielded Flux Cored Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 1/2 in. (13 mm) Thick, E71T-11, As-Welded Condition.		
Standard Welding Procedure Specification (SWPS) for Argon Plus 25% Carbon Dioxide Shielded Flux Cored Arc Welding of Carbon Steel (M-1/P-1/S-1, Groups 1 and 2), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, E7XT-XM, As-Welded or PWHT Condition, Primarily Pipe Applications.		
GMAW – Gas Metal Arc Welding		
Standard Welding Procedure Specification for Argon Plus 25% Carbon Dioxide Shielded Gas Metal Arc Welding (Short Circuiting Transfer Mode) followed by Argon Plus 2% Oxygen Shielded Gas Metal Arc Welding (Spray Transfer Mode) of Carbon Steel (M-1/P-1/S-1, Groups 1 and 2), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, ER70S-3, Flat Position Only, As-Welded or PWHT Condition, Primarily Pipe Applications.	B2.1-1-233: 2006	
Standard Welding Procedure Specification for Argon Plus 2% Oxygen Shielded Gas Metal Arc Welding (Spray Transfer Mode) of Carbon Steel (M-1/P-1/S-1, Groups 1 and 2), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, ER70S-3, Flat Position Only, As-Welded or PWHT Condition, Primarily Pipe Applications.		
GTAW/SMAW Combination of Welding Processes		
Standard Welding Procedure Specification for Gas Tungsten Arc Welding Followed by Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, ER70S-2 and E7018, As-Welded or PWHT Condition.	B2.1-1-021-94 and B2.1-1-021-94R	
Standard Welding Procedure Specification for Gas Tungsten Arc Welding followed by Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Groups 1 or 2), 1/8 in. (3.2 mm) through 3/4 in. (19 mm) Thick, ER70S-2 and E7018, As-Welded or PWHT Condition,	B2.1-1-209-96	
Primarily Pipe Applications.		
	B2.1-1-209-96 (R2007)	

Welded or PWHT Condition, Primarily Pipe Applications.	
Standard Welding Procedure Specification for Gas Tungsten Arc Welding with Consumable Insert Root Followed by Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, INMs-1, ER70S-2, and E7018 As-Welded or PWHT Condition, Primarily Pipe Applications.	
GMAW/FCAW – Combination of Welding Processes	
Standard Welding Procedure Specification for Argon Plus 25% Carbon Dioxide Shielded Gas Metal Arc Welding (Short Circuiting Transfer Mode) Followed by Argon Plus 25% Carbon Dioxide Shielded Flux Cored Arc Welding of Carbon Steel (m-1/P-1/S-1, Groups 1 and 2), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, ER70S-3 and EXT-X, As-Welded or PWHT Condition, Primarily Pipe Applications.	B2.1-1-232:2006

#### Austenitic Stainless Steel — (M8/P8/S8 Materials)

SMAW — Shielded Metal Arc Welding		
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 in. (3.2 mm) through 1½ in. (38 mm) Thick, As-Welded Condition.	B2.1-8-023-94	
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 in. (3.2 mm) through 1½ in. (38 mm) Thick, E3XX-XX, As-Welded Condition, Primarily Pipe Application.	B2.1-8-213-97 and B2.1-8-213- 96(R2007)	
GTAW — Gas Tungsten Arc Welding		
Standard Welding Procedure Specification for Gas Tungsten Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 n. (3.2 mm) through 1 ½ in. (38 mm) Thick, As-Welded Condition.	B2.1-8-024-94	
Standard Welding Procedure Specification for Gas Tungsten Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/16 in. (1.6 mm) through 1 ½ in. (38 mm) Thick, ER3XX, As-Welded Condition, Primarily Plate and Structural Applications.		
Standard Welding Procedure Specification for Gas Tungsten Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/16 in. (1.6 mm) through 1 ½ in. (38 mm) Thick, ER3XX, As-Welded Condition, Primarily Pipe Applications.		
Standard Welding Procedure Specification for Gas Tungsten Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/16 in. (1.6 mm) through 1 ½ in. (38 mm) thick, ER3XX, As-Welded Condition, Primarily Pipe Applications.		
Standard Welding Procedure Specification for Gas Tungsten Arc Welding With Consumable Insert Root of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, IN3XX and ER3XX As-Welded Condition, Primarily Pipe Applications.		
Combination Processes GTAW/SMAW		
Standard Welding Procedure Specification for Gas Tungsten Arc Welding followed by Shielded Metal Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, As-Welded Condition.		
Standard Welding Procedure Specification for Gas Tungsten Arc Welding followed by Shielded Metal Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, ER3XX and E3XX-XX, As-Welded Condition, Primarily Plate and Structural Applications.		
Standard Welding Procedure Specification for Gas Tungsten Arc Welding Followed by Shielded Metal Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, ER3XX and E3XX-XX, As-Welded Condition, Primarily Pipe Applications.		
Standard Welding Procedure Specification for Gas Tungsten Arc Welding Followed by Shielded Metal Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, ER3XX and E3XX-XX, As-Welded Condition, Primarily Pipe Applications.		

Standard Welding Procedure Specification for Gas Tungsten Arc Welding With Consumable Insert Followed by Shielded Metal Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) thick, IN3XX, ER3XX, and E3XX-XX As-Welded Condition, Primarily Pipe Application.	B2.1-8-216-1998
Standard Welding Procedure Specification for Gas Tungsten Arc Welding with Consumable Insert Root followed by Shielded Metal Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, IN3XX, ER3XX, and E3XX-XX As-Welded Condition, Primarily Pipe Applications.	B2.1-8-216:2001 R2012

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

SMAW — Shielded Metal Arc Welding	
Standard Welding Procedure Specifications for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Groups 1 or 2) to Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, E309 (L)-15, -16, or -17, As-Welded Condition, Primarily Pipe Applications.	B2.1-1/8-228:2002 R2013
GTAW — Gas Tungsten Arc Welding	
Standard Welding Procedure Specification for Gas Tungsten Arc Welding of Carbon Steel (M-1/P-1/S-1, Groups 1 or 2) to Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/16 in. (1.6 mm) through 1 ½ in. (38 mm) Thick, ER309 (L), As-Welded Condition, Primarily Pipe Applications.	B2.1-1/8- 227:2002, <u>2002</u> <u>AMD1 and</u> R2013
Standard Welding Procedure Specifications for Gas Tungsten Arc Welding with Consumable Insert Root of Carbon Steel (M-1/P- 1/S-1, Groups 1 or 2) to Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/16 in. (1.6 mm) through 1½ in. (38 mm) Thick, IN309 and ER309(L), As-Welded Condition, Primarily Pipe Applications.	
GTAW/SMAW Combination of Welding Processes	
Standard Welding Procedure Specifications for Gas Tungsten Arc Welding followed by Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1,Groups 1 or 2) to Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 in. (3.2 mm) through 1½ in. (38 mm) Thick, ER309(L) and E309(L)-15, -16, or -17, As-Welded Condition, Primarily Pipe Applications.	
Standard Welding Procedure Specifications for Gas Tungsten Arc Welding with Consumable Insert Root followed by Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Groups 1 or 2) to Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 in. (3.2 mm) through 1½ in. (38 mm) Thick, IN3009, ER309, and E309-15, -16, or -17 or IN309, ER309(L) and ER309(L)-15, -16, or -17, As-Welded Condition, Primarily Pipe Applications.	

#### Chromium Molybdenum Steel (M4/P4 and M5a/P5A Materials)

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

\_\_\_\_

mm) Thick, PWHT Condition, IN515 and ER80S-B2, Primarily Pipe Applications.	R2009
Standard Welding Procedure Specifications for Gas Tungsten Arc Welding of Chromium-Molybdenum Steel (M-5A/P-5A), ER90S-B3, 1/8 in. (3.2 mm) through 1½ in. (38 mm) Thick, As-Welded Condition, 1/8 in. (3.2 mm) through 3/4 in. (19 mm) Thick, PWHT Condition, Primarily Pipe Applications.	B2.1-5A- 222:1999 R2009
Standard Welding Procedure Specifications for Gas Tungsten Arc Welding (Consumable Insert Root) of Chromium-Molybdenum Steel (M- 5A/P-5A), 1/8 in. (3.2 mm) through 1-1/2 in. (38 mm) Thick, As-Welded Condition, 1/8 in. (3.2 mm) through 3/4 in. (19 mm) Thick, PWHT Condition, IN521 and ER90S-B3, Primarily Pipe Applications.	
Chromium-Molybdenum Steel Processes GTAW/SMAW	
Standard Welding Procedure Specifications for Gas Tungsten Arc Welding (Consumable Insert Root) followed by Shielded Metal Arc	B2.1-4-
Welding of Chromium-Molybdenum Steel (M-4/P-4, Group 1 or 2), 1/8 in. (3.2 mm) through 1-1/2 in. (38 mm) Thick, As-Welded	221:1999
Condition, 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, PWHT Condition, IN515, ER80S-B2, and E8018-B2, Primarily Pipe Applications.	R2009
Standard Welding Procedure Specifications for Gas Tungsten Arc Welded followed by Shielded Metal Arc Welding of Chromium-	B2.1-5A-
Molybdenum Steel (M-5A/P-5A), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, As-Welded Condition, 1/8 in. (3.2 mm) through 1 ½ in.	224:1999
(38 mm) Thick, PWHT Condition, ER90S-B3 and E9018-B3, Primarily Pipe Applications.	R2009
Standard Welding Procedure Specifications for Gas Tungsten Arc Welding (Consumable Insert Root) followed by Shielded Metal Arc	B2.1-5A-
Welding of Chromium-Molybdenum Steel (M-5A/P-5A), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, As-Welded Condition, 1/8 in. (3.2	226:1999
mm) through 1 ½ in. (38 mm) Thick, PWHT Condition, IN521, ER90S-B3, and E9018-B3, Primarily Pipe Applications.	R2009
Standard Welding Procedure Specifications (SWPS) for Gas Tungsten Arc Welded followed by Shielded Metal Arc Welding of Chromium-	B2.1-4-
Molybdenum Steel (M-4A/P-4, Group 1 or 2), 1/8 in. (3.2 mm) through 1/2 in. (13 mm) Thick, As-Welded Condition, 1/8 in. (3.2 mm)	219:199
through 1 ½ in. (38 mm) Thick, PWHT Condition, ER80S-B2 and E9018-B2, Primarily Pipe Applications.	R2009

# PART 3, SECTION 1 REPAIRS AND ALTERATIONS — GENERAL AND ADMINISTRATIVE REQUIREMENTS

#### 1.1 SCOPE

a) This part provides requirements and guidelines that apply when performing repairs and alterations to pressure-retaining items.

b) The National Board administers three four specific accreditation programs:

- 1) "R" Repairs and Alterations to Pressure-Retaining Items
- 2) "NR" Repair and Replacement Activities for Nuclear Items

3) "VR" — Repairs to Pressure Relief Valves

4) "T/O" - Test Only In-service testing only of Pressure Relief Valves

c) This part describes some of the administrative requirements for the accreditation of repair organizations. Additional administrative requirements can be found in:

NB-415, ACCREDITATION OF "R" REPAIR ORGANIZATIONS
 NB-417, ACCREDITATION OF "NR" REPAIR ORGANIZATIONS
 NB-514, ACCREDITATION OF "VR" REPAIR ORGANIZATIONS
 NB-528, ACCREDITATION OF "T/O" TEST ONLY ORGANIZATIONS

d) Requirements for repairs to pressure relief valves can be found in NBIC Part 4.

# **REQUEST FOR CODE REVISION**

The following are proposed revisions to Part 3 Section 2 and the Glossary. The proposal expands Section 2 to include rules for brazing and fusing and definitions for brazing, fusing and welding in the Glossary.

#### **EXPLANATION**

In a recent request for revision to the rules relating to locomotive boilers, it was proposed to allow brazing on certain boiler parts. While considering the proposal, it was noted that the NBIC does not yet provide rules for brazing. While developing this proposal for revision, it was decided to expand Part 3 Section 2 to include fusing as well as brazing.

CURRENT	PROPOSED	MODIFIED
PART 3, SECTION 2	PART 3, SECTION 2	No changes to proposal.
REPAIRS AND	REPAIRS AND	
ALTERATIONS —	ALTERATIONS —	
WELDING AND HEAT	WELDING, BRAZING,	
TREATMENT	FUSING AND HEAT	
	TREATMENT	
2.1 SCOPE	2.1 SCOPE	Add subparagraph (c) in
This section provides	a) This section provides	response to Mr. Richard's
requirements and guidelines for	requirements and guidelines for	comment.
welding and heat treating when	welding <u>, brazing, fusing</u> and heat	
performing welded repairs and	treating when performing welded	
alterations to pressure-retaining	repairs and alterations to pressure-	
items. Careful consideration	retaining items.	
shall be given to pressure-	b) Careful consideration shall be	(c) Careful consideration
retaining items that have been	given to pressure-retaining items that have been fabricated of either	shall be given to
fabricated of either creep strength enhanced ferritic		pressure-retaining items
materials or ferritic materials	creep strength enhanced ferritic steel materials or ferritic steel	that have been previously
enhanced by heat treatment.	materials enhanced by heat	repaired by brazing
The tensile and creep strength	treatment. The tensile and creep	brazed to preclude the
properties of these materials can	strength properties of these	
be degraded by not following	materials can be degraded by not	possibility of degrading
specific welding and heat	following specific welding procedure	the prior work.
treatment requirements. The	specification and heat treatment	
user is cautioned to seek	requirements. The user is cautioned	
technical guidance for welding	to seek technical guidance for	
and heat treating requirements	welding and heat treating	
in accordance with the original	requirements for these materials in	
code of construction.	accordance with the original code of	
	construction.	
2.2 WELDING	2.2 WELDING, BRAZING AND	No change to proposal.
Welding shall be performed in	FUSING	
accordance with the	Welding <u>, brazing and fusing</u> shall	

		1
requirements of the original code of construction used for the pressure-retaining item whenever possible.	be performed in accordance with the requirements of the original code of construction used for the pressure-retaining item whenever possible.	
2.2.1 WELDING PROCEDURE SPECIFICATIONS Welding shall be performed in accordance with Welding Procedure Specifications (WPS) qualified in accordance with the original code of construction or the construction standard or code selected. When this is not possible or practicable, the WPS may be qualified in accordance with ASME Section IX.	2.2.1 WELDING PROCEDURE SPECIFICATIONS A procedure specification is a written document providing direction to the person applying the material joining process. Welding, brazing and fusing shall be performed in accordance with Welding Procedure Specifications (WPS) procedure specifications for welding (WPS), brazing (BPS), and fusing (FPS) qualified in accordance with the original code of construction or the construction standard or code selected. When this is not possible or practicable, the WPS procedure specification may be qualified in accordance with ASME Section IX. No change to this paragraph.	No change to proposal.
PROCEDURE SPECIFICATIONS An "R" Certificate Holder may use one or more applicable Standard Welding Procedure Specifications (SWPS) shown in NBIC Part 3, Table 2.3 without supporting Procedure Qualification Records (PQRs) since SWPS are pre-gualified.	i to enange to tins paragraph.	i vo enange to proposal.
2.2.3 PERFORMANCE QUALIFICATION Welders and welding operators shall be qualified for the welding processes that are used. Such qualification shall be in accordance with the requirements of the original code of construction, the construction standard, code selected or ASME Section IX. Use of a Standard Welding Procedure Specification shown in NBIC Part 3, 2.3 is permitted for performance qualification testing.	2.2.3 PERFORMANCE QUALIFICATION Welders and welding operators shall be qualified for the welding processes that are used. The "R" Certificate Holder shall qualify the performance of personnel for each process they will use for repairs and alterations of pressure retaining items. Such qualification shall be in accordance with the requirements of the original code of construction, the construction standard, code selected, or ASME Section IX. Use of a Standard Welding Procedure Specification shown in NBIC Part 3, 2.3 is permitted for performance qualification testing.	No change to proposal.

2.2.4 WELDING RECORDS	2.2.4 WELDING	No change to proposal.
The "R" Certificate Holder shall	<b>QUALIFICATION RECORDS</b>	
maintain a record of the results	The "R" Certificate Holder shall	
obtained in Welding Procedure	maintain a record of the results	
Qualifications, except for those	obtained in Welding Procedure	
qualifications for which the	Qualifications, procedure	
provisions of NBIC Part 3, 2.2.2	specification qualification (except	
are used and of the results	for those qualifications for which the	
obtained in welding performance	provisions of NBIC Part 3, 2.2.2 are	
qualifications. These records	used) and of the results obtained in	
shall be certified by the "R"	welding-performance qualifications.	
Certificate Holder and shall be	These records shall be certified by	
available to the Inspector.	the "R" Certificate Holder and shall	
	be available to the Inspector.	
2.2.5 WELDER'S	2.2.5 WELDER'S QUALIFIED	No change to proposal.
		No change to proposal.
The "R" Certificate Holder shall	The "R" Certificate Holder shall	
establish a system for the	establish a system for the	
assignment of a unique	assignment of a unique	
identification mark to each	identification mark to each	
welder/welding operator qualified	welder/welding operator person	
in accordance with the	qualified in accordance with the	
requirements of the NBIC. The	requirements of the NBIC. The "R"	
"R" Certificate Holder shall also	Certificate Holder shall also	
establish a written procedure	establish a written procedure	
whereby welded joints are	whereby welded production joints	
identified as to the welder or	are identified and traceable to the	
welding operator who made	person as to the welder or welding	
them. This procedure shall use	operator who made them. This	
one or more of the following	procedure shall use one or more of	
methods and be acceptable	the following methods and be	
to the Inspector. The welder's or	acceptable to the Inspector.	
welding operator's identification	<u>a)</u> The <del>welder's or welding</del>	
mark may be stamped (low	operator's person's identification	
stress stamp) adjacent to welded	mark may be stamped (low stress	
joints made by the individual, or	stamp <u>, if used</u> ) adjacent to welded	
the "R" Certificate Holder may	production joints made by the	
keep a documented record of	individual, or <u>,</u>	
welded joints and the welders or	b) the "R" Certificate Holder may	
welding operators used in	keep a documented record of	
making the joints.	welded production joints and the	
	wolders or wolding operators	
	persons used in making the joints.	
2.2.6 WELDER'S	2.2.6 WELDER'S CONTINUITY	No change to proposal.
CONTINUITY	OF QUALIFIED PERSONNEL	
The performance qualification of	The performance qualification of a	
a welder or welding operator	welder or welding operator qualified	
shall be affected when one of	person shall be affected when one	
the following conditions occur:	of the following conditions occur:	
a) When the welder or welding	a) When the <del>welder or welding</del>	
operator has not welded using a	<del>operator</del> person has not <del>welded</del>	
specific process during a period	using used a specific process	
of six months or more, their	during a period of six months or	

qualifications for that process	more, their qualifications for that	
shall expire; or	process shall expire; or	
b) When there is specific reason	b) When there is specific reason to	
to question a welder's ability to	question a welder's the person's	
make welds that meet the	ability to make welds joints that	
specification, the qualification	meet the specification, the	
which supports the welding that	qualification which supports the	
is being performed shall be	welding process that is being	
revoked. All other qualifications	performed shall be revoked. All	
not questioned remain in effect.	other qualifications not questioned	
	remain in effect.	
2.2.6.1 WELDER'S	2.2.6.1 WELDER'S PROCESS	No change to proposal.
CONTINUITY RECORDS	CONTINUITY RECORDS	
a) The "R" Certificate Holder	a) The "R" Certificate Holder shall	
shall maintain a welding	maintain <del>a</del> welding process	
continuity record and shall make	continuity records and shall make	
the record available to the	the records available to the	
Inspector.	Inspector.	
b) The method of recording	b) The method of recording welding	
welding continuity and the record	process continuity and the record	
retention period shall be	retention period shall be described	
described in the "R" Certificate	in the "R" Certificate Holder's	
Holder's Quality System Manual.	Quality System Manual.	
c) When there is specific reason	c) When there is specific reason to	
to question a welder's ability to	question a welder's person's ability	
make welds that meet the	to make welds joints that meet the	
specification, the qualification	specification, the qualification which	
which supports the welding that	supports the welding process that is	
is being performed shall be	being performed shall be revoked.	
revoked. All other qualifications	All other qualifications not	
not questioned remain in effect.	questioned remain in effect.	
2.3 STANDARD WELDING	No change to this paragraph	No change to proposal.
PROCEDURE	rto enange to unis paragraph	tto enunge to proposui.
SPECIFICATIONS		
2.4 AWS REFERENCE	No change to this paragraph.	No change to proposal.
STANDARDS		
2.5 HEAT TREATMENT	2.5 HEAT TREATMENT	No change to proposal.
2.5.1 PREHEATING	2.5.1 PREHEATING	No change to proposal.
a) Preheating may be employed	a) Preheating may be employed	0 1 1
during welding to assist in	during welding use of a process to	
completion of the welded joint.	assist in completion of the welded	
The need	joint. The need for and the	
for and the temperature of	temperature of preheat are	
preheat are dependent on a	dependent on a number of factors	
number of factors such as		
	such as chemical analysis, degree	
chemical analysis,	of restraint of the items being	
	inight motorial thickness and	
degree of restraint of the items	joined, material thickness, and	
being joined, material thickness,	mechanical properties. The Welding	
being joined, material thickness, and mechanical properties. The	mechanical properties. The <del>Welding</del> Procedure Specification procedure	
being joined, material thickness, and mechanical properties. The Welding Procedure Specification	mechanical properties. The Welding Procedure Specification procedure specification for the material being	
being joined, material thickness, and mechanical properties. The Welding Procedure Specification for the material being welded	mechanical properties. The Welding Procedure Specification procedure specification for the material being welded joined shall specify the	
being joined, material thickness, and mechanical properties. The Welding Procedure Specification for the material being welded shall specify the preheat	mechanical properties. The Welding Procedure Specification procedure specification for the material being welded joined shall specify the preheat temperature requirements.	
being joined, material thickness, and mechanical properties. The Welding Procedure Specification for the material being welded	mechanical properties. The Welding Procedure Specification procedure specification for the material being welded joined shall specify the	

		T1
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 do not necessarily ensure satisfactory completion of the welded 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	preheating given in NBIC Part 3, Table 2.5.1 as a general guide. It is cautioned that the preheating temperatures listed <u>may not be the</u> <u>same as those of the original code</u> <u>of construction and do not</u> necessarily ensure satisfactory completion of the <del>wolded</del> 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	
and Group Number, the suggestions of this section apply to the applicable materials of the	designation, P-Number and Group Number, the suggestions of this section apply to the applicable	
original code of construction, either ASME or other, which conform by chemical	materials of the original code of construction, either ASME or other, which conform by chemical	
composition and mechanical properties to ASME materials	composition and mechanical properties to ASME materials	
having the ASME P-Number and Group Number designations.	having the ASME P-Number and Group Number designations.	
TABLE 2.5.1	No abanga ta thia Tabla	No change to proposal.
MINIMUM TEMPERATURES	No change to this Table.	
FOR PREHEATI		
2.5.2 POSTWELD HEAT	No change to this paragraph.	No change to proposal.
a) Postweld heat treatment shall		
be performed as required by the		
original code of construction, the		
construction standard or code selected in accordance with a		
written procedure. The		
procedure shall contain the		
parameters for postweld heat treatment.		
No additional changes for the		No change to proposal.
remainder of Part 3 Section 2.		
PART 3, SECTION 9	PART 3, SECTION 9	No change to proposal.
REPAIRS AND	REPAIRS AND	
ALTERATIONS—	ALTERATIONS—	
	GLOSSARY OF TERMS	
GLOSSARY OF	9.1 DEFINITIONS	
TERMS 9.1 DEFINITIONS		
	Add the following:	
L	ried die fonowing.	I]

Brazing – see Welding	No change to proposal.
<b>Fusing</b> – see Welding	No change to proposal.
<u>Welding (Brazing, Fusing) – a</u> group of processes which produce a localized coalescence of metal or nonmetal materials.	Add "d" to "localize" so it reads "localized".

# 18-47

# Repair Form Guides on Web – Hellman – 3-23-18

#### CODE REVISION AND ADDITION <u>Proposed Revisions or Additions</u>

Proposing revision to Part 3, 5.12 by removing:

- the general instructions for completing all "R" Report forms in paragraph 5.12.4.1,
- the instructions for completing "NR" Report forms in paragraph 5.12.5.1, and
- the instructions for completing "NVR" Report forms in paragraph 5.12.6.1

Proposing revision to Part 3, by adding a new paragraph (5.13 – Instructions for Completing National Board Form "R", "NR", and "NVR" Reports) that would make reference to the National Board website for the latest revision and current instructions on completing each specific form.

Blank "R", "NR", and "NVR" forms can be left in place as "example forms", but the balloon numbers identifying each field within the forms are to be deleted.

The proposed text revision can be seen in the attached document: 2017NBICPart3 – R and NR Forms and Guides – Web Reference – Hellman – 3-23-18 (ATTACHMENT 1).

#### Statement of Need

Currently, instructions for completing all National Board "R" Reports are under a single paragraph (5.12.4.1). Due to revisions of specific forms, these general instructions no longer coincide with all intended report forms (R-1, R-2, R-3, and R-4).

Proposed addition of paragraph 5.13 will reference the National Board website for the instructions specific to each Report of Repair, as well as the instructions for "NR" and "NVR" forms. This will help ensure that the most current revision of all Report forms are used and completed correctly.

#### **Background Information**

A screen shot of the NBIC website with the specific instructions for reference is attached (ATTACHMENT 2).

A copy of the "GUIDE FOR COMPETING NATIONAL BAORD FORM R-2, REPORT OF ALTERATION" is attached as an example of the instructions available on the website (ATTACHMENT 3).

6) If the characters are incorrect or damaged, wipe off the cement with a compatible solvent and reapply.

**Note:** The preceding methods can be applied jointly to identify the graphite part and to transfer the "R" stamp.

# 5.11 REMOVAL OF ORIGINAL STAMPING OR NAMEPLATE

If it becomes necessary to remove original stamping, the Inspector shall, subject to the approval of the Jurisdiction, witness making of a facsimile of stamping, the obliteration of old stamping, and transfer of stamping to the new item. When stamping is on a nameplate, the Inspector shall witness transfer of nameplate to the new location. Any relocation shall be described on the applicable NBIC "R" Form. The re-stamping or replacement of a code symbol stamp shall be performed only as permitted by the governing code of construction.

#### 5.12 REPAIR AND ALTERATION FORMS AND INSTRUCTIONS FOR COMPLETING FORMS

The following forms may be used for documenting specific requirements as indicated on the top of each form.

- 5.12.1 FORM R-1, REPORT OF REPAIR, see Pg. 89
- 5.12.2 FORM R-2, REPORT OF ALTERATIONS, see Pg. 91
- 5.12.3 FORM R-3, REPORT OF PARTS FABRICATED BY WELDING, see Pg. 93
- 5.12.4 FORM R-4, REPORT SUPPLEMENTARY SHEET, see Pg. 95

# 5.12.4.1 INSTRUCTIONS FOR COMPLETING NATIONAL BOARD FORM "R" REPORTS

These instructions are to be used when completing the National Board Form "R" Reports. When computer generated, the format of the form shall replicate the type and relative location of the information depicted on the Form "R" Reports shown in NBIC Part 3, 5.12.1 through 5.12.4.

- 1)The name and address of the "R" Certificate Holder performing the work as it appears on the "Certificate of Authorization". On a Form R-2, the organization that performed the design work will complete line 1a) and the organization completing the construction activities will complete line 1b).
- 2)When registering a Form "R" Report with the National Board, this line is solely designated for a uniquesequential 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. For re-rating only, the Design Organization registers the Form R-2. Where physical work is also performed, the Construction Organization registers the Form R-2.
- 3)Name and address of the owner of the pressure-retaining item.
- 4)Name and address of plant or facility where the pressure-retaining item is installed.
- 5)Description of the pressure-retaining item, such as boiler or pressure vessel, or piping. Include the applicable unit identification.
- 6)Name of the original manufacturer of the pressure-retaining item. If the original manufacturer is unknown, indicate by, "unknown."

- 7)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."
- 8)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."
- 9)Identify the year in which fabrication/construction of the item was completed.
- 10)Indicate edition and addenda of the NBIC under which this work is being performed.
- 11)Indicate the name, section, division, edition, and addenda of the original code of construction for the pressure-retaining item. Also indicate the name, section, division, edition, and addenda of the construction code used for the work being performed. If code cases are used, they shall be identified in the "Remarks" section.
- 12)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 or alteration (i.e. welding, bonding, cementing), the specific location of the work performed to the PRI, the steps taken to remove a defect or as allowed by 3.3.4.8 to remain in place, the method of repair or alteration 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 needed to describe the scope of work, a Form R-4 shall be used and attached. Information determined to be of a proprietary nature need not be included, but shall be stated on the form.
- 13)Indicate test pressure applied.

- 14)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.
- 15)Indicate any additional information pertaining to the work involved (e.g., routine repairs, code cases). For Form R-3, the part manufacturer is to indicate the extent he has performed any or all of the design function. If only a portion of the design, state which portion.
- 16) Type or print name of authorized representative of the "R" Certificate Holder attesting to accuracy of the work described.
- 17)Indicate National Board "R" Certificate or Authorization number.
- 18) Indicate month, day, and year that the "R" certificate expires.
- 19)Enter date certified.
- 20)Record name of "R" Certificate Holder who performed the described work, using full name as shown on the Certificate of Authorization or an abbreviation acceptable to the National Board.
- 21)Signature of authorized representative.
- 22) Type or print name of Inspector.
- 23) Indicate Inspector's Jurisdiction.
- 24) Indicate Inspector's employer.
- 25)Indicate address of Inspector's employer (city and state or province).

- 26)Indicate month, day, and year of inspection by Inspector. In case of routine repairs this shall be the month, day, and year the Inspector reviews the completed routine repair package.
- 27)Signature of Inspector.
- 28)National Board commission number of Inspector, and when required by the Jurisdiction, the applicable State or Provincial numbers.
- 29)Document name and address of organization that purchased the parts for incorporation into the repair or alteration. If the part's origin is unknown or the part was built for stock, so state.
- 30)Document name of organization responsible for specifying the code design conditions, if known. If origin of design conditions are unknown, state "unknown."
- 31)Document name of organization responsible for performing the code design, if known. If code design organization is unknown, state "unknown."
- 32)Name, section, and division of the design code, if known. If the design is unknown, state "unknown"
- 33) Indicate code edition year used for fabrication.
- 34)Indicate code addenda date used for fabrication.
- 35)Indicate the code paragraph reference for formula used to establish the MAWP, if known. If the code reference of the formula is unknown, state "unknown."
- 36)If available, identify component by part's original name, function, or use the original equipment manufacturer's "mark or item number."
- 37)Indicate quantity of named parts.
- 38)Match line number references for identification of parts and description of parts.
- 39) Indicate manufacturer's serial number for the named part.
- 40)Indicate drawing number for the named part.
- 41)Indicate maximum allowable working pressure for the part, if known.
- 42) Use inside diameter for size: indicate shape as square, round, etc.
- 43) Indicate the complete material specification number and grade.
- 44) Indicate nominal thickness of plate and minimum thickness after forming.
- 45) Indicate shape as fat, dished, ellipsoidal, or hemispherical.
- 46) Indicate minimum thickness after forming.
- 47) Indicate outside diameter.
- 48)Indicate minimum thickness of tubes.
- 49)Complete information identical to that shown on the Form "R" to which this sheet is supplementary.
- 50) Indicate the Form "R" type. Example: Form R-1, Form R-2, Form R-3.
- 51)Indicate the reference line number from the Form R to which this sheet is supplementary.
- 52) Complete information for which there was insufficient space on the reference Form "R".

- 53)If applicable, document the unique purchase order, job, or tracking number, assigned by organization performing work.
- 54)Indicate the maximum allowable working pressure of the pressure-retaining item.
- 55)Indicate the type of repair, e.g., welded, graphite pressure equipment, or fiber-reinforced plastic pressure equipment.
- 5.12.5 FORM NR-1, NUCLEAR COMPONENTS AND SYSTEMS IN NUCLEAR POWER PLANTS, SEE PG. 96

### 5.12.5.1 GUIDE FOR COMPLETING NATIONAL BOARD FORM NR-1 REPORT OF REPAIR/ REPLACEMENT ACTIVITIES FOR NUCLEAR FACILITIES

This guide is to be used when completing the National Board Form NR-1, Report of Repair/Replacement Activities for Nuclear Facilities. When computer generated, the form shall replicate the content and format of the information depicted on the Form NR-1, Report of Repair/Replacement Activities for Nuclear Facilities.

Title Block: Check type of activity, repair/replacement and/or rerating, as applicable.

Check category of activity, 1, 2, or 3, as described in Part 3, Paragraph 1.6.2.

 Name and address of the organization, as shown on the National Board "NR" Certificate of Authorization, which performed the activity.

2)Indicate NR Form Registration Number.

- 3)Indicate the repair/replacement plan, job number, etc., as applicable, assigned by the organization that performed the work for traceability to documentation.
- 4)Name and address of the owner of the nuclear facility.
- 5)Name and address of the nuclear power plant and, if applicable, identification of the unit.
- 6)Identify the system or component (e.g., residual heat removal, reactor coolant) with which the repair/ replacement and/or re-rating activity is associated.
- 7)Identify the original design specification number and revision for the system or component listed in line 4.
- 8)Identify the original construction code, edition/addenda used for the system or component identified in line 4.
- 9)NBIC Edition used for performing activities specified on this form.
- 10)Organization having responsibility for design when there is a change from the original design specification.
- 11)Identify code edition/addenda used for design, when applicable.
- 12)Check the type of test conducted (e.g., hydrostatic, pneumatic, system leakage, exempt, or other) and indicate the pressure applied when applicable.
- 13)Indicate the number of components where work was performed. Each component shall be indicated on page 2 of the form NR-1.
- 14)Provide a detailed summary describing the scope of work completed. Information to be considered should include type of work (welding, brazing, fusing), location, steps taken for removal or acceptance

of defects, examinations, testing, heat treat, and other special processes or methods utilized. If Necessary, attach additional data, sketch, drawing, Form R-4, etc. In the remarks section state if additional data is attached.

- 15)Indicate any additional information pertaining to the work, including manufacturer's data reports.
- 16)Number in sequence beginning with No. 1 to identify each component work was performed. This number may be used to correspond with the detailed description of work performed.
- 17)Identify the type of item. i.e. piping, pump, valve, etc.
- 18) Identify the manufacturer's name of component.
- 19) Identify the manufacturer's serial no. or other assigned number for traceability.
- 20) Identify the National Board registration number, if previously assigned.
- 21) Identify the code class criteria, as assigned for each component.
- 22) Identify the code section used to perform work.
- 23) Identify Code section year and/or addenda used to perform work.
- 24) Identify any code cases used for work performed.
- 25)Identify any revisions to be made to the design specifications or if any design reconciliations were performed.
- 26) Type or print name of authorized representative from the certificate holder.
- 27)Name of the organization that performed the identified work, using the full name as shown on the Certificate of Authorization, or an abbreviation acceptable to the National Board.
- 28)Indicate code section as applicable to the repair/replacement activity and/or re-rating activity performed.
- 29) Indicate National Board Certificate of Authorization number.
- 30)Indicate month, day, and year the certificate expires.
- 31)Signature of authorized representative from the NR certificate holder.
- 32)Indicate month, day and year of signature by the Authorized Representative
- 33) Title of authorized representative as defined in the Quality Program.
- 34) Type or print name of Authorized Nuclear Inspector.
- 35)Indicate the Jurisdiction where the activity is performed, when required.
- 36) Indicate Authorized Nuclear Inspector's employer.
- 37) Indicate month, day, and year of inspection by the Authorized Nuclear Inspector.
- 38) Signature of Authorized Nuclear Inspector.
- 39) Indicate month, day, and year of signature by the Authorized Nuclear Inspector.
- 40) National Board Commission number and required endorsements.

# 5.12.6 FORM NVR-1, NUCLEAR PRESSURE RELIEF DEVICES, SEE PG. 99

#### 5.12.6.1 GUIDE FOR COMPLETING NATIONAL BOARD FORM NVR-1 REPORT OF REPAIR/REPLACEMENT ACTIVITIES FOR NUCLEAR PRESSURE RELIEF DEVICES

This guide is to be used when completing the National Board Form NVR-1, Report of Repair/Replacement Activities for Nuclear Pressure Relief Devices. When computer generated, the format of the form shall replicate the type and relative location of the information depicted on the Form NVR-1, Report of Repair/Replacement Activities for Nuclear Pressure Relief Devices.

Title Block: Check type of activity, repair/replacement, as applicable.

- Check category of activity, 1, 2, or 3, as described in Part 3, Paragraph 1.6.2.
- 1)Name and address of the organization, as shown on the National Board "VR" and "NR" Certificates of Authorization, which performed the activity.
- 2)Indicate NVR Form Registration Number.
- 3)Indicate the repair/replacement plan number, job number, etc., as applicable for traceability, assigned by the organization that performed the work
- 4)Name and address of the organization for which the work was performed. 5)-
- Name and address of the owner nuclear facility.
- 6)Name and address of the nuclear facility and, if applicable, identification of the unit.
- 7)Identify the edition, addenda, and as applicable, code cases of the code used for the inservice inspection activity.
- 8)Identify the edition, addenda, and as applicable, code cases of the code used for the repair/replacement activity.
- 9)Identify the NBIC edition used for the repair/replacement activity
- 10)Identify the organization responsible for design or design reconciliation, if applicable.
- 11) Indicate the set pressure of the valve.
- 12) Indicate the blowdown, if applicable, as a percentage of set pressure.
- 13) Indicate the location of testing.
- 14)Indicate medium (steam, air, etc.) used for the adjustment of the set pressure and, if applicable, blowdown.
- 15)Provide a detailed summary describing the scope of work completed. Information to be considered should include type of work (welding, brazing, fusing), location, steps taken for removal or acceptance of defects, examinations, testing, heat treat, and other special processes or methods utilized. If Necessary, attach additional data, sketch, drawing, Form R-4, etc. If additional data is attached, so state in the remarks section.
- 16)Indicate any additional information pertaining to the work, such as, additional documentation that is attached to this form to further support item 15.
- 17)Manufacturer's name of the affected item.

18)Describe the type of pressure relief device (e.g., safety valve, safety relief valve, pressure relief valve).

19)Manufacturer's serial number of the affected item.

20)National Board number, if applicable, of the affected item.

21) Indicate the service as steam, liquid, air/gas, etc.

22) Indicate the pressure relief device by inlet size, in inches.

23) Indicate the year the affected item was manufactured.

24) Indicate the name, section and division of the original construction code for the affected item.

25) Indicate the code class for the affected item as applicable, i.e. Class 1, 2 or 3.

26)Indicate the construction code edition for the affected item.

27)Indicate the construction code addenda, as applicable, for the affected item. 28)

Indicate any applicable code cases used for manufacturing of the affected item. 29)-

Name of the replacement part.

30)Identifying number of the replacement part.

31)Number/quantity of each replacement part used.

32)Indicate the Serial number or other traceability used by the manufacturer of the replacement part.

33) Type or print name of authorized representative from the certificate holder.

34)Indicate code as applicable to the repair/replacement activity performed.

35)Indicate National Board Certificate of Authorization number, if applicable for the "VR" Stamp.

36) Indicate month, day, and year the certificate expires, if applicable for the "VR" Stamp.

37) Indicate National Board Certificate of Authorization number, if applicable for the "NR" Stamp.

38) Indicate month, day, and year the certificate expires, if applicable for the "NR" Stamp.

39) Signature of authorized representative from the certificate holder defined in item 27 above.

40) Indicate month, day, and year of signature by the authorized representative.

41) Title of authorized representative as defined in the Quality Program.

42) Type or print name of Authorized Nuclear Inspector.

43) Indicate the Jurisdiction where the activity is performed, when required.

44) Indicate Authorized Nuclear Inspector's employer.

45) Indicate address of Authorized Nuclear Inspector's employer (city and state or province).

46) Indicate month, day, and year of inspection by the Authorized Nuclear Inspector.

47)Signature of Authorized Nuclear Inspector defined in item 42 above.

48)Indicate month, day, and year of signature by the Authorized Nuclear Inspector.

49) National Board Commission number and required endorsements.

#### 5.13 INSTRUCTIONS FOR COMPLETING NATIONAL BOARD FORM "R", "NR", and "NVR" REPORTS

The current National Board Form "R", "NR", and "NVR" Reports, and the instructions for completing them, can be found on the National Board website: https://www.nationalboard.org. . When computer generated, the format of the form shall replicate the type and relative location of the information depicted on the example Form "R", "NR", and "NVR" Reports shown in NBIC Part 3, 5.12.1 through 5.12.6.

(vame)         (vation)         (vat			INSPECTORS		NB-66,	Rev. 14, (12/07
in accordance with provisions of the National Board Inspection Code		-			<b>1</b>	
WORK PERFORMED BY:					(Authorize	d Rep. initials
Image: of region reg		IT accordance w		nai boaru inspection cou	2	
WORK PERFORMED BY:					(Inspecto	rs initials)
WORKPERFORMEDBY:       ③         (mame of repair organization)       (PC.no., job no., etc.)         (pddress)       (pddress)         (pddress)       (pddress)         (pddress)       (pddress)         (pddress)       (pddress)         (pddress)       (pddress)         (pddress)       (pddress)         (pddress)       (pderess)					( <del>3</del> )	
WORPERFORMEDBY:					(Form " <b>R</b> '	Registration
(name of repar organization)       (PD.no., jobino., etc.)         [address]         (name)         [address]         [address]         [address]         (address]         [address]         (address]         [address]         (address]         (address]         (address]         (bolier, pressure vessel, or piping)         DENTIFYING NOS:         (mame)         (mame)         (address]         (celtion)         (mame)         (bolier, pressure vessel, or piping)         (DENTIFYING NOS:         (mame)	WORKPERFORMED BY:	5			<b>(4</b> )	
OWNER:       Image:         (rame)       (rame)         (address)       (rame)         (address)       (rame)         (address)       (rame)         (bolier, pressure vessel, or piping)       (rame)         (bolier, pressure vessel, or piping)       (radicreal)         (mig. serial no.)       (radicreal)         (rame/second)       (radicreal)         (rame/second)       (radicreal)         (rame/second)       (radicreal)         (rame/second)       (radicreal)         (radicreal)       (radicreal)         (rame/second)       (radicreal)         (rame/second)       (radicreal)         (rame/second)       (radicreal)         (rame/second)       (radicreal)         (rame/second)       (rame/second)         (rame/second)       (raddenda)		(name of repair organization	1)		(P.O.no., jo	ob no., etc.)
OWNER:       Image:         (rame)       (rame)         (address)       (rame)         (address)       (rame)         (address)       (rame)         (bolier, pressure vessel, or piping)       (rame)         (bolier, pressure vessel, or piping)       (radicreal)         (mig. serial no.)       (radicreal)         (rame/second)       (radicreal)         (rame/second)       (radicreal)         (rame/second)       (radicreal)         (rame/second)       (radicreal)         (radicreal)       (radicreal)         (rame/second)       (radicreal)         (rame/second)       (radicreal)         (rame/second)       (radicreal)         (rame/second)       (radicreal)         (rame/second)       (rame/second)         (rame/second)       (raddenda)						
(name)         (adress)         LOCATION OF INSTALLATION:	(address)					
(address)         LOCATION OF INSTALLATION:          (name) (name) (address) TEMIDENTIFICATION:						
LOCATION OF INSTALLATION:	(name)					
LOCATION OF INSTALLATION:	(address)					
Interview       (address)         ITEMIDENTIFICATION:       (a)         (bolier, pressure vessel, or piping)       (b)         IDENTIFYING NOS:       (a)         (mfg. serial no.)       (National Board no.)         (urrisdiction no.)       (ather)         (editon)       (addreda)         Original Code of Construction for Item:       (addreda)         (name / section / division)       (edition / addenda)         Construction Code Used for Repair Performed:       (address)         (rame / section / division)       (edition / addenda)         REPAIRTYPE:       (edition / addenda)         Construction Code Used for Repair Performed:       (address)         (rame / section / division)       (edition / addenda)         REPAIRTYPE:       (edition / addenda)         REPAIRTYPE:       Form R-4, Report Supplementary Sheet is attached       DOT         DESCRIPTIONOF WORK:       Form R-4, Report Supplementary Sheet is attached       FFSA Form (NB-403) is attached         (ure form R-4, If necessary)       (use form R-3's properly completed for the following items of this report):         (b)       (b)       (c)       (c)         (ure form rest, if applied       (c)       (c)       (c)         (b)       (c)       (c)       (c)<						
(address)         ITEMIDENTIFICATION: <ul> <li>(bolier, pressure vessel, or piping)</li> <li>(bolier, pressure vessel, or piping)</li> </ul> IDENTIFYING NOS: <ul> <li>(mfg. serial no.)</li> <li>(wational Board no.)</li> <li>(jurisdiction no.)</li> <li>(juris</li></ul>	LOCATION OF INSTALLA					
ITEMIDENTIFICATION: (boller, pressure vessel, or piping) IDENTIFYING NOS: (mfg. serial no.) (mfg. serial no.) (nter) (wither) (		(name)				
IDENTIFYING NOS: (b)(ler, pressure vessel, or piping)     IDENTIFYING NOS:     (mfg. serial no.)     (vational Board no.)     (iurisdiction no.)     (other)     (vear bu     (iurisdiction no.)     (other)     (vear bu     (vear bu     (iurisdiction no.)     (other)     (vear bu     (iurisdiction no.)     (other)     (vear bu     (vear bu     (vear bu)     (vear bu) <td>(address)</td> <td></td> <td></td> <td></td> <td></td> <td></td>	(address)					
IDENTIFYING NOS: (b)(ler, pressure vessel, or piping)     IDENTIFYING NOS:     (mfg. serial no.)     (name / section / division)     (addenda)   Original Code of Construction for Item:      (addenda)   Original Code of Construction for Item:    (addenda)    Original Code of Construction for Item:    (addenda)    Original Code of Construction for Item:    (addenda)    Original Code of Construction for Item:    (addenda)    Original Code of Construction for Item:    (addenda)    Original Code of Construction for Item:    (addenda)    Original Code of Construction for Item:    (addenda)    Original Code of Construction Addenda)    (addenda)    Original Code of Construction Code Used for Repair Performed:    (addenda)    Original Code of Construction Code Used for Repair Performed:    (addenda)    Original Code of Construction Code Used for Repair Performed:    (addenda)    Original Code of Construction Code Used for Repair Performed: <td></td> <td>(8)</td> <td></td> <td></td> <td></td> <td></td>		(8)				
IDENTIFYING NOS:	TEMIDENTIFICATION:			ANUFACTURER:		
IDENTIFYING NOS: (mage serial no.) (National Board no.) (jurisdiction no.) (other) (year but the series of the ser	60	<u>`````````````````````````````````````</u>		(1)	(12)	(14)
NBIC EDITION/ADDENDA:		/				
Addection     (edition) <td></td> <td><math>\sim</math></td> <td>(National Board no.)</td> <td>(junsaiction no.)</td> <td>(other)</td> <td>(year bu</td>		$\sim$	(National Board no.)	(junsaiction no.)	(other)	(year bu
Original Code of Construction for Item: (name / section / division) Construction Code Used for Repair Performed: (name / section / division) (edition / addenda) REPAIRTYPE: Perform R-4, Report Supplementary Sheet is attached (use Form R-4, If necessary) (use Form R-4,	NBICEDITION/ADDEND/					
Onginan Code of Construction for item:     (name / section / division)     (edition / addenda)        Construction Code Used for Repair Performed:     (mame / section / division)        (edition / addenda)           REPAIRTYPE:     welded                 REPAIRTYPE:   (edition / addenda)                          (edition / addenda) </td <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>						
Construction Code Used for Repair Performed: (name / section / division) REPAIRTYPE: welded graphite pressure equipment DOT DESCRIPTION OF WORK: Form R-4, Report Supplementary Sheet is attached FFSA Form (NB-403) is attached (use form R-4, if necessary)	Original Code of Constru				(adition / addenda)	
Construction decorrection depoint equipment     (name / section / division)     (edition / addenda)        REPAIRTYPE:     (edition / addenda)        REPAIRTYPE:     (edition / addenda)        (edition / addenda)        REPAIRTYPE:        (edition / addenda)           (edition / addenda)                    (edition / addenda) <b>Construction Construction Const</b>	Construction Code Lload		$\sim$		(edition / addenda)	
REPAIRTYPE: welded graphite pressure equipment FRP pressure equipment DOT   DESCRIPTION OF WORK: Form R-4, Report Supplementary Sheet is attached FFSA Form (NB-403) is attached   (use Form R-4, if necessary) Image: Complementary Sheet is attached FFSA Form (NB-403) is attached     Image: Complementary Sheet is attached FFSA Form (NB-403) is attached     Image: Complementary Sheet is attached FFSA Form (NB-403) is attached     Image: Complementary Sheet is attached FFSA Form (NB-403) is attached     Image: Complementary Sheet is attached FFSA Form (NB-403) is attached     Image: Complementary Sheet is attached FFSA Form (NB-403) is attached     Image: Complementary Sheet is attached FFSA Form (NB-403) is attached     Image: Complementary Sheet is attached FFSA Form (NB-403) is attached     Image: Complementary Sheet is attached FFSA Form (NB-403) is attached     Image: Complementary Sheet is attached FFSA Form (NB-403) is attached     Image: Complementary Sheet is attached FFSA Form (NB-403) is attached     Image: Complementary Sheet is attached FFSA Form (NB-403) is attached     Image: Complementary Sheet is attached FFSA Form (NB-403) is attached     Image: Complementary Sheet is attached FFSA Form (NB-403) is attached     Image: Complementary Sheet is attached FFSA Form (NB-403) is attached     Image: Complementary Sheet is attached FFSA Form (NB-403) is attached	ConstructionCode Osed	ior Repair Performed.	¥		(edition / addenda)	
DESCRIPTION OF WORK:       Form R-4, Report Supplementary Sheet is attached       FFSA Form (NB-403) is attached         (use Form R-4, if necessary)       (1)       (1)         (use form R-4, if necessary)       (2)       (1)         (use for matching to the following items of this report):       (1)       (1)         (use for form the following items of the following items of this report):       (1)       (1)         (name of part, item number, data report type or certificate of Compliance, mfg's. name and identifying stamp)       (2)         (1)       (2)       (2)       (2)         (1)       (2)       (2)       (2)         (1)		_	_		_	
(use Form R-4, if necessary)	REPAIRTYPE: 18 U wel	Ided 🖵 graphite pr	ressure equipment 🛛 🖵 F	RP pressure equipment	L DOT	
	DESCRIPTION OF WORK:	: 🔲 Form R-4, Rep	ort Supplementary Sheet is att;	ached 🛛 🗌 FFSA Form (N	IB-403) is attached	
Image: Second state of the second state state state of the second state s	(use Form R-4, if necessary)	$\frown$				
(Liquid, Pneumatic, Vacuum, Leak) REPLACEMENT PARTS: (Attached are Manufacturer's Partial Data Reports or Form R-3's properly completed for the following items of this report): (name of part, item number, data report type or certificate of Compliance, mfg's. name and identifying stamp) (23)		(19)				
(Liquid, Pneumatic, Vacuum, Leak) REPLACEMENT PARTS: (Attached are Manufacturer's Partial Data Reports or Form R-3's properly completed for the following items of this report): (name of part, item number, data report type or certificate of Compliance, mfg's. name and identifying stamp) (23)						
(Liquid, Pneumatic, Vacuum, Leak) REPLACEMENT PARTS: (Attached are Manufacturer's Partial Data Reports or Form R-3's properly completed for the following items of this report): (name of part, item number, data report type or certificate of Compliance, mfg's. name and identifying stamp) (23)						
(Liquid, Pneumatic, Vacuum, Leak) REPLACEMENT PARTS: (Attached are Manufacturer's Partial Data Reports or Form R-3's properly completed for the following items of this report): (name of part, item number, data report type or certificate of Compliance, mfg's. name and identifying stamp) (23)						
(Liquid, Pneumatic, Vacuum, Leak) REPLACEMENT PARTS: (Attached are Manufacturer's Partial Data Reports or Form R-3's properly completed for the following items of this report): (name of part, item number, data report type or certificate of Compliance, mfg's. name and identifying stamp) (23)						
(Liquid, Pneumatic, Vacuum, Leak) REPLACEMENT PARTS: (Attached are Manufacturer's Partial Data Reports or Form R-3's properly completed for the following items of this report): (name of part, item number, data report type or certificate of Compliance, mfg's. name and identifying stamp) (23)						
(Liquid, Pneumatic, Vacuum, Leak) REPLACEMENT PARTS: (Attached are Manufacturer's Partial Data Reports or Form R-3's properly completed for the following items of this report): (name of part, item number, data report type or certificate of Compliance, mfg's. name and identifying stamp) (23)						
REPLACEMENT PARTS: (Attached are Manufacturer's Partial Data Reports or Form R-3's properly completed for the following items of this report):  (name of part, item number, data report type or certificate of Compliance, mfg's. name and identifying stamp)  (3)				6	<u>\</u>	
(name of part, item number, data report type or certificate of Compliance, mfg's. name and identifying stamp)			pplied	psi MAWP		psi
	(Liquid, Pneumatic, Vacuum, L	Leak)		psi MAWP		
	(Liquid, Pneumatic, Vacuum, L	Leak)		psi MAWP		
REMARKS:	(Liquid, Pneumatic, Vacuum, L REPLACEMENT PARTS: (	<sup>Leak)</sup> (Attached are Manufacturer	r's Partial Data Reports or Form R-3'	's properly completed for the follow		
REMARKS:	(Liquid, Pneumatic, Vacuum, L REPLACEMENT PARTS: ( (name of part, item number, d	<sup>Leak)</sup> (Attached are Manufacturer	r's Partial Data Reports or Form R-3'	's properly completed for the follow		
REMARKS:	(Liquid, Pneumatic, Vacuum, L REPLACEMENT PARTS: ( (name of part, item number, d	<sup>Leak)</sup> (Attached are Manufacturer	r's Partial Data Reports or Form R-3'	's properly completed for the follow		
REMARKS:	(Liquid, Pneumatic, Vacuum, L REPLACEMENT PARTS: ( (name of part, item number, d	<sup>Leak)</sup> (Attached are Manufacturer	r's Partial Data Reports or Form R-3'	's properly completed for the follow		
	(Liquid, Pneumatic, Vacuum, L REPLACEMENT PARTS: ( (name of part, item number, d	<sup>Leak)</sup> (Attached are Manufacturer	r's Partial Data Reports or Form R-3'	's properly completed for the follow		
	(Liquid, Pneumatic, Vacuum, L REPLACEMENT PARTS: ( (name of part, item number, d	<sup>Leak)</sup> (Attached are Manufacturer	r's Partial Data Reports or Form R-3'	's properly completed for the follow		
	(Liquid, Pneumatic, Vacuum, L REPLACEMENT PARTS: ( (name of part, item number, d	<sup>Leak)</sup> (Attached are Manufacturer	r's Partial Data Reports or Form R-3'	's properly completed for the follow		
	(Liquid, Pneumatic, Vacuum, L REPLACEMENT PARTS: ( (name of part, item number, d	<sup>Leak)</sup> (Attached are Manufacturer	r's Partial Data Reports or Form R-3'	's properly completed for the follow		
	(Liquid, Pneumatic, Vacuum, L REPLACEMENT PARTS: ( (name of part, item number, d	<sup>Leak)</sup> (Attached are Manufacturer	r's Partial Data Reports or Form R-3'	's properly completed for the follow		

	THE			
вХв	NATIONAL	Board and Pressure		
	OF BOILER	AND PRESSURE	VESSEL	INSPECTORS

NB-66, Rev. 14, (12/07/16)

3 (Form "R" Registration no.) (P.O.no., job no., etc.)

	CERTIFICATE OF	COMPLIANCE	
I, correct and that all material, constr "R" Certificate of Authorization No. Date		, .	belief the statements made in this report are tionel Board Inspection Code. National Board
	CERTIFICATE OF	INSPECTION	
I, 31 Inspectors and certificate of compe	, holding a valid commis tency, where required, issued by the Ju	' /'	ional Board of Boiler and Pressure Vessel )and employed by
signing this certificate, neither the u in this report. Furthermore, neither or loss of any kind arising from or co	nd belief, this work complies with the a ndersigned nor my employer makes a the undersigned nor my employer sha	ny warranty, expressed	and state and state ts of the National Board Inspection Code. By d or implied, concerning the work described her for any personal injury, property damage,
Date <del>36</del> /	Signed (inspector)	()	Vational Board and Jurisdiction no. including endorsement)

BXB NATIONAL BOARD OF Boiler and Pressure Vessel Inspectors	NB-229, Rev. 8, (12/07/16
FORM R-2 REPORT OF ALTERATION in accordance with provisions of the National Board Inspection	(Authorized Rep. initials)
	(Inspectors initials)
	(Form"R" Registration no.)
a. DESIGN PERFORMED BY:	(P.O. no., job no., etc.)
(address)	
b. CONSTRUCTION PERFORMED BY:	
(name of "R" organization responsible for construction)	
(address)	
2. OWNER OF PRESSURE RETAINING ITEM:	
(name)	
(address)	
. LOCATION OF INSTALLATION:	
(name)	
(address)	
I. ITEM IDENTIFICATION:NAME OF ORIGINAL MANUFACTURER: (boiler, pressure vessel, or piping)	
. IDENTIFYING NOS:	(other) (year built)
5. NBICEDITION/ADDENDA:	
Original Code of Construction for Item:	(edition / addenda)
Construction Code Used for Alteration Performed:	
(name / section / division)	(edition / addenda)
a. DESCRIPTION OF DESIGN SCOPE: 🔲 Form R-4, Report Supplementary Sheet is attached	
b. DESCRIPTION OF CONSTRUCTION SCOPE: Form R-4, Report Supplementary Sheet is attached	
Pressure Test, if appliedpsi MAWP	psi

	Τн	E				
вХв	ΝA	TIONAL	BOAR	20		INSPECTORS
-00-	ПF	BOILER	AND	Pressure	VESSEL	INSPECTORS

NB-229, Rev. 8, (12/07/16)

(Form "R" Registration no.)

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

8. REPLACEMENT PARTS: (Attached are Manufacturer's Partial Data Reports or Form R-3's properly completed for the following items of this report):

(name of part, item number, data report type or Certificate of Compliance, mfg's. name and identifying stamp)

9. REMARKS:

DESIGN CERTI	FICATION
Design Change described in this report conforms to the National Board Inspec	and belief the statements in this report are correct and that the <i>tion Code</i> . National Board " <b>R</b> " Certificate of Authorization No.
Date,Signed	
(name of design organization) (authorized rep	resentative)
CERTIFICATE OF DESIGN	I CHANGE REVIEW
I,, holding a valid Commission issued by Th	e National Board of Boiler and Pressure Vessel
Inspector and certificate of competency, where required, issued by the juris	diction ofand employed by
have reviewed the design change as described in this report and state that the applicable requirements of the <i>National Board Inspection Code</i> .	
By signing this certificate, neither the undersigned nor my employer make in this report. Furthermore, neither the undersigned nor my employer shal loss of any kind arising from or connected with this inspection.	
DateSignedCor	nmissions
(inspector)	nmissions(National Boardand jurisdiction no. including endorsement)
CONSTRUCTION C	ERTIFICATION
material, construction, and workmanship on this Alteration conforms to the Muthorization No	
DateSignedS	
(name of alteration organization) (authorized	representative)
CERTIFICATE OF	INSPECTION
	on issued by the National Board of Boiler and Pressure Vessel
Inspectors and certificate of competency, where required, issued by the Jur	isdiction ofand employed byof
have inspected the work described in this report on	,and state
that to the best of my knowledge and belief, this work complies with the ap	plicable requirements of the National Board Inspection Code. By
signing this certificate, neither the undersigned nor my employer makes any	warranty, expressed or implied, concerning the work described
in this report. Furthermore, neither the undersigned nor my employer shall	be liable in any manner for any personal injury, property damage,
or loss of any kind arising from or connected with this inspection.	
DateSigned	
(inspector)	(National Board and jurisdiction no. including endorsement)

DF BOILER	AND PRE	SSURE VES	BEL INSPECT	ORS				NB	-230, Rev. 4 (12/08,
	FC	)RM R-3 F	REPORT O	FPARTS		TED BY			
			nce with provi					(Author	rized Rep. initials)
								<del>2</del>	
								(Inspec	ctors initials)
									)
MANUFACTURE	D BY:	4						(Form "	" <b>R-3"</b> Registration
	(na	ame of " <b>NR</b> " certific	cate holder)					(P.O. no	., job no., etc.)
(address)									
	500	<b>(6</b> )							
MANUFACTURED (name)	) FUK:								
(address)									
DESIGN CONDIT	ION SPECIFI	ED BY:	7		C	ODE DESIGN	BY: 🖲		
				(10)		(11)		(12)	
DESIGN CODE:				10					
REPAIR/ALTERAT	ION/MODIFI	CATION ACTI	VITIES						
Name of Part	Qty.		Manufacturer's Identifying No.		Manufacturer's Drawing No.		MAWP	Shop Hydro PSI	Year Built
13	14	æ	æ		<b>17</b>		18	<b>19</b>	æ
DESCRIPTION OF	PARTS								
	(a) Conn	ections other t	than tubes		Heads or Ends			(b) Tubes	
			Thislands	Shape	Thickness	Material	Diamete	r Thickness	Material
Line No.	Size and Shape	Material Spec. No.	Thickness (in.)	Shape	(in.)	Spec. No.	(in.)	(in.)	Spec. No.
							(in.)		

7. REMARKS: 🛞

	THE				
вХв	NATIONAL	BOAR	2D		INSPECTORS
-00-	OF BOILER	AND	Pressure	VESSEL	INSPECTORS

NB-230, Rev. 4 (12/08/16)

3
(Form <b>"R-3"</b> Registration no.)
(P.O. no., job no., etc.)

CERTIFICATE OF COMPLIANCE	
I,, certify that to the best of my knowledge and belief the statements made in this report correct and that all material, fabrication, construction, and workmanship of the described parts conforms to the <i>National Board Inspection</i> <i>Code</i> and the standards of construction cited.	
National Board"R"Certificate of Authorization No. 32 expression: 33 ,	
(name of "R" Certificate holder) (Authorized Representative)	
CERTIFICATE OF INSPECTION  I,, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and certificate of competency, where required, issued by the Jurisdiction of and emplo	
have inspected the part described in this report on 4,,, and state that to the best of my knowledge and belief th parts comply with the applicable requirements of the National Board Inspection Code.	5
By signing this certificate, neither the undersigned nor my employer makes any warranty, expressed or implied, concerning the work described in this report. Furthermore, neither the undersigned nor my employer shall be liable in any manner for any personal injury property damage, or loss of any kind arising from or connected with this inspection. Date	,

ATIONAL BOARD of Boiler and Pressure Vessel Inspectors	NB-231, Rev. 3, (12/08/1
FORM R-4 REPORT SUPPLEMENT SHEET	
in accordance with provisions of the National Board Inspection Code	
	( <b>1</b> )
	(form" <b>R</b> " referenced)
	(P.O. no., job no., etc.)
WORKPERFORMED BY: (3) (name)	
(name)	
(address)	
OWNER:	
(name)	
(address)	
LOCATION OF INSTALLATION: 5	
(name)	
(address)	
FERENCE	
IE NO. CONTINUED FROM FORM R-	
· ·	
ite	
(authorized representative) (Name of "R" certificate h	nolder)
ate,Signed	dictionno.includingendorsement)

NB-81, Rev. 8, (03/30/17)

# FORM NR-1, REPORT OF REPAIR/REPLACEMENT ACTIVITIES FOR NUCLEAR FACILITIES

CATEGORY OF ACT		(NB,Eqrm Registration No.)
REPAIR/REPLAC	EMENT ERE-RATING	(R/R Plan No., Job No., etc.)
		(K/R Plan No., Job No., etc.)
1. WORKPERFOR	MED BY:	
(address)		
2. OWNER:		
(name	)	
(address)		
3. NAME, ADDRE	SS, AND IDENTIFICATION OF NUCLEAR FACILITY:	
	(5)	
(name)		
(address)		
/unit identification		
(unit identification	$\bigcirc$	
4. SYSTEM/COM	PONENT:ORIGINAL DESIGN SPECIFICATION NO./REV.:	(7)
5. CONSTRUCTIO	N CODE, SECTION & EDITION/ADDENDA AND APPLICABLE CODE CASES USED FOR THE SYSTEM	M OR COMPONENT:
6. NBIC EDITION	USED FOR PERFORMING REPAIRS/REPLACEMENT OR RE-RATING ACTIVITY:	
7. DESIGN RESPO		
8. TESTS CONDU	CTED:       Hydrostatic       Pneumatic       System Leakage       Pressure         Image: System Leakage       Description       System Leakage       Pressure	psi (MPa)
9. NUMBER OF C	DMPONENTS REPAIRED/REPLACED AND/OR RE-RATED (refer to page 2):	
10. DESCRIPTION	OF WORK (use of properly identified additional sheet[s] or sketch[es] is acceptable):	
11. REMARKS: _	(H)	
	ed from The National Board of Boiler and Pressure Vessel Inspectors 1055 Crupper Avenue, Columbus, Ohio 43229-1183	Page 1 of 3

70 SECTION СI

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

Page 2 of 3

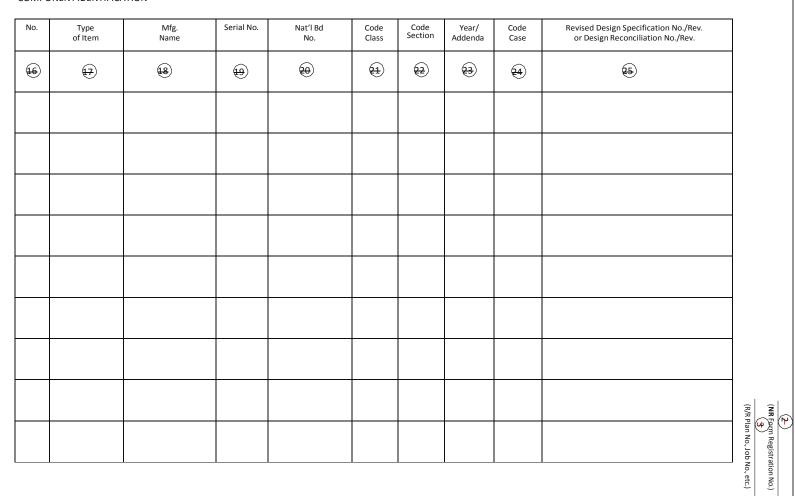
WORKPERFORMED BY:



(Name of "NR" certificate holder)

(Address of "NR" certificate holder)

#### COMPONENT IDENTIFICATION



NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS

2017

NATIONAL BOARD INSPECTION CODE

NB-81, Rev. 8, (03/30/17)

Attachment Page 124 of 145 ATTACHMENT 1 - Page 18 of 22

	ТНЕ		
вХв	THE NATIONAL BOARD OF BOILER AND PI		
-00-	OF BOILER AND PI	RESSURE VESSEL	INSPECTORS

NB-81, Rev. 8, (03/30/17)

#### (NR Form Registration No.)

(R/R Plan No., Job No., etc.)

CERTIFICATE OF COMPLIANCE					
I,	, employed by				
certify that to the best of my knowledge and belief the statements made in this report are correct and the repair/replacement activities or re-rating described above conform to					
National Board Certificate of Authorization No.	Expiration date:				
Signed: Date: _	<u>32</u>				
Title:					
	CERTIFICATE OF INSPECTION				
	— , holding a valid commission issued by the National Board of Boiler and Pressure Vessel				
Inspectors and certificate of competency, when	re required, issued by the Jurisdiction of				
activities described in this report on state that to the best of my knowledge and belief, these activities have been completed in accordance with the Code specified and the <i>National Board Inspection Code</i> <b>NR</b> <sup>n</sup> rules.					
By signing this certificate, neither the undersig	gned nor my employer makes any warranty, expressed or implied, concerning the work				
described in this report. Furthermore, neither	the undersigned nor my employer shall be liable in any manner for any personal injury,				
property damage, or loss of any kind arising fro Signed: Date:	The connected with this inspection.				
(inspector)	(National Board and endorsement)				

GF BOILER AND PRESSURE VESSEL INSP	PECTORS			NB-160, Rev. 8, (03/30/17)
FORMNVR-1, REPORT	OFREPAI	R/REPLACEMEN	TACTIVITIE	SFOR
NUCLEA	RPRESS	URERELIEFDEV	ICES	( <del>2</del> )
				(NVR Form Registration No
ATEGORY OF ACTIVITY: 1 2 3				(R/R Plan No., Job No., etc.
REPAIR/REPLACEMENT RE-RATING				
. WORKPERFORMEDBY:				
(name of "NVR" authorized organi	zation )			
(address)				
. WORK PERFORMED FOR:				
(name)				
(address)				
3. OWNER:5				
(name)				
(address)				
. NAME, ADDRESS, AND IDENTIFICATION OF NUCLEAR	R FACILITY:	(name)		
(address)/ (unit identification)				
CODE APPLICABLE FOR INSERVICE INSPECTION:	( <del>7</del> ) (edition)	(addenda)		(code case(s))
CODE USED FOR REPAIR/REPLACEMENT ACTIVITY:	8			
	(edition)	(addenda)		(code case(s))
. NBIC USED FOR REPAIR/REPLACEMENT ACTIVITY:	(edition)			
. DESIGN RESPONSIBILITY:	(cultion)			
. REPAIRED PRESSURE RELIEF DEVICE: SEE PAGE 2			12	
0. OPENING PRESSURE:	~	DWDOWN (if applicable):		$\frown$
1. SET PRESSURE AND BLOWDOWN ADJUSTMENT MA	DE AT:	-	USING:	(14)
<ol> <li>DESCRIPTION OF WORK: (include name and identifying n</li></ol>	number of replac	ement parts):		
2. REMARKS:				

BATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS

(Name	e of "NR" certificate holder)	-						
(Addre	ess of "NR" certificate holder)							
RESSU	RE RELIEF DEVICE							
	Name of Mfg.	Туре	Mf	;. Serial No.	Nat'l Bd No.	Service	Size	Year Bui
	€ <del>7</del> )	(18)		<b>1</b>	Ð	<u>(1</u> )	22	æ
ONSTR	UCTION CODE							
	Section	Class	Edition		Addenda	Coo	le Case(s)	
				Ð		æ		
	<del>24</del> )	<del>25</del>	<del>20</del>		Ð	Ģ	28)	
IAMEA		ER OF REPLACEMENT PARTS			Ð	Ę	28)	
				Quantity		Number/Traceability I		
No.	ND IDENTIFYING NUMB	ER OF REPLACEMENT PARTS		Quantity (1)				
No.	ND IDENTIFYING NUMB Part Name	ER OF REPLACEMENT PARTS				Number/Traceability I		
No.  2.	ND IDENTIFYING NUMB Part Name	ER OF REPLACEMENT PARTS				Number/Traceability I		
IAME A No. 1. 2. 3.	ND IDENTIFYING NUMB Part Name	ER OF REPLACEMENT PARTS				Number/Traceability I		
No.	ND IDENTIFYING NUMB Part Name	ER OF REPLACEMENT PARTS				Number/Traceability I		
No.	ND IDENTIFYING NUMB Part Name	ER OF REPLACEMENT PARTS				Number/Traceability I		

Page 2 of 3

NB-160, Rev. 8, (03/30/17)

NB-23 2017

(R/R Plan No., Job No., etc.) (NR Form Registration No.)

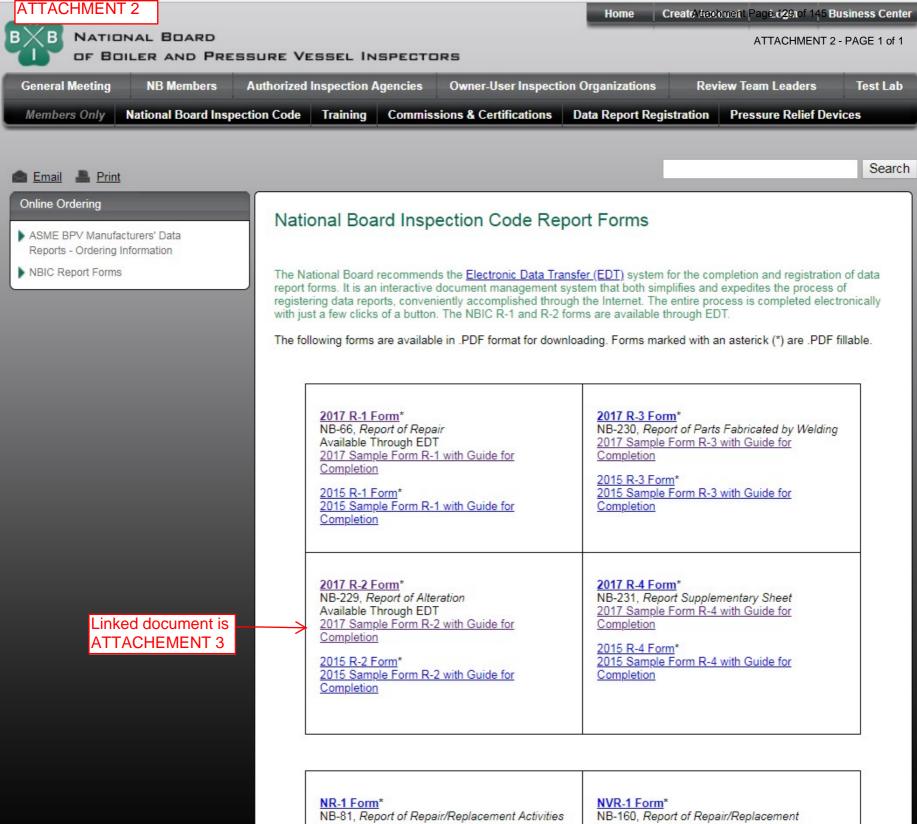
- <b>M</b> -	ТНЕ
вХв	THE National Board of Boiler and Pressure Vessel <b>Inspectors</b>
-00-	OF BOILER AND PRESSURE VESSEL INSPECTORS

NB-160, Rev. 8, (03/30/17)

(form "NVR" registration no.)

(R/R Plan No., Job No., etc.)

CERTIFICATE OF COMPLIANCE				
I,, certify that to the best of my knowledge ar correct and the repair/replacement of the pressure relief devices described above conform to NationalBoardInspectionCode "VR"& "NR" rules.	and belief the statements made in this report are $\underline{34}$ and the			
National Board Certificate of Authorization No. National Board Certificate of Authorization No. Date 39 Signed 3	_ to use the " <b>VR</b> " stamp expires			
(authorized representative)	(title)			
CERTIFICATE OF INSPECTION         I,      , holding a valid commission issued by the National Board of Boiler and Pressure Vessel         Inspectors and certificate of competency, where required, issued by the Jurisdiction of, and employed by      , and employed by         Have inspected the repair/replacement described in this report on knowledge and belief, this repair/replacement has been completed in accordance with the Code specified and the National Board Inspection Code "VR" & "NR" rules.				
By signing this certificate, neither the undersigned nor my employer makes any warranty, expression replacement described in this report. Furthermore, neither the undersigned nor my employer personal injury, property damage, or loss of any kind arising from or connected with this inspector. Signed 42 (inspector)	shall be liable in any manner for any			



for Nuclear Facilities Sample Form NR-1 with Guide for Completion NB-160, Report of Repair/Replacement Activities for Nuclear Pressure Relief Devices Sample Form NVR-1 with Guide for Completion Attachment Page 129 of 145

ATTACHMENT 2 - PAGE 1 of 1 Attachment Page 130 of 145

### GUIDE FOR COMPLETING NATIONAL BOARD FORM R-2, REPORT OF ALTERATION

This guide is to be used when completing the National Board Form R-2, Report of Alteration. When computer generated, the format of the form shall replicate the type and relative location of the information depicted on the Form R-2, Report of Alteration.

When additional space is needed, a Form R-4 shall be used and attached. Information determined to be of a proprietary nature need not be included, but shall be stated on the form.

- 1) Initials of the National Board "R" Certificate of Authorization authorized representative who registers the Form "R".
- 2) Initials of the Inspector who certified the completed Form "R" for registration.
- 3) When registering a Form "R" 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, Paragraph 5.6, a log shall be maintained identifying unique and sequentially numbered Form "R" reports that are registered with the National Board. For re-rating only, the Design Organization registers the Form R-2.
- 4) If applicable, document the unique purchase order, job, or tracking number assigned by organization performing work.
- 5) The name and address of the National Board "R" Certificate of Authorization holder performing the design as it appears on the "Certificate of Authorization".
- 6) The name and address of the National Board "R" Certificate of Authorization holder performing the construction activity as it appears on the "Certificate of Authorization."
- 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, pressure vessel, or piping.
- 10) Name of the original manufacturer of the pressure-retaining item. If the original manufacturer is unknown, state "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, state "unknown."
- 12) When the pressure-retaining item is registered with the National Board, document the applicable registration number. If the pressureretaining 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) Record the Jurisdiction Number, if available.
- 14) Document any other unique number assigned to the pressure retaining item such as a unique number assigned by the owner or user. If unknown, state "unknown."
- 15) Identify the year in which fabrication/construction of the item was completed.
- 16) Indicate edition and addenda, if applicable, 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.
- 20) The information to be considered when describing the 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 3.4.8 to remain in place, and the method of alteration described as listed in the examples of NBIC Part 3, Section 3 or applicable supplement.



- 21) Indicate the type of Pressure test performed (Liquid, Pneumatic, Vacuum)
- 22) Indicate test pressure applied.
- 23) Indicate the maximum allowable working pressure of the part. (As altered)
- 24) As applicable, identify which 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.
- 25) Indicate any additional information pertaining to the work involved (e.g., routine repairs, code cases, interpretations used).
- 26) Type or print name of the National Board "R" Certificate of Authorization authorized representative responsible for design certification.
- 27) Indicate National Board "R" Certificate or Authorization number.
- 28) Indicate month, day, and year the National Board "R" Certificate of Authorization expires.
- 29) Indicate the date the alteration was certified.
- 30) Record the name of National Board "R" Certificate of Authorization holder who performed the described work, using full name as shown on the "Certificate of Authorization" or an abbreviation acceptable to the National Board.
- 31) Signature of National Board "R" Certificate of Authorization authorized representative.
- 32) Type or print the name of Inspector certifying the design review.
- 33) Indicate the Inspector's Jurisdiction.
- 34) Indicate the Inspector's employer; also indicate the address of the Inspector's employer (city and state or province).
- 35) Indicate the month, day and year of the design certification by the Inspector.
- 36) Signature of the Inspector certifying the design review.
- 37) Inspectors National Board commission number and endorsement that qualifies the Inspector to sign this report, and when required by the Jurisdiction, the applicable State or Provincial numbers.
- 38) Type or print name of the National Board "R" Certificate of Authorization authorized representative responsible for any construction.
- 39) Indicate the National Board "R" Certificate or Authorization number.
- 40) Indicate month, day, and year the National Board "R" Certificate of Authorization expires.
- 41) Indicate the date the alteration was certified.
- 42) Record the name of National Board "R" Certificate of Authorization holder who performed the described work, using full name as shown on the Certificate of Authorization or an abbreviation acceptable to the National Board.
- 43) Signature of National Board "R" Certificate of Authorization authorized representative
- 44) Type or print the name of Inspector certifying the construction inspection.
- 45) Indicate the Inspector's Jurisdiction.
- 46) Indicate the Inspector's employer; also indicate the address of the Inspector's employer (city and state or province).
- 47) Indicate the month, day and year of the inspection by the Inspector.
- 48) Indicate the month, day and year the completed Form "R" was signed by the Inspector.
- 49) Signature of the Inspector certifying the construction inspection.
- 50) Inspectors National Board commission number and endorsement that qualifies the Inspector to sign this report, and when required by the Jurisdiction, the applicable State or Provincial numbers.

Attachment Page 133 of 145



ATTACHEMENT 3 - PAGE 3 of 4 NB-229, Rev. 8, (12/07/16)

	FORM R-2 REPORT OF ALTERATION in accordance with provisions of the National Board Inspection Code	(Authorized (2) (Inspectors i (3) (Form " <b>R</b> " Re	
1a.	DESIGN PERFORMED BY:	(P.O. no., job	no., etc.)
1b.	(address) CONSTRUCTION PERFORMED BY: 6 (name of "R" organization responsible for construction)		
2.	(address) OWNER OF PRESSURE RETAINING ITEM: 7 (name)		
3.	(address) LOCATION OF INSTALLATION: (name)		
4.	(address) ITEM IDENTIFICATION: 9 (boiler, pressure vessel, or piping) NAME OF ORIGINAL MANUFACTURER: 10		
5.		(other)	(year built)
6.	NBIC EDITION/ADDENDA:       16       (11)         (edition)       (addenda)         Original Code of Construction for Item:       17		
	(name / section / division) (edition Construction Code Used for Alteration Performed:	/ addenda) / addenda)	
7a.	DESCRIPTION OF DESIGN SCOPE: Form R-4, Report Supplementary Sheet is attached		
7b.	DESCRIPTION OF CONSTRUCTION SCOPE: Form R-4, Report Supplementary Sheet is attached		
	(21) Pressure Test, if applied (22) psi MAWP (23)		psi



ATTACHEMENT 3 - PAGE 4 of 4

NB-229, Rev. 8, (12/07/16)	
3	
(Form "R" Registration no.)	
4)	
(P.O. no., job no., etc.)	

8. REPLACEMENT PARTS: (Attached are Manufacturer's Partial Data Reports or Form R-3's properly completed for the following items of this report):

(name of part, item number, data report type or Certificate of Compliance, mfg's. name and iden $(24)$	tifying stamp)
9. REMARKS: 25	
Design Certification	
I, <u>(26)</u> , certify that to the best of my knowledge an Design Change described in this report conforms to the <i>National Board Inspecti</i> $\binom{27}{2}$	d belief the statements in this report are correct and that the on Code. National Board " <b>R</b> " Certificate of Authorization No. expires on (28)
Date,SignedSigned	
(name of design organization) (authorized represe	ntative)
certificate of design change review	
I, <u>(32)</u> , holding a valid Commission issued by The N	ational Board of Boiler and Pressure Vessel
Inspector and certificate of competency, where required, issued by the jurisdic	
	of
have reviewed the design change as described in this report and state that to the applicable requirements of the <i>National Board Inspection Code</i> .	the best of my knowledge and belief such change complies with
By signing this certificate, neither the undersigned nor my employer makes an	y warranty, expressed or implied, concerning the work described
in this report. Furthermore, neither the undersigned nor my employer shall be	liable in any manner for any personal injury, property damage or
loss of any kind arising from or connected with this inspection.	nissions
(inspector)	(National Board and jurisdiction no. including endorsement)
CONSTRUCTION CERT	TFICATION
38	
n, <u>even</u> , certify that to the best of my knowledge an material, construction, and workmanship on this Alteration conforms to the Na	d belief the statements in this report are correct and that all tional Board Inspection Code. National Board " <b>B</b> " Certificate of
Authorization No. $(40)$ expires on $(40)$	
Date (41) , (42) Signed (43)	
(name of alteration organization) (authorized repr	esentative)
CERTIFICATE OF INSPECTION	
I,, holding a valid commission	issued by the National Board of Boiler and Pressure Vessel
Inspectors and certificate of competency, where required, issued by the Jurisc	liction ofand employed by
have inspected the work described in this report on $46$	of and state
that to the best of my knowledge and belief, this work complies with the app	icable requirements of the National Board Inspection Code. By
signing this certificate, neither the undersigned nor my employer makes any using this second control of the s	
in this report. Furthermore, neither the undersigned nor my employer shall be or loss of any kind arising from or connected with this inspection.	e name in any manner for any personal injury, property damage,
Date Signed	
(inspector)	(National Board and jurisdiction no. including endorsement)

Attachment Page 135 of 145

## 18-48

## 7/17/18

# Request for NBIC Part 3, Section 2 Revision

Robert V. Underwood-The Hartford Steam Boiler Inspection & Insurance Company

Purpose	To clarify and revise paragraph 2.5.3(e) of NBIC Part 3 relating to Alternative Welding Methods Without Postweld Heat Treatment.
Scope:       1) Replace reference to "boiler, pressure vessel, and piping systems" with "pretaining items."         2) Replace references to radiography with volumetric examination	
	<ol> <li>Replace references to radiography with volumetric examination.</li> <li>Replace the last sentence of 2.5.3(e) relating to MT/PT of final weld if RT is not practical and re-evaluation of maximum allowable working pressure and/or design temperature with reference to existing requirements in 4.2(a) of Part 3.</li> </ol>
Background	<ol> <li>Using "pressure retaining items" in lieu of specific items such as boilers, pressure vessels, and piping systems is consistent with other areas of the NBIC.</li> </ol>
	<ol> <li>The construction Codes were recently revised to permit UT in lieu of radiography. Replacing references to radiography in the 2.5.3(e) with volumetric examination is consistent with other areas of the NBIC Part 3.</li> </ol>
	<ol> <li>The last sentence of 2.5.3(e) is redundant and NDE requirements are already addressed in 4.2(a) of Part 3.</li> </ol>
Proposed Revision	See page 2 for proposed revisions.

## 2.5.3 ALTERNATIVE WELDING METHODS WITHOUT POST WELD HEAT TREATMENT

## (revising Paragraph (e) only)

## 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. (9.6 mm) deep or welds in a boiler, pressure vessel, or piping system pressure retaining item that were originally required to be radiographed volumetrically examined in accordance with paragraph 4.2 of Part 3. In situations where it is not practical to perform radiography, the accessible surfaces of each non radiographed repair weld shall be fully examined using the MT or PT method to determine that no defects exist and the maximum allowable working pressure and/or allowable temperature shall be re-evaluated to the satisfaction of the jurisdiction at the location of installation.

#### 4.2 NONDESTRUCTIVE EXAMINATION

- a) The nondestructive examination (NDE) requirements, including technique, extent of coverage, procedures, personnel qualification, and acceptance criteria, shall be in accordance with the original code of construction for the pressure-retaining item. Weld repairs and alterations shall be subjected to the same nondestructive examination requirements as the original welds. Where this is not possible or practicable, alternative NDE methods acceptable to the Inspector and the Jurisdiction where the pressure-retaining item is installed, where required, may be used.
- b) NDE personnel shall be qualified and certified in accordance with the requirements of the original code of construction. When this is not possible or practicable, NDE personnel may be qualified and certified in accordance with their employer's written practice. ASNT SNT-TC-1A, *Recommended Practice Nondestructive Testing Personnel Qualification and Certification* (2006 edition), or ANSI/ASNT CP-189, *Standard for Qualification and Certification of Nondestructive Testing Personnel* (2006 edition), shall be used as a guideline for employers to establish their written practice. Provisions for training, experience, qualification, and certification of NDE personnel shall be described in the "R" Certificate Holder's written quality system.

## Item 18-50 7/16/18

## **Request for NBIC Part 3, Supplement 2 Revision**

Robert V. Underwood-The Hartford Steam Boiler Inspection & Insurance Company

Purpose	To revise S2.11(a) and (e) for clarity.
Scope:	<ol> <li>Revise S2.11(a) by removing reference to visual examination "VT" from an acceptable method of NDE for final inspection.</li> </ol>
	<ol> <li>Revise S2.11(e) to ensure it is clear that exclusive use of "VT" is only permitted for final testing of routine repairs per 4.4.1(e).</li> </ol>
Background	<ol> <li>The existing S2.11(a) could indicate that visual examination could be used for a final weld inspection to ensure satisfactory weld repairs have been accomplished. We have found that in many cases people will read the paragraph and not go read all referenced sections, thus causing unacceptable NDE to be performed.</li> </ol>
	2) The existing S2.11(e) indicates that VT is permitted for repair inspection when, in fact, it is only permitted for final testing of routine repairs per 4.4.1(e) of Part 3. We are proposing to revise this sentence for clarity.
Proposed Revision	See below for proposed revisions.

## S2.11 NONDESTRUCTIVE EXAMINATION

- a) The Inspector may require nondestructive examination (RT, PT, MT, <u>and UT, and VT</u>) as necessary to ensure satisfactory welded repairs have been accomplished.
- b) The nondestructive examination (NDE) requirements, including technique, extent of coverage, procedures, personnel qualification, and acceptance criteria, shall be in accordance with the original code of construction for the pressure-retaining item. Weld repairs and alterations shall be subjected to the same nondestructive examination requirements as the original welds.
- c) Where the original code of construction is unknown or the NDE method is not possible or practicable, alternative NDE methods may be used. These methods shall be acceptable to the owner, the Inspector and where required, the Jurisdiction of the pressure-retaining item.
- d) NDE methods used shall be suitable for providing meaningful results to verify the integrity of the repair and or alteration.
- e) Exclusive use of visual examination (VT) for repair inspection is only permitted when performing final examination for routine repairs following the requirements in accordance with of Part 3, 4.4.1 e).

# **18-51**

#### **CODE REVISION OF NBIC PART 3, SECTION 6, SUPPLEMENT 6**

#### **REPAIR, ALTERATION, AND MODIFICATION OF DOT TRANSPORT TANKS, S6.10.3**

#### a) Proposed Revision to S6.10.3:

#### S6.10 HEAT TREATMENT

#### S6.10.1 PREHEATING

Preheating may be employed during welding to assist in completion of the welded joint (see NBIC Part 3, 2.5.1). 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 of the base metals being joined. The Welding Procedure Specification for the material being welded shall specify the preheat temperature requirements.

#### **S6.10.2 POSTWELD HEAT TREATMENT**

Postweld heat treatment may be performed as required by the original code of construction in accordance with a written procedure. The procedure shall contain the parameters for postweld heat treatment. Local PWHT that is not specified by the original code of construction may be performed in accordance with an Alternative Postweld Heat Treatment Method described in NBIC Part 3, 2.5.<u>3-2</u> with acceptance by the Inspector and required by the Competent Authority.

#### **S6.10.3 ALTERNATIVES TO 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, alternative methods of postweld heat treatment or special welding methods in accordance with NBIC Part 3, 2.5.3, and acceptable to the Inspector and Competent Authority may be used.
- b) When the standard governing the original construction is the Code of Federal regulation for DOT/MC 331 cargo tanks for propane, butane, anhydrous ammonia, and other DOT permitted commodities, and the tanks are made to the ASME Code, Section VIII, Division 1, Part UHT, repairs, alterations, or modifications shall conform insofar as possible, to the edition of the construction standard or specification most applicable to the work. Where this is not possible or practicable, it is permissible to use other codes, standards, or specifications provided the "TR" Certificate Holder has the concurrence of the DOT. Shells and heads of MC 331 cargo tanks were made from quenched and tempered alloy steel plate, SA517, Grade E (originally Code Case 1298) and Grade F (originally Code Case 1204) prior to 1994.
- c) The 1994 ASME Code Addenda revised UHT-5(b) to permit the joining of UHT materials to UCS or UHA materials in head and shell sections. Propane, butane, and anhydrous ammonia are the most common transported commodities and the shipper is required by DOT to comply with certain composition limitations. Propane and butane transported must have sufficiently low hydrogen sulfide content so as not to exceed the limitations for Classification One of the ASTM D1838-74 copper strip test, and the anhydrous ammonia transported must be inhibited with a minimum water content of 0.2% by weight. In addition, such cargo tanks made for propane, butane, and anhydrous ammonia service must be postweld heat treated, unless specifically exempted by a DOT special permit that exempts PWHT.

#### **S6.11 NONDESTRUCTIVE EXAMINATION**

- b) The nondestructive examination (NDE) requirements, including technique, extent of coverage, procedures, personnel qualification, and acceptance criteria, shall be in accordance with the original code of construction used for the pressure vessel, and repairs, alterations, and modifications 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 Competent Authority may be used on a case-by-case basis.
- c) 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 for 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. The ASNT Central Certification Program (ACCP) may be used to fulfill the examination and demonstration requirements of the employer's written practice. Provisions for training, experience, qualification and certification of NDE personnel shall be described in the "R" Certificate Holder's written quality system.

#### b) Statement of Need:

- NBIC Part 3, Supplement 6 (DOT) allows alternatives to PWHT (S6.10.3) and NDE (S6.11) however they do not have the controls in place in accordance with NBIC Part 3, 2.5.3 and 4.4.1e). Lack of these controls when utilizing alternative methods have the potential to become a major safety issue.
- Editorial correction in S6.10.3 for reference to NBIC Part 3, 2.5.2 Postweld Heat Treatment (PWHT). Original reference to 2.5.3 (Alternative Welding Methods Without Postweld Heat Treatment) was incorrect.

# 18-52 Request for NBIC Part 3, Revision to definition of "Jurisdiction"

Terrence Hellman National Board thellman@nationalboard.org 614-431-3234

Purpose	Revise the definition of "Jurisdiction" in the NBIC.
Scope:	Revision to the glossary of Parts 1-4 of the NBIC to have the definition of "Jurisdiction" revised.
Background:	The first sentence in the current definition does not include non- members jurisdictions. The second sentence refers to jurisdictional involvement in reviews, and is not relevant to the definition of "jurisdiction".
Proposed Revision:	See below:

CURRENT DEFINITION	PROPOSED DEFINITION
Jurisdiction — The National Board	Jurisdiction — <u>A governmental entity</u>
member Jurisdiction where the	with the power, right, or authority to
organization is located. Alternatively,	interpret and enforce law, rules, or
where the Jurisdiction elects not to	ordinances pertaining to boilers,
perform the review or where there is no	pressure vessels, or other pressure-
Jurisdiction or where the Jurisdiction is	retaining items where the pressure
the organization's Authorized	retaining item is installed. It includes
Inspection Agency, The National Board	National Board member jurisdictions
of Boiler and Pressure Vessel	defined as "jurisdictional authorities."
Inspectors will represent the	Where there is no National Board
Jurisdiction. At the Jurisdiction's	Member Jurisdiction, the National
discretion, the Jurisdiction may choose	Board shall act on behalf of the
to be a member of the review team if	Jurisdiction.
the Jurisdiction chooses not to be the	
team leader.	

## Item 18-54 7/16/18

# Request for NBIC Part 3, Supplement 2 Revision

Robert V. Underwood-The Hartford Steam Boiler Inspection & Insurance Company

Purpose	To delete the last sentence in S2.7.2 relating to welded replacement parts.
Scope:	To delete the last sentence of S2.7.2 which could permit an "NR" Certificate Holder to provide welded replacement parts if it isn't possible for the manufacturer to provide them.
Background	<ul> <li>S2.7.2 addresses welded replacement parts for historical boilers. The last sentence permits an "NR" Certificate Holder to provide a welded replacement part if it isn't possible for the manufacturer to provide them (by referring to organizations accredited per 1.6 of Part 3).</li> <li>Paragraph 1.6 of the NBIC Part 3 was revised in the 2015 Edition from "R" Certificate Holder Quality Program requirements to "NR" Certificate Holder Quality Program requirements. Going back to at least the 2001 Edition of the NBIC, an "R" Certificate Holder was permitted to provide welded replacement parts for historical boilers if it wasn't possible for the Manufacturer to provide them.</li> <li>NBIC Part 3, 3.2.2(c) requires <u>ASME Certificate Holders</u> provide welded replacement parts. The deletion of the last sentence of S2.7.2 is for consistency of general NBIC requirements.</li> <li>I am proposing to either delete the last sentence of S2.7.2 to be consistent with the rest of the NBIC.</li> </ul>
Proposed	
Revision	See page 2 for proposed revision

**OPTION 1:** Delete last sentence which will require ASME Certificate Holders provide welded replacement parts.

### S2.7.2 REPLACEMENT PARTS

Replacement pressure parts formed by casting, forging, or die forming, and on which no welding has been performed shall be supplied as material. Such parts shall be marked with the material identification required by the construction standard used for the repair. Replacement parts fabricated by welding shall be manufactured by an organization certified as required by the construction standard used for the repair. When it is not possible or practical for a manufacturer to supply replacement parts fabricated by welding, an organization accredited as described in NBIC Part 3, 1.6 may fabricate the part with the approval of the Jurisdiction.

## **REFERENCE:**

### Existing 3.2.2(c) of NBIC Part 3 (Requires ASME Certificate Holder to supply parts)

- c) When ASME Code is the original code of construction, replacement parts subject to internal or external pressure fabricated by welding, which require inspection by an Authorized Inspector shall be fabricated by an organization having an appropriate ASME Certificate of Authorization. The item shall be inspected and stamped as required by the applicable section of the ASME Code. A completed ASME Manufacturer's Partial Data Report shall be supplied by the manufacturer.
  - ASME stamping and completion of an ASME Manufacturer's Partial Data Report is not required for parts fabricated by the "R" Certificate Holder that will be used on pressure retaining items being repaired or altered by the same "R" Certificate Holder. The controls for this activity shall be described in the quality control system.
  - 2) The "R" Certificate Holder, using replacement parts fabricated and certified to an ASME Code edition and addenda different from that used for the original construction, shall consider and seek technical advice, where appropriate, for change or conflicts in design, materials, welding, heat treatment, examinations and tests to ensure a safe repair/alteration is performed. Note that work once classified as a repair could now be considered an alteration.

Attachment Page 145 of 145