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THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS

NATIONAL BOARD SUBGROUP REPAIRS AND ALTERATIONS

MINUTES

Meeting of July 14, 2015
Columbus, OH

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The National Board of Boiler & Pressure Vessel Inspectors
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1. **Call to Order :**
   The meeting was called to order at 8am by Chairman Angelo Bramucci

2. **Announcements:** The announcements were presented by Bill Vallance and George Galanes

3. **Adoption of the Agenda:** The agenda was revised to add 7 new action items and one new interpretation. A motion was made and unanimously approved to accept the agenda as revised

4. **Approval of Minutes of January 20, 2015**
   A motion was made and unanimously approved to accept the minutes of the January 20, 2015 meeting**.**

5. **Review of the Roster (Attachment Page 1-3)**
   Roster was reviewed. Ms. Pat Becker is sitting in for Ron Pullman. There are 19 members present. Sign-In sheet attached.

6. **Interpretations**

Item Number: IN14-0701	**NBIC Location: Part 3**	**Attachment Page 4**

General Description: Interpretation question regarding certification required and documentation of post weld heat treatment

Subgroup: Repairs and Alterations

Task Group: Unknown

History:

<u>July 2014</u>
Mr. Galanes reported that a task group of W. Sperko (PM), B. Wielgoszinski and himself has been
assigned.

<u>January 2015</u>
Mr. Galanes presented the proposed answers to the interpretation questions along with the Subcommittee on Repairs and Alterations' rationale for their answers. SC Repairs and Alterations approved the interpretation response with one abstention. The NBIC Committee voted unanimously to send this item to letter ballot for vote. The letter ballot did not receive sufficient response to pass.

Meeting Action: Mr. Galanes is expected to report.
<u>July 14, 2015</u>
Mr. Galanes reported during the ballot process there appeared to be issues with not enough votes being received. After the interpretation was reaffirmed a motion was made and unanimously approved, to send the interpretation out again for a ballot.

Item Number: IN14-0801	NBIC Location: Part 3, 3.3.3) s)	Attachment Pages 5-6

General Description: Interpretation question clarifying definition of "minimum required thickness" required on U-1 form as nominal wall thickness minus corrosion allowance

Subgroup: Repairs and Alterations

Task Group: Brian Morelock (PM)

History:

January 2015
Mr. Galanes gave a report. SC Repairs and Alterations motioned and approved the interpretation unanimously. The NBIC Committee voted unanimously to send this item to letter ballot for vote. The letter ballot did not receive sufficient response to pass. One abstention with a comment for revision was registered in the voting.

Meeting Action: Mr. Morelock is expected to report.
Mr. Morelock reported during the ballot process there appeared to be issues with not enough votes being received. After the interpretation was reaffirmed a motion was made and unanimously approved, to send the interpretation out again for a ballot.

Item Number: IN15-0201	NBIC Location: Part 3	Attachment Page 7-8

General Description: Interpretation question regarding "R" Symbol Stamp quality system.

Subgroup: Repairs and Alterations

Task Group: Bob Wielgoszinski, Ben Schafer, & Rob Trout

History: None

Meeting Action: Mr. Galanes is expected to report.
July 14, 2015
Mr. Galanes reported the history behind the interpretation letter. B. Wielgoszinski and his task group above will work on this interpretation. Task Group appointed.

7. Action Items

Item Number: NB12-0801	NBIC Location: Part 3	Attachment Pages 9-18

General Description: Add requirements for repair and alteration of gasketed PHEs in the field

Subgroup: Repairs and Alterations

Task Group: R. Cauthon (PM), B. Wielgoszinski, N. Carter

History:

January 2012
This item was transferred from R/A General. A task group of E. Ortman (PM), G. Galanes and B. Wielgoszinski was assigned.

July 2012
A progress report was provided by Mr. Cauthon

January 2013
A progress report on this Action Item was given by B. Wielgoszinski and E. Ortman. During discussions it was suggested by R. Wielgoszinski that it may only be necessary to list actions that are considered repairs and actions considered alterations. The Task Group will continue to gather information for the next meeting.

July 2013
A progress report along with 3 documents for review was presented by Mr. Ed Ortman.

January 2014
Mr. Ortman is coordinating the NBIC updates with the ASME code future requirements. Once established a letter ballet will be sent out. Mr. Galanes and Mr. Pillow will be copied on correspondence should questions come up.

July 2014
Mr. Cauthon gave a progress report; Section VIII Div.1 has a revision in progress to address PHEs. We are waiting resolution of that action before finalizing the NBIC proposal.

January 2015
Mr. Cauthon gave a progress report. Progress is being made in ASME BPV Section VIII Division 1 on a PHE appendix, which the task group is keeping tabs on.

Meeting Action: Mr. Cauthon is expected to report.
July 14, 2015
Mr. Cauthon reported ASME in working slowly on the PHE's in Section VIII Division 1. The committee has asked the National Board Staff to correspond with the secretary of the ASME PHE committee and sent our NBIC proposal for their committees' comments.

Item Number: NB13-1403 NBIC Location: Part 3 Attachment Pages 19-20

General Description: Installation of boiler tubes and arch tubes

Subgroup: Repairs and Alterations

Task Group: R. Stone (PM)

History:

March 2015
Subgroup Locomotive Boilers requested this item be moved to Subgroup Repairs and Alterations for further work.

Meeting Action: Mr. Galanes is expected to report.
July 14, 2015
Mr. Galanes commenced the discussion and Mr. Lynn Moedinger from the locomotive committee to provided background information.
A motion was made and unanimously approved to close the item with no action.

Item Number: NB14-0203	**NBIC Location: Part 3**	**Attachment Pages 21-26**

General Description: Review Part 3 for any changes needed to be made to "R" accreditation requirements

Subgroup: Repairs and Alterations

Task Group: Ron Trout (PM), N. Carter, & R Cauthon

History:

July 2014
A progress report was given by Mr. Cauthon. Information of proposed changes to accreditation section of Part 3 of the NBIC was presented for information. This item passed subgroup in July 2014, but no vote was taken in subcommittee.

January 2015
Mr. Galanes gave a progress report. SC Repairs and Alterations will vote to on this item via letter ballot. The ballot did not pass, with four disapproval votes from Mr. Brian Morelock, Mr. George Galanes, Mr. Rob Troutt, and Mr. Wayne Jones.

Meeting Action: Mr. Galanes is expected to report.
July 14, 2015
Rob Troutt presented a revised document for the accreditation section of Part 3. A motion was made and unanimously approved to move this onto the Subcommittee. Task group assigned.

Item Number: NB14-0301	**NBIC Location: Part 3**	**Attachment Pages 27-30**

General Description: Add requirements for encapsulation

Subgroup: Repairs and Alterations

Task Group: Bob Wielgoszinski (PM), George Galanes, Frank Johnson , & Kathy Moore

History:

July 2014
A progress report was given by Mr. Wielgoszinski

January 2015
Mr. Wielgoszinski is expected to report.

Meeting Action: Mr. Wielgoszinski is expected to report.
July 14, 2015
Mr. Wielgoszinski presented a document on encapsulation. Discussion was made and agreed to proceed that encapsulation is an alteration. Further work is to be done. Progress Report. Task group assigned.

Item Number: NB14-0302	**NBIC Location: Part 3, S6**	**Attachment Pages 31-39**

General Description: Develop additional "TR" forms to include in Part 3

Subgroup: Repairs and Alterations

Task Group: C. Withers (PM), B. Underwood, K. Moore, B. Vallance

History:

July 2014
A progress report was given on the status of form development by Bill Vallance

January 2015
Mr. Galanes gave a progress report. A new task group was formed to address "TR" program revisions.

Meeting Action: Mr. Withers is expected to report.
July 14, 2015
B. Vallance presented information that no action was taken. Chuck Withers is going to meet with Stan **S**taniszewski of Department of Transportation, DOT. The discussions will ensure Supplement 6 meets the DOTs needs and to have program use the R stamp and not the TR stamp. Progress Report

Item Number: NB14-0701	**NBIC Location: Part 3, 3.2.2 c)**	**Attachment Pages 40-45**

General Description: Result of IN13-0301, clarify requirements about an "R" certificate holder using an ASME pressure part they fabricated in a separate repair or alteration they are performing

Subgroup: Repairs and Alterations

Task Group: Bob Wielgoszinski (PM)

History:

July 2013
A letter ballot was approved to be sent to the NBIC Main Committee for comment only.

January 2014
Mr. Wielgoszinski presented a report. Through much discussion Mr. Wielgoszinski will present a report to the sub-committee after incorporation of discussion comments on January 15, 2014.

July 2014
A progress report was given with a document NB14-0701 with responses to ballot comments.

January 2015
Mr. Galanes gave a progress report. Mr. Wielgoszinski provided further information on the item. SC Repairs and Alterations will vote on this item via letter ballot. The ballot did not pass, with disapproval votes from Mr. Brian Boseo, Mr. George Galanes, Mr. Paul Edwards, Mr. Rob Troutt, and Mr. Wayne Jones.

Meeting Action: Mr. Galanes is expected to report.
July 14, 2015
Mr. Wielgoszinski presented a revised document to address the lasts ballots negative votes. The Committee felt the current proposal put a burden on a lot of the R certificate holders by having them have an ASME Stamp along with the R stamp. The committee voted and approved, with two abstentions, to reaffirm the original proposal and send it out for a ballot vote. Mr. Edwards and Galanes abstained. Task Group member is appointed.

Item Number: NB14-1102	**NBIC Location: Part 3**	**Attachment Pages 46-47**

General Description: ~~Diagram~~ Diaphragm Weld Repair

Subgroup: Repairs and Alterations

Task Group: Unknown

History:

March 2015
SG Locomotive Boilers requested that this item be transferred to SG Repairs and Alterations for further work.

Meeting Action: Mr. Galanes is expected to report.
July 14, 2015
Mr. Lynn Moedinger from the locomotive sub group provided the items history. A motion was made and unanimously approved to close the item with no action.

Item Number: NB14-	**NBIC Location: Part 3, S6.5**	**Attachment Pages 48-49**

2401

General Description: Replace the referenced TR-1 form with a TR-3 form

Subgroup: Repairs and Alterations

Task Group: C. Withers (PM), B. Underwood, K. Moore, B. Vallance

History:

July 2014
No action taken on this item as there currently in not a form within Part 3.

January 2015
Mr. Galanes gave a progress report. A new task group was formed to address "TR" program revisions.

Meeting Action: Mr. Withers is expected to report.
July 14, 2015
Mr. B. Vallance presented information that no action was taken. Chuck Withers is going to meet with Stan **S**taniszewski of the Department of Transportation, DOT. The discussions will ensure Supplement 6 meets the DOTs needs and to have program use the R stamp and not the TR stamp. Progress Report

Item Number: NB14-2402 **NBIC Location: Part 3, S6.3** **Attachment Pages 50-51**

General Description: Remove "TR" accreditation requirements from the NBIC because "TR" accreditation requirements will be addressed in a separate National Board "TR" document

Subgroup: Repairs and Alterations

Task Group: C. Withers (PM), B. Underwood, K. Moore, B. Vallance

History:

July 2014
It was discussed to form a task group to look over the NBIC Supplement-6 DOT too see where updates can be made. No action taken on this item.

January 2015
Mr. Galanes gave a progress report. A new task group was formed to address "TR" program revisions.

Meeting Action: Mr. Withers is expected to report.
July 14, 2015
Mr. B. Vallance presented information that no action was taken. Chuck Withers is going to meet with Stan **S**taniszewski of the Department of Transportation, DOT. The discussions will ensure Supplement 6 meets the DOTs needs and to have program use the R stamp and not the TR stamp. Progress Report

Item Number: NB15-0509	NBIC Location: Part 3, 2.5.3.6	Attachment Page 52

General Description: Originally contained PR15-0157, PR15-0158, PR15-0156, and PR15-0501; now only addressing PR15-0156 and PR15-0501 regarding use of propriety filler metal names in Welding Method 6

Subgroup: Repairs and Alterations

Task Group: George Galanes, (PM)

History:

January 2015
Two of the public review comments, PR15-0157 and PR15-0158, were removed from NB15-0509 and added to a new action item, NB15-1402. For NB15-0509, Mr. Galanes gave progress report on the use of proprietary electrode names in welding method 6. The Subcommittee on Repairs and Alterations approved a proposed wording change, but elected to return the item without vote for further work in light of new information.

Meeting Action: Mr. Galanes is expected to report.
July 14, 2015
Mr. Galanes presented a document to revise Welding Method 6 for electrode names. Motion was made and unanimously approved revision and to move it onto the Subcommittee. Task group assigned.

Item Number: NB15-0511	NBIC Location: Part 3, 5.13.5.1	Attachment Page 53

General Description: Result of PR15-0120, how does one fill out "NR" paperwork if the repairs or alterations were performed to an international code other than Section III or Section XI?

Subgroup: Repairs and Alterations

Task Group: P. Edwards (PM), B. Schafer, B. Wielgoszinski, C. Withers

History:

January 2015
Mr. Galanes gave a progress report. This item was transferred to the "NR" task group for further work.

Meeting Action: Mr. Edwards is expected to report.
July 14, 2015
Mr. Edwards presented a progress report on the NR task groups' progress that will be continuing.

Item Number: NB15-1003	NBIC Location: Part 3	www.nbicshare.org July 2015 S. G.

General Description: Update “stamp” vs. “certification” language to maintain consistency with ASME code

Subgroup: Repairs and Alterations

Task Group: Rob Troutt (PM), J. Amato, J. Pillow

History:

January 2015
Mr. Galanes gave a progress report. A task group was assigned for further work with Rob Troutt as the project manager.

Meeting Action: Mr. Troutt is expected to report.
July 14, 2015
Mr. Troutt presented a revised NBIC Part 3 where the term Stamp vs. Certification language was revised. A motion was made and unanimously approved to move this to the Subcommittee.

Item Number: NB15-1101 **NBIC Location: Part 3** **Attachment pages 54-93**

General Description: Investigate code addition for carbon fiber wrap reinforcement of high pressure metal pressure vessels

Subgroup: Repairs and Alterations

Task Group: Dave Martinez (PM) & Kathy Moore

History:

January 2015
Mr. Galanes gave a report. In July 2015, a presentation will be given by HJ3 Composite Technologies, Inc. about this system.

Meeting Action: Mr. Galanes is expected to report.
July 14, 2015
Mr. Olley Scholer from HJ3 provided a presentation for Carbon Fiber Reinforced Polymer (CFRP) Reinforcement of High Pressure Metal Pressure Vessels. This process could be an inclusion in the NBIC Part 3 for repairs to vessels and piping. Task group appointed.

Item Number: NB15-1201 **NBIC Location: Part 3, 5.6** **No Attachment**

General Description: Expand requirements for form logs in Section 5 to include not only “R” program, but also “VR” and “NR”

Subgroup: Repairs and Alterations

Task Group: Chuck Withers, (PM)

History:

January 2015
Mr. Galanes gave a report. More information from National Board staff needs to be obtained before work can continue.

Meeting Action: Mr. Galanes is expected to report.
July 14, 2015
Mr. Galanes indicated no action was taken and suggests having Chuck Wither be designated as the project manager. Further information should be obtained for National Board staff for the origin of the action item. Task group assigned.

Item Number: NB15-1401	**NBIC Location: Part 3, Section 3**	**Attachment Pages 94-100**

General Description: Investigate new requirements for weld buildup of thin walled tubes

Subgroup: Repairs and Alterations

Task Group: W. Sperko (PM), G. Galanes, J. Siefert

History:

January 2015
Mr. Galanes gave a progress report, and a new task group was formed to address this issue.

Meeting Action: Mr. Sperko is expected to report.
July 14, 2015
B. Wielgoszinski reported the project manager is out of the country this meeting and has not has a chance to work with his task group to evaluate the attached report findings and present a case for a revision to part 3.

Item Number: NB15-1402	**NBIC Location: Part 3, 2.5.3.6**	**Attachment Pages 101-102**

General Description: Result of PR15-0157 and PR15-0158, investigate appropriate

humidity protection for materials used in Welding Method 6

Subgroup: Repairs and Alterations

Task Group: G. Galanes (PM), J. Seifert, N. Carter

History:

January 2015
Mr. Galanes gave a progress report. A task group was formed to work on the public comments related to humidity protection in Welding Method 6.

Meeting Action: Mr. Galanes is expected to report.
July 14, 2015
Mr. Galanes presented a document to revise paragraph 3 of Welding Method 6. A motion was made and unanimously approved the revision and to move it onto the Subcommittee.

Item Number: NB15-1403	**NBIC Location: Part 3**	**Attachment Pages 103-138**

General Description: Create a new supplement on weld repair to CSEF Grade 91 steel

Subgroup: Repairs and Alterations

Task Group: G. Galanes (PM), J. Siefert

History:

January 2015
Mr. Galanes gave a progress report. Mr. Siefert presented a power point presentation with research on Grade 91 steel that could be used to develop a new supplement

Meeting Action: Mr. Galanes is expected to report.
July 14, 2015
Mr. Siefert gave a presentation with research on Grade 91 steel repairs that could be used to develop a new supplement. The Task Group developed wording for a possible new supplement that was presented. A motion was made and unanimously approved to move the new supplement wording to the subcommittee.

Item Number: NB15-1404	**NBIC Location: Part 3, 1.6.1, 3.2.1**	**Attachment Pages139-147**

General Description: Define “existing material” as used in 1.6.1 and 3.2.1

Subgroup: Repairs and Alterations

Task Group: W. Jones (PM), M. Toth, J. Amato, R. Troutt

History:

January 2015
Mr. Galanes gave a progress report. The task group is working to develop a footnote in the text to define existing material.

Meeting Action: Mr. Jones is expected to report.
July 14, 2015
The task group presented several paragraph revisions After discussion the task group will now develop a definition for "existing material" to be placed in the glossary.

Item Number: NB15-1410	**NBIC Location: Part 3, S6.14**	**Attachment Pages 148-149**

General Description: Result of PR15-0122, add requirements for the number of repairs or alterations allowed under a single nameplate/stamping

Subgroup: Repairs and Alterations

Task Group: C. Withers (PM), B. Underwood, K. Moore, B. Vallance

History:

January 2015
Mr. Galanes gave a progress report. This item was transferred for further work to the "TR" task group.

Meeting Action: Mr. Withers is expected to report.
July 14, 2015
Mr. B. Vallance presented information that no action was taken. Chuck Withers is going to meet with Stan **S**taniszewski of the Department of Transportation, DOT. The discussions will ensure Supplement 6 meets the DOTs needs and to have program use the R stamp and not the TR stamp. Progress Report

Item Number: NB15-1801	**NBIC Location: Part 3**	**Attachment Pages 150-155**

General Description: Assuring leak tightness by seal welding

Subgroup: Repairs and Alterations

Task Group: M. Webb (PM)

History: None

Meeting Action: Mr. Webb is expected to report.
July 14, 2015
Mr. Webb presents a possible addition to the routine repairs section of Part 3. A motion was made and approved, with 3 negatives, to move this to the Subcommittee. The negatives were Jim Pillow, Dave Martinez, and B. Boseo.

Item Number: NB15-1901	NBIC Location: Part 3	No Attachment

General Description: Address the performance of postweld heat treatment on PRIs that were not previously postweld heat treated

Subgroup: Repairs and Alterations

Task Group: B. Wielgoszinski (PM), George Galanes, and Walt Sperko.

History: None

Meeting Action: Mr. Wielgoszinski is expected to report.
July 14, 2015
A progress report was given by Mr**.** Wielgoszinski. Task group members added.

Item Number: NB15-2501	NBIC Location: Part 3, 3.3.4.10	No Attachment

General Description: Bolts, Screws, Studs, Nuts, and Washers

Subgroup: Repairs and Alterations

Task Group: None assigned

History: None

Meeting Action: Mr. Galanes is expected to report.
July 14, 2015
A motion was made and unanimously approved to close the item with no action.

Item Number: NB15-2601	NBIC Location: Part 3	Attachment Pages 156-157

General Description: Radius of flush patches

Subgroup: Repairs and Alterations

Task Group: R. Wielgoszinski (PM)

History: None

Meeting Action: Mr. Wielgoszinski is expected to report.
July 14, 2015
Mr. Wielgoszinski presented a change to add a ½ inch radius to corner of a flush patch in paragraph 3.3.4.6 a) 2). After discussion information found in supplement S1.2.11.2 radius and wording; of at least 3 times the plate thickness shall was added. A motion was made and unanimously approved to move this to the Subcommittee.

8. New Business

Item Number: IN15-0401	NBIC Part 3, 4.2 a), 4.4 a, b, c, d)	Attachment Page 158

General Description: May Phased Array UT (PAUT) examination be used for verification of final circumferential weld repair integrity in lieu of pressure testing or other typical NDE methods (MT/PT/RT) involving boiler tubes where the thickness is below ½ inch, with NPS of 4 inch and less?

Subgroup: Repairs and Alterations

Task Group: George Galanes

History:

Meeting Action: Mr. Galanes is expected to report.

July 14, 2015

Mr. Galanes turned the discussion over the Jamie Walker of Hayes Mechanical who sent in the Item. The Chief of Iowa will not accept the alternative NDE, phased Array, for an HP boiler weld repair instead of a hydro test.

It was decided to have a National Board Staff person call the Chief to gather his reasoning for the committee to consider.

Item Number: NB15-1902	NBIC Location: Part 3	Attachment Pages 159-160

General Description: Weld Method 6 revisions

Subgroup: Repairs and Alterations

Task Group: George Galanes(PM),

History: None

Meeting Action:

July 14, 2015

Mr. Galanes provided a report to revise text in weld method 6. A motion was made and unanimously approved to send these revisions onto the Subcommittee. Task group assigned

Item Number: NB15-1903	NBIC Location: Part 3	Attachment Page 161

General Description: Distribution of R forms, when it is required.

Subgroup: Repairs and Alterations

Task Group: Bill Vallance (PM),

History: None

Meeting Action:
July 14, 2015
Mr. Scribner presented the draft wording for a change to Section 5 of Part 3. A motion was and unanimously approved to send the wording onto the Subcommittee.

Item Number: NB15-2305	**NBIC Part 3 Footnotes**	**No Attachment**

General Description: Evaluate footnotes in part 3

Subgroup: Repairs and Alterations

Task Group: Rob Trout,(PM) Jim Pillow, Joel Amato

History:

Meeting Action:
July 14, 2015
Mr. Scribner presented a request to have the task group evaluate footnotes throughout Part 3 for their necessity or if they should be within the Code rules.

Item Number: NB15-2502	**NBIC Part 3, 3.4.5**	**Attachment Pages 162-167**

General Description: Provide guidance for the inspection, repair and replacement of the tubes in water tube boilers when OEM procedures are not available.

Subgroup: Repairs and Alterations

Task Group:

History:

Meeting Action: Mr. Galanes is expected to report.
July 14, 2015
The Committee has asked Mr. Vallance to obtain the history of this action item.

Item Number: NB15-2503	**NBIC Part 3, 3.4.6**	**Attachment Pages 168-185**

General Description: Calculating Tube Expansion By Wall Thickness Reduction. To provide a reference calculation for inspectors and code users to determine the percentage

of wall thickness reduction when expanding boiler tubes into different diameter holes in drums and tube sheets.

Subgroup: Repairs and Alterations

Task Group:

History:

Meeting Action: Mr. Galanes is expected to report.
July 14, 2015
The Committee has asked Mr. Vallance to obtain the history of this action item.

Item Number: NB15-2801	**NBIC Part 3, 4.2 b)**	**Attachment Pages 186-215**

General Description: Change reference standard, "ACCP-189" to "ANSI/ASNT CP-189" and also included reference to the ACCP Program.

Subgroup: Repairs and Alterations

Task Group: N. Carter,(PM)

History:

Meeting Action: Mr. N. Carter is expected to report.
July 14, 2015
N. Carter presented a revision to the paragraph 4.2 b). A Motion was made and approved to move this to the Subcommittee. There were 2 abstentions, R. Trout and Kathy Moore.

Item Number: NB15-2802	**NBIC Part 3, S6.10 b)**	**Attachment Pages 216-217**

General Description: Change reference standard, "ACCP-189" to "ANSI/ASNT CP-189" and also included reference to the ACCP Program.

Subgroup: Repairs and Alterations

Task Group:

History:

Meeting Action: Mr. N. Carter is expected to report.
July 14, 2015
N. Carter presented a revision to the paragraphs above. A Motion was made and unanimously approved to move this to the Subcommittee.

9. Future Meetings

January 11-14 2016 – Corpus Christi, Texas
July 18-21 2016 – Columbus, Ohio
January 2017—San Antonio Texas

10. Adjournment

Motion was made and unanimously approved to adjourn the meeting at 2:30PM

Last Name	First Name	Interest Category	Role
Bramucci	Angelo	Authorized Inspection Agencies	Chair
Schulte	Bryan	Users	Vice Chair
Vallance	William		Secretary
Amato	Joel	Jurisdictional Authorities	Member
Boseo	Brian	National Board Certificate Holders	Member
Cauthon	Randall	Manufacturers	Member
Edwards	Paul	National Board Certificate Holders	Member
Galanes, PE	George	Users	Member
Hopkins	Craig	National Board Certificate Holders	Member
Johnson	Frank	Users	Member
Jones	Wayne	Authorized Inspection Agencies	Member
Larson	James	Authorized Inspection Agencies	Member
Martinez	David	Authorized Inspection Agencies	Member
McManamon, Jr.	Larry	Labor	Member
Miletti	Ray	Manufacturers	Member
Moore	Kathy	[R] Stamp Holder	Member
Morelock, PE	Brian	Users	Member
Ortman	Edward	Users	Member
Pillow	James	General Interest	Member
Pulliam	Ron	Manufacturers	Member
Schaefer	Benjamin	National Board Certificate Holders	Member
Sekely	James	General Interest	Member
Sperko	Walter	General Interest	Member
Toth	Martin	National Board Certificate Holders	Member
Troutt	Rob	Jurisdictional Authorities	Member
Valdez	Rick	Manufacturers	Member
Webb	Michael	Users	Member
White	Tom	Users	Member

SG Repairs and Alterations Attendance Sheet - 7/14/15

Name	Company	Phone Number	Email	Signature
Angelo Bramucci	Alstom Power Inc	860-285-9176	angelo.c.bramucci@power.alstom.com	
Bryan Schulte				
William Vallance	~~[illegible]~~ NaT'L Bd.	6148888320	bvallance@nationalboard.org	
Joel Amato	Jurisdiction MN	651 284-5137	joel.amato@state.mn.us	
Brian Boseo	Graycor Services	708 941 3016	brian_bosco@graycor.com	
Randal Cauthon	ALSTOM POWERINC	860-285-3481	randal.t.cauthon@alstom.com	
Paul Edwards	CB&I STONE & WEBSTER	617-589-5690	PAUL.EDWARDS@CBI.COM	
George Galanes	DTS Inc	630-799-8162	ggalanes@diamondtribunalservices.com	
Craig Hopkins				
Frank Johnson	PBF Energy	419-386-8450	FrankJohnson@PBFEnergy.com	
Wayne Jones	ARISE	251 895-8826	WAYNE.JONES@ARISEINC.COM	
James Larson				
David Martinez	FM Global	757-274-6106	david.martinez@fmglobal.com	
Larry McManamon				
Ray Miletti				
Kathy Moore	Joe Moore Co	919-606-7472	Kathymoore@joemoorecompany.com	
Brian Morelock	EASTMAN CHEMICAL	423-963-5289	morelock@eastman.com	
James Pillow	Commonarc	860-688-2501	JPILLOW@commonarc.com	
Ron Pulliam	B&W / filling in	330 860-2801	pabecker@babcock.com	
Benjamin Schaefer	AEP	614-716-1843	bschaefer@aep.com	

James Sekely	Welding Services	4123895567	JSekely@Comcast.net	
Wlater Sperko				
Marty Toth				
Rob Troutt	Texas	512-634 2727	Rob.Trouth@TPLR.texas.gov	
Rick Valdez	ARB, INC	6613964312	rvaldez@arbinc.com	
Michael Webb	Xcel/Energy	303) 628-2890	mike.i.webb@xcelenergy.com	
Tom White				
BOB UNDERWOOD	HSB Global	618-593-6231	robert_underwood@hsbct.com	
Monte Bost	HSB Global	937-620-3676	Monte_bost@hsbct.com	
Nathan Carter	HSB Global Stds	860-722-5750	nathan_carter@hsbct.com	
BOB WIELGOSZINSKI	HSB - GS	860 722 5764		
Darrell Wisner	Duke Energy	317-838-6926	darrell.wisner@duke-energy.com	
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DAN MAREK	MAINTHIA TECHNOLOGIES	216-433-5494	DANIEL.T.MAREK@NASA.GOV	
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NBIC Interpretation Final 1/22/2015

IN14-0701 - *Part 3 PWHT* - Subject: NBIC 2010, part 3, Post Weld Heat Treatment of a Vessel.

Q1. Must a company that performs post weld heat treatment be required to hold an "R" certification?
ANS: YES

Q2. Is this post weld heat treatment now considered an "Alteration" to this vessel, as per NBIC part 3?
ANS:
YES

Q3. Shall this "Alteration" be documented on a NBIC R-2 form? ANS: YES

Subject: NBIC 2010 Edition, Part 3, Postweld Heat Treatment of a Vessel

Committee Question 1

An R-Certificate holder decides to perform postweld heat treatment (PWHT) of a vessel at the request of a client, where no PWHT was performed in the original construction. Is the performance of PWHT of the vessel considered an alteration and subject to documentation using a Form R2?

Reply: Yes.

Committee Question 2

For the vessel described above, must the weld procedures used for construction of the vessel be qualified with PWHT?

Reply: Yes.

Committee Question 3

Must the PWHT described above be performed by the R-Certificate holder?

Reply: No, the PWHT may be subcontracted; however the R certificate holder retains the responsibility for the performance of the PWHT.

Rationale: PWHT can reduce the mechanical properties and/or notch toughness of the original vessel material affecting the pressure retaining capability, which is the definition of an alteration in the NBIC.

PROPOSED INTERPRETATION

Inquiry No.	IN14-0801				
Source	William R Chalfant, PBF Energy, Delaware City Refinery				
Subject	**2013 NBIC , Part 3, Section 3.3.3 s) and 3.3.4.3.a)**				
Edition	2013				
Question	Question #1: 2013 NBIC, Part 3, Section 3.3.4.3.a) When performing weld metal buildup of wasted areas of pressure retaining items in accordance with NBIC Part 3, paragraph 3.3.4.3.a), is the interpretation that the final metal thickness (including base metal and weld metal build up) shall be the calculated minimum required thickness in accordance with the original Code of Construction plus any future corrosion allowance for the desired remaining life? Question #2: 2013 NBIC, Part 3, Section 3.3.3, paragraph s) When replacing a part on a pressure retaining item in accordance with NBIC Part 3, paragraph 3.3.3.s), is it the intent of the term "minimum required thickness" to mean nominal wall thickness minus corrosion allowance as shown on the original Manufacturer's Data Report?				
Reply	Reply #1: Yes. Reply #2: Yes.				
Committee's Question	**Question #1: 2013 NBIC, Part 3, Section 3.3.4.3 a)** **When performing weld metal buildup of wasted areas of pressure retaining items, is the wall thickness required to be restored to the thickness listed on the Manufacturers Data Report?**				
Committee's Reply	**Reply #1: No. The minimum thickness after build-up shall be the original thickness of the pressure retaining item minus the corrosion allowance.**				
Rationale	**See Below.**				
SC Vote	Unanimous	No. Affirmative	No. Negative	No. Abstain	No. Not Voting
NBIC Vote	Unanimous	No. Affirmative	No. Negative	No. Abstain	No. Not Voting

Negative Vote Comments	

Reference:

2013 NBIC Part 3, Section 3.3.3 s): s) 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.*

2013 NBIC Part 3, Section 3.3.4.3.a)

a) Shells, Drums, Headers

Wasted areas in stayed and unstayed shells, drums, and headers may be built up by welding, provided that in the judgment of the Inspector the strength of the structure has not been impaired. Where extensive weld buildup is employed, the Inspector may require an appropriate method of NDE for the completed surface of the repair. For suggested methods of building up wasted areas by welding. (See NBIC Part 3, Figure 3.3.4.3-a).

Rationale:

ASME Section VIII, Division 1 references:

MANDATORY APPENDIX 3 DEFINITIONS

3-2 DEFINITIONS OF TERMS

thickness of vessel wall:

(a) design thickness: the sum of the required thickness and the corrosion allowance (see UG-25).

(b) required thickness: that computed by the equations in this Division before corrosion allowance is added (see UG-22).

(c) nominal thickness: except as defined in UW-40(f) and modified in UW-11(g), the nominal thickness is the thickness selected as commercially available, and supplied to the Manufacturer. For plate material, the nominal thickness shall be, at the Manufacturer's option, either the thickness shown on the Material Test Report {or material Certificate of Compliance [UG-93(a)(1)]} before forming, or the measured thickness of the plate at the joint or location under consideration.

We Energies
231 W. Michigan Street
Milwaukee, WI 53203

www.we-energies.com

IN15-0201

March 13, 2015

Mr. Brad Besserman
National Board of Boiler and Pressure Vessel Inspectors
1055 Crupper Ave.
Columbus, OH 43229-1183

Subj.; NBIC Interpretation Inquiry

Dear Mr. Besserman;

This letter is a written request for interpretation regarding the National Board Inspection Code, ANSI /NB-23 relating to the National Board "R" Symbol Stamp Quality System. The request is presented using the format of stating the question, presenting a suggested reply and an applicable background statement. The request involves two Quality System organization questions as outlined below.

Question 1; Is it permissible to amend or revise the content or implementation of the Quality System, including the written Quality System Manual, without the direct involvement of the titled individual designated as responsible to ensure compliance as given in the Statement of Authority and Responsibility?

Reply 1; No – The titled individual designated as responsible for Quality System shall be fully involved in the preparation, planning and implementation of any and all amendments or revisions to the Quality System, including the written Quality System Manual. The Statement of Authority and Responsibility is required to grant the freedom and authority to carry out this responsibility.

Background 1 - The National Board Inspection Code, ANSI /NB-23, 2013, Part 3, 1.6 and 1.6.1, e) sets the requirement for having a Quality System functional responsibility. The National Board Certificate of Authorization is required to be formalized and conducted in accordance with a written Quality System. Revisions, changes or updates of the system are normal and expected during the life of the program. The titled individual designated as responsible for Quality System has the defined responsibility to ensure that the requirements of the NBIC and the Jurisdiction are followed. This individual is also granted the freedom and authority to fulfil those responsibilities. Administration of program changes and revisions is part of the responsibility scope. Any action involving the Quality System that bypasses the titled individual circumvents the process. In addition, revisions to the Quality System must be accepted by the Authorized Inspection Agency prior to implementation. The titled individual is also responsible to ensure this approval is obtained.

Question 2; Is it permissible for a single immediate supervisor to manage both quality and non-quality related work assigned to the titled individual designated as responsible for Quality System?

Reply 2; No – Quality related functions shall follow the administrative relationship structure between the titled individual designated as responsible for Quality System and the officer of the organization who signed the Statement of Authority and Responsibility. The structure of the quality related system shall follow the Quality System organization chart, which addresses functions that affect quality. A single immediate supervisor managing both quality and non-quality related work details performed by the titled individual may be viewed as a conflict of interest.

Background 2 – The National Board Inspection Code, ANSI /NB-23, 2013, Part 3, 1.6.1, d) 3) and f) sets the requirement for having a Quality System organization structure. The size and population of an organization may determine if multiple duties are needed. In cases where titled individuals have quality and non-quality responsibilities, management of functions that affect quality shall follow the administration structure of the quality organization as a separate administrative item. Immediate supervision management function is limited to non-quality issues for individuals performing both quality and non-quality activities. Management separation of quality and non-quality functions is a standard practice in the industry.

Please forward this request to the applicable NBIC committee as necessary for review and reply. Please feel free to contact me if you have any questions or would like to discuss this matter further.

Thank you,

Tim Bacha
Principal Engineer
PH (414) 221 3517
CF (414 587 5036

NBIC Subcommittee R&A Action Block

Subject	Gasketed Plate Heat Exchangers		
File Number	NB12-0801	**Prop. on Pg.**	1 thru 9
Proposed Revision	Add examples of routine repairs, repairs, and alterations for gasketed plate heat exchangers and revise R-1 form to include gasketed PHEs.		
Statement of Need	Because of the unique design of the PHE, the current ASME Pressure Vessel and NBIC Codes do not specific ally address the design of PHE's, nor the potential r epairs or alterati ons. This is intended to provide guidance to the industry and the Jurisdictions.		
Project Manager	Ed Ortman		

SubGroup	R&A Specific		
SubGroup Negatives		**SG Meeting Date**	July 16, 2013

SubCommittee Negatives		**SC Meeting Date**	July 17, 2013

3.2.5 CALCULATIONS

For alterations, calculations shall be completed prior to the start of any physical work. All design calculations shall be completed by an organization experienced in the design portion of the standard used for construction of the item. All calculations shall be made available for review by the Inspector accepting the design.

3.2.6 REFERENCE TO OTHER CODES AND STANDARDS

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

In the event of a conflict with the requirements of the NBIC, the requirements of the NBIC take precedence. Some examples are as follows:

(a) National Board *Bulletin* - National Board Classic Articles Series;

(b) ASME PCC-1, Guidelines for Pressure Boundary Bolted Flange Joint Assembly;

(c) ASME PCC-2, Repair of Pressure Equipment and Piping.

3.3 REPAIRS TO PRESSURE-RETAINING ITEMS

3.3.1 DEFECT REPAIRS

Before a repair is made to a defect in a welded joint or base metal, care should be taken to investigate its cause and to determine its extent and likelihood of recurrence.

3.3.2 ROUTINE REPAIRS

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

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

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

d) Repairs falling within one or more of the following categories may be considered routine:

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

5) The following on gasketed plate heat exchangers:
i) Removal and replacement of heat transfer plates identical to those listed on the Manufacturer's Data Report;
ii) In kind replacement of tightening bolts;
iii) A change in welded attachments (e.g. welded feet).

s,

ld

3) Weld buildup of wasted areas in heads and shells not exceeding an area of 100 sq. inches (64,520 sq. mm) or a thickness of 25% of nominal wall thickness or ½ inch (13 mm), whichever is less; A11

4) Corrosion resistance weld overlay not exceeding 100 sq. in. (64,520 sq. mm).

3.3.3 EXAMPLES OF REPAIRS

a) Weld repairs or replacement of pressure parts or attachments that have failed in a weld or in the base material;

b) The addition of welded attachments to pressure parts, such as:

1) Studs for insulation or refractory lining;

2) Hex steel or expanded metal for refractory lining;

3) Ladder clips;

4) Brackets having loadings that do not affect the design of the pressure-retaining item to which they are attached; and

5) Tray support rings.

c) Corrosion resistant strip lining, or weld overlay;

d) Weld buildup of wasted areas;

e) Replacement of heat exchanger tubesheets in accordance with the original design;

f) Replacement of boiler and heat exchanger tubes where welding is involved;

g) In a boiler, a change in the arrangement of tubes in furnace walls, economizers, or super heater sections;

h) Replacement of pressure-retaining parts identical to those existing on the pressure-retaining item and described on the original *Manufacturer's Data Report*. For example:

1) Replacement of furnace floor tubes and/or sidewall tubes in a boiler;

2) Replacement of a shell or head in accordance with the original design;

3) Rewelding a circumferential or longitudinal seam in a shell or head;

4) Replacement of nozzles of a size where reinforcement is not a consideration;

i) Installation of new nozzles or openings of such a size and connection type that reinforcement and strength calculations are not a consideration required by the original code of construction;

j) The addition of a nozzle where reinforcement is a consideration may be considered to be a repair, provided the nozzle is identical to one in the original design, located in a similar part of the vessel, and not closer than three times its diameter from another nozzle. The addition of such a nozzle shall be restricted by any service requirements;

k) The installation of a flush patch to a pressure-retaining item;

l) The replacement of a shell course in a cylindrical pressure vessel;

m) Welding of gage holes;

n) Welding of wasted or distorted flange faces;

o) Replacement of slip-on flanges with weld neck flanges or vice versa;

p) Seal welding of buttstraps and rivets;

q) Subject to the administrative procedures of the Jurisdiction and approval of the Inspector, the replacement of a riveted section or part by welding;

r) The repair or replacement of a pressure part with a code-accepted material that has a nominal composition and strength that is equivalent to the original material, and is suitable for the intended service; and

s) Replacement of a pressure-retaining part with a material of different nominal composition, 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*.

t) The replacement of a Pressure Relieving Device (PRD) attached by welding, provided the replacement device's relieving capacity is equal to or greater than the PRD-capacity required by the original code of construction.

3.3.4 REPAIR METHODS

u) In a gasketed plate heat exchanger:
1) Weld repair of any pressure part (e.g. nozzle repair or in kind replacement of nozzle);
2) In kind replacement of frame or pressure plates.

Except as provided in NBIC Part 3, 3.3.4.u, a repair of a defect in a welded joint or base material shall not be made until the defect has been removed. A suitable Nondestructive Examination (NDE) method, such as Magnetic Particle (MT) or Liquid Penetrant (PT), may be necessary to ensure complete removal of the defect. If the defect penetrates the full thickness of the material, the repair shall be made with a full penetration weld such as a double buttweld or single buttweld with or without backing. Where circumstances indicate that the defect is likely to recur, consideration should be given to removing the defective area and installing a flush patch or taking other corrective measures acceptable to the Inspector, and when required, by the Jurisdiction.

3.4 ALTERATIONS

3.4.1 RE-RATING[10]

Re-rating of a pressure-retaining item by increasing the maximum allowable working pressure (internal or external) or temperature or decreasing the minimum design metal temperature below which notch toughness testing is required by the original code of construction, shall be done only after the following requirements have been met to the satisfaction of the Jurisdiction at the location of the installation:

a) Revised calculations verifying the new service conditions shall be prepared in accordance with the "R" Certificate Holder's Quality Control System. Establishing a higher joint efficiency to re-rate a pressure-retaining item is not permitted;

b) All re-ratings shall be established in accordance with the requirements of the construction standard to which the pressure-retaining item was built;

c) Current inspection records verify that the pressure-retaining item is satisfactory for the proposed service conditions;

d) The pressure-retaining item has been pressure tested, as required, for the new service conditions. Any insulation, coatings, or coverings that may inhibit or compromise a meaningful pressure test shall be removed, to the extent identified by the Inspector;

e) In lieu of pressure testing, alternative methods can be used to ensure the structural integrity of the re-rated pressure-retaining item. The alternative methods shall be documented and subject to review and approval by the Jurisdiction.

3.4.2 ALTERATIONS BASED ON ALLOWABLE STRESS VALUES

For re-rating or re-calculating a new minimum wall thickness for a pressure-retaining item using a later edition/addenda of the original code of construction or selected construction standard or code that permits use of higher allowable material stress values than were used in the original construction, the following requirements shall apply:

a) The "R" Certificate Holder shall verify, by calculations and other means, that the re-rated item can be satisfactorily operated at the new service condition (e.g., stiffness, buckling, external mechanical loadings);

b) The pressure-retaining item shall not be used in lethal service;

c) The pressure-retaining item shall not be used in high-cycle operation or fatigue service (i.e., loadings other than primary membrane stress are controlling design considerations) unless the pressure-retaining item was originally designed for fatigue service and a fatigue analysis is performed;

d) The pressure-retaining item shall have been constructed to the 1968 edition or later edition/addenda of the original code of construction;

e) The pressure-retaining item shall be shown to comply with all relevant requirements of the edition/addenda of the code of construction, which permits the higher allowable stress values (e.g., reinforcement, toughness, examination, pressure testing);

10 Re-rating: Except as provided for Yankee Dryers in Supplement 5, this code does not provide rules for de-rating boilers or pressure vessels; however, when the MAWP and/or allowable temperature of a boiler or pressure vessel is reduced, the Jurisdiction where the object is installed should be contacted to determine if specific procedures should be followed.

f) The pressure-retaining item shall have a satisfactory operating history and current inspection of the pressure-retaining item shall verify the item exhibits no unrepaired damage (e.g., cracks, corrosion, erosion). Areas of corrosion or erosion may be left in place provided the remaining wall thickness is greater than the minimum thickness for the new design conditions;

g) The re-rating shall be acceptable to the Inspector and, where required, the Jurisdiction;

h) All other requirements of Part 3, as applicable, and jurisdictional requirements shall be met;

i) Use of this paragraph shall be documented in the Remarks section of Form R-2.

3.4.3 EXAMPLES OF ALTERATIONS

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

b) A decrease in the minimum temperature;

c) The addition of new nozzles or openings in a boiler or pressure vessel except those classified as repairs;

d) A change in the dimensions or contour of a pressure-retaining item;

e) In a boiler, an increase in the heating surface or steaming capacity as described on the original Manufacture's Data Report;

f) The addition of a pressurized jacket to a pressure vessel;

g) Except as permitted in NBIC, Part 3, 3.3.3 s);

h) Replacement of a pressure-retaining part in a pressure-retaining item with a material of different allowable stress or nominal composition from that used in the original design; and

i) The addition of a bracket or an increase in loading on an existing bracket that affects the design of the pressure-retaining item to which it is attached.

j) The replacement of a Pressure Relieving Device (PRD) as a result of work completed on a Pressure-Retaining Item (PRI) that changes the resultant capacity to exceed the Minimum Required Relieving Capacity (MRRC) required by the original code of construction as described on the original Manufacturer's Data Report.

3.4.4 ALTERATION OF ASME CODE SECTION VIII, DIVISION 2 OR 3, PRESSURE VESSELS

k) The following on gasketed plate heat exchangers:
a) A change in heat transfer plate material;
b) A change in thickness of heat transfer plates;
c) A change in tightening bolt material or grade;
d) A change in tightening bolt diameter
e) A change in the material or thickness of the frame plate of pressure plates.

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

5.13.1 FORM R-1, REPORT OF REPAIR

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

1. Work performed by (1) (name of repair organization) (2) (Form Registration No.)
   (53) (PO No., job No., etc.)
2. Owner (3) (name)
   (address)
3. Location of installation (4) (name)
   (address)
4. Item identification (5) (boiler, pressure vessel or piping) Name of original manufacturer (6)
5. Identifying nos.: (7) (mfg. serial no.) (8) (National Board No.) (8) (jurisdiction No.) (8) (other) (9) (year built)
6. NBIC Edition/Addenda: (10) (edition) (10) (addenda)
   Original Code of Construction for Item: (11) (name/section/division) (11) (edition/addenda)
   Construction Code Used for Repair Performed: (11) (name/section/division) (11) (edition/addenda)
7. Repair Type: (55) ☐ Welded ☐ Graphite Pressure Equipment ☐ FRP Pressure Equipment
8. Description of work: (12) (use Form R-4, if necessary) ☐ Form R-4, Report Supplementary Sheet is attached ☐ FFSA Form (NB-403) is attached
   _____ Pressure Test, if applied (13) psi MAWP (54) psi
9. Replacement Parts. Attached are Manufacturer's Partial Data Reports or Form R-3s properly completed for the following items of this report:
   (14) (name of part, item number, data report type or Certificate of Compliance, mfg. name, and identifying stamp)
10. Remarks: (15)

Note to Editor: Add as part of line 7

☐ Gasketed Plate Heat Exchanger

SECTION 5

CERTIFICATE OF COMPLIANCE

I, (16), certify that to the best of my knowledge and belief the statements in this report are correct and that all material, construction, and workmanship on this Repair conforms to the *National Board Inspection Code*.
National Board "R" Certificate of Authorization No. (17) expires on (18),
Date (19), (20) (name of repair organization) Signed (21) (authorized representative)

CERTIFICATE OF INSPECTION

I, (22), 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 (23)
and employed by (24) of (25)
have inspected the work described in this report on (26), and state that to the best of my knowledge and belief this work complies with the applicable requirements of the *National Board Inspection Code*.
By signing this certicate, 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 (19), Signed (27) (inspector) Commissions (28) (National Board and Jurisdiction No.)

This form may be obtained from The National Board of Boiler and Pressure Vessel Inspectors, 1055 Crupper Ave., Columbus, OH 43229 NB-66 Rev. 12

5.13.4.1 INSTRUCTIONS FOR COMPLETING NATIONAL BOARD FORM "R" REPORTS A11

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, 5.13.1 through 5.13.4.

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 sheet 1 of 2, and the organization completing the construction activities will complete sheet 2 of 2. A11

2. 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 3,5.6, 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. A11

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. A11

6. Name of the original manufacturer of the pressure-retaining item. If the original manufacturer is unknown, indicate by, "unknown". A11

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". A11

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". A11

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 summary describing the exact scope of work that was completed to a Pressure-Retaining Item (PRI). The information to be included when describing the scope of work shall consider items such as, the nature of the repair or alteration characterized by the listed examples, the specific location of the work performed to the PRI, the method of repair used to include as applicable, the steps taken to remove a defect or as allowed by NBIC Part 3, 3.3.4.8 to remain in place, the welding process and procedure when used, any special processes required such as PWHT; noting the soak time and temperatures recorded, and any acceptable in-process and final NDE-examinations or tests performed. When additional space is needed to fully describe the scope of work, a Form R-4 shall be used and attached. A11

13. Indicate test pressure applied.

A11 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.

A11 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.

A11 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.

A11 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.

A11 30. Document name of organization responsible for specifying the code design conditions, if known. If origin of design conditions are unknown, state "unknown".

A11 31. Document name of organization responsible for performing the code design, if known. If code design organization is unknown, state "unknown".

A11 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". A11

36. If available, identify component by part's original name, function, or use the original equipment manufacturer's "mark or item number." A11

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 flat, 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. A11

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, or gasketed plate heat exchanger.

Subgroup Locomotives National Board Item No. NB13-1403

Current Level: Subgroup

NBIC Part 3 Paragraph(s): At or near S1.2.9.2

Title: **Installation of Boiler Tubes & Arch Tubes**
Date Opened: April 2011

Background:
1. This subject is based on the experiences of Mike Tillger with a boiler repair firm that cut the boiler tubes too short for installation into a locomotive. The boiler repair firm personnel tried to heat the boiler tubes during the installation process in order to lengthen them sufficiently to engage the tube sheet. When Mike questioned them about it they replied, "we do this all the time". Mike forbid it and sent them back to their shop to obtain the correct length tubes.

This same problem also occurs in the power boiler industry for firetube and water tube boilers on which the boiler tubes and/or tube panels have been formed incorrectly (wrong the shape) or are cut too short.

2. I encountered a locomotive boiler on which the firebox tube ends were machined to a smaller diameter in order to obtain the required swedge size. The wall thickness reduction of the boiler tube this created was considerable and made the tubes unfit for use.

Proposed Action:

1. Boiler tubes and arch tubes shall be cut to or made to the correct length required for installation with all parts at ambient temperature. The use of heating or stretching the tube at installation to obtain the required length is prohibited. Tubes that are cut too short shall be rejected.

2. The ends of boiler tubes and arch tubes may be swedged to the diameter required to fit the tube sheet holes. The swedging shall create smooth surfaces, smooth curves, and a uniform diameter reduction across the entire swedged length. The creation of sharp corners, sharp edges or a partial collapse of tube interior within the swedged section is prohibited. Tubes that are swedged incorrectly shall be rejected.

Swedging shall be performed using dies whenever possible.
Machining the tube end to obtain the required swedge diameter is prohibited.

3. Bends in boiler tubes and arch tubes shall be formed to correct shape and curvature required for installation with all parts at ambient temperature. The bending work shall be performed to create smooth surfaces over the entire bend. The creation of sharp corners,

sharp edges, or a partial collapse of tube interior within the bend is prohibited.

The use of heating or stretching the tube at installation to obtain the correct bend shape is prohibited. Tubes that are formed to the wrong shape or curvature shall be rejected.

Subgroup voted Date:

1.4 ACCREDITATION

a) Organizations performing repairs or alterations to pressure-retaining items shall be accredited as described in this section, as appropriate for the scope of work to be performed.

b) Organizations performing repairs outside the scope of the NBIC may be accredited and shall meet any additional requirements of the Jurisdiction where the work is performed.

1.5.1 ACCREDITATION PROCESS

a) The National Board administers accreditation programs for authorization of organizations performing repairs and alterations to pressure-retaining items in accordance with NB-415 and/or pressure relief valves in accordance with NB-514. ADD FOOTNOTE FOR NB-415 AND NB-514 SHOWING COPIES CAN BE OBTAINED AT http:www.nationalboard.org

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b) Any organization may apply to the National Board to obtain a *Certificate of Authorization* for the requested scope of activities. A review shall be conducted to evaluate the organization's quality system. The individual assigned to conduct the evaluation shall meet the qualification requirements prescribed by the National Board. Upon completion of the evaluation, any deficiencies within the organization's quality system will be documented and a recommendation will be made to the National Board regarding issuance of a *Certificate of Authorization*.

c) As part of the accreditation process, an applicant's quality system is subject to a review. National Board procedures provide for the confidential review resulting in recommendations to issue or not issue a *Certificate of Authorization*.

d) The accreditation programs provide requirements for organizations performing repairs and alterations to pressure-retaining items. ~~Depending upon the expected scope of activities at the time of review, organizations may be authorized to perform design only, metallic or non-metallic repairs, and/or alterations either in the shop only, field only, or shop and field. Repairs and/or alterations to metallic and non-metallic pressure-retaining items are made by welding, bonding and/or mechanical assembly.~~

~~e) Organizations desiring to renew or obtain a National Board *Certificate of Authorization* shall apply to the National Board using forms obtained from the National Board. Application for renewal shall be made prior to the expiration date of the *Certificate of Authorization*.~~

~~f)~~c) ~~When an organization has plants or shops in more than one location, the organization shall submit separate applications for each plant or shop.~~ The organization may perform repairs or alterations in its plants, shops, or in the field, provided such operations are described in the organization's Quality System.

~~g)~~f) The Jurisdiction[2] ~~m~~, as defined in Part 3, Section 9, may audit the Quality System and activities of an organization upon a valid request from

2 ~~Jurisdiction: The National Board member jurisdiction where the organization is located. Alternatively, where the Jurisdiction elects not to~~

an owner, user, inspection agency, or the National Board.

~~h)~~g) The NBIC Committee may at any time change the rules for the issuance of Certificates of Authorization and use of the "R" Symbol Stamp. These rules shall become binding on all certificate holders.

1.5.2 NATIONAL BOARD "R" SYMBOL STAMP

~~a) All "R" Symbol Stamps shall be obtained from the National Board of Boiler and Pressure Vessel Inspectors. Authorization to use the "R" Symbol Stamp may be granted by the National Board at its absolute discretion to the certificate holder.~~

~~b)~~a) The "R" Symbol Stamp is furnished on loan by the National Board for a nominal fee. ~~Each organization shall agree if authorization to use the "R" Symbol Stamp is granted, that the "R" Symbol Stamp is at all times the property of the National Board and will be promptly returned upon demand. If the organization discontinues the use of the "R" Symbol Stamp, inspection agreement with an Authorized Inspection Agency, or if the Certificate of Authorization has expired and no new certificate has been issued, the "R" Symbol Stamp shall be returned to the National Board.~~

~~c)~~b) ~~The organization's Quality System shall provide for adequate control of the "R" Symbol Stamp.~~ Provisions may be made for the issuance of the "R" Symbol Stamp for use at various field locations.

d) ~~The holder of a Certificate of Authorization may obtain more than one "R" Symbol Stamp provided the organization's Quality System describes how the use of such stamps is controlled from the location shown on the certificate.~~

e) ~~An organization shall not permit others to use the "R" Symbol Stamp loaned to it by the National Board.~~

c) Additional requirements shall be met in accordance with NB-415 and/or NB-514 as applicable.

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1.6 QUALITY SYSTEM

A holder of a National Board Certificate of Authorization shall have and maintain a written Quality System. The System shall satisfactorily meet the requirements of the NBIC and shall be available for review. The Quality System may be brief or voluminous, depending on the projected scope of work. It shall be treated confidentially by the National Board.

1.6.1 OUTLINE OF REQUIREMENTS FOR A QUALITY SYSTEM FOR QUALIFICATION FOR THE NATIONAL BOARD "R" *CERTIFICATE OF AUTHORIZATION*

The following is a guide for required features of a Quality System which shall be included in the organization's Quality System Manual. As a minimum, each organization shall address the required features relative to the scope of work to be performed. Organizations shall explain their intent, capability and applicability for each required feature outlined in this section. Work may be subcontracted provided controls are clearly defined for maintaining full responsibility for code compliance by the National Board repair organization certifying the work.

a) **Title Page**

The name and complete address of the company to which the National Board *Certificate of Authorization* is issued shall be included on the Title Page of the Quality System Manual.

b) **Contents Page**

~~perform the review or where there is no jurisdiction or where the jurisdiction is the organization's Authorized Inspection Agency, the National Board of Boiler and Pressure Vessel Inspectors will represent the jurisdiction. At the jurisdiction's discretion, the jurisdiction may choose to be a member of the review team if the jurisdiction chooses not to be the team leader.~~

The manual should contain a page listing the contents of the manual by subject, number (if applicable), and revision number of each document.

c) **Scope of Work**

The manual shall clearly indicate the scope and type of repairs or alterations the organization is capable of and intends to carry out.

d) **Statement of Authority and Responsibility**

A dated *Statement of Authority*, signed by an officer of the organization, shall be included in the manual. Further, the *Statement of Authority* shall include:

1) A statement that all repairs or alterations carried out by the organization shall meet the requirements of the NBIC and the Jurisdiction, as applicable;

2) A statement that if there is a disagreement in the implementation of the Quality System, the matter is to be referred for resolution to a higher authority in the company;

3) The title of the individual who will be responsible to ensure that 1) above is followed and has the freedom and authority to carry out the responsibility.

e) **Manual Control**

The manual shall include the necessary provisions for revising and issuing documents to keep the manual current. The title of the individual authorized to approve revisions shall be included in the manual. Revisions must be accepted by the Authorized Inspection Agency prior to issuance of the manual and its implementation.

f) **Organization**

An organizational chart shall be included in the manual. It shall include the title of the heads of all departments or divisions that perform functions that can affect the quality of the repair or alteration, and it shall show the relationship between each department or division.

The manual shall identify the title of those individuals responsible for preparation, implementation, or verification of the Quality System. The responsibilities shall be clearly defined and the individuals shall have the organizational freedom and authority to fulfill those responsibilities.

g) **Drawings, Design and Specifications**

The manual shall contain controls to ensure that all design information, applicable drawings, design calculations, specifications, and instructions are prepared or obtained, controlled, and interpreted in accordance with the original code of construction.

h) **Repair and Alteration Methods**

The manual shall include controls for repairs and alterations, including mechanical assembly procedures, materials, nondestructive examination methods, pre-heat, and postweld heat treatment, as applicable. Special requirements such as nonmetallic repairs and alterations to graphite and fiber-reinforced thermosetting plastic pressure-retaining items including bonding or mechanical assembly procedures shall be addressed, if applicable.

i) **Materials**

The manual shall describe the method used to ensure that only acceptable materials (including welding material) are used for repairs and alterations. The manual shall include a description of how existing material is identified and new material is ordered, verified, and identified. The manual shall identify the title of the individual(s) responsible for each function and a brief description of how the function is to be performed.

j) **Method of Performing Work**

The manual shall describe the methods for performing and documenting repairs and alterations in sufficient detail to permit the Inspector to determine at what stages specific inspections are to be performed. The method of repair or alteration must have prior acceptance of the Inspector.

k) **Welding, NDE and Heat Treatment**

The manual shall describe controls for welding, nondestructive examination, and heat treatment. The manual is to indicate the title of the individual(s) responsible for the welding procedure specification (WPS) and its qualification, and the qualification of welders and welding operators. It is essential that only welding procedure specifications and welders or welding operators qualified, as required by the NBIC, be used in the repair or alteration of pressure-retaining items. It is also essential that welders and welding operators maintain their proficiency as required by the NBIC, while engaged in the repair or alteration of pressure-retaining items. The manual shall also describe controls for ensuring that the required WPS or Standard Welding Procedure Specification (SWPS) is available to the welder or welding operator prior to welding. Similar responsibility for nondestructive examination and heat treatment shall be described in the manual.

l) **Examinations and Tests**

Reference shall be made in the manual for examinations and tests upon completion of the repair or alteration.

m) **Calibration**

The manual shall describe a system for the calibration of examination, measuring, and test equipment used in the performance of repairs and alterations.

n) **Acceptance and Inspection of Repair or Alteration**

The manual shall specifically indicate that before the work is started, acceptance of the repair/alteration shall be obtained from an Inspector who will make the required inspections and confirm NBIC compliance by signing and dating the applicable NBIC Report Form [3] upon completion of the work.

The manual shall specifically address allowance for acceptance of the inspector for application of the "R" symbol stamp to a pressure retaining item.

The manual shall provide for adequate control of the "R" Symbol Stamp.

o) **Inspections**

The manual shall make provisions for the Inspector to have access to all drawings, design calculations, specifications, procedures, process sheets, repair or alteration procedures, test results, and other documents as necessary to ensure compliance with the NBIC. A copy of the current manual shall be available to the inspector.

p) **Report of Repair or Alteration Form**

The manual shall indicate the title of the individuals responsible for preparing, signing, and presenting the

NBIC Report Forms to the Inspector. The distribution of the NBIC Report Forms[3] shall be described in the manual.

q) **Exhibits**

Any forms referenced in the manual shall be included. The form may be a part of the referencing document or included as an appendix. For clarity, the forms may be completed and identified as examples. The name and accepted abbreviations of the "R" Certificate Holder shall be included in the manual.

r) **Construction Code**

The manual shall include provisions for addressing the requirements that pertain to the specific construction code for the equipment being repaired or altered.

s) **Nonconforming Items**

There shall be a system acceptable to the Inspector for the correction of nonconformities. A nonconformance is any condition that does not comply with the applicable rules of the NBIC, construction code, jurisdictional requirements, or the quality system. Nonconformance must be corrected or eliminated before the repaired or altered component can be considered in compliance with the NBIC.

t) **Records Retention**

The quality manual shall describe a system for filing, maintaining, and easily retrieving records supporting or substantiating the administration of the Quality System within the scope of the "R" Certificate of Authorization.

1) Records may represent any information used to further substantiate the statements used to describe the scope of work completed to a pressure-retaining item (PRI), and documented on a Form "R" report.

2) Records are not limited to those depicting or calculating an acceptable design, material compliance or certifications, NDE-reports, PWHT-charts, a WPS used, a welder, bonder, or cementing technician's process continuity records, drawings, sketches, or photographs.

3) The record retention schedule described in the Quality System Manual is to follow the instructions identified in NBIC Part 3, Table 1.6.5.1.

Table 1.6.5.1

Form "R" Reports, Records, or Documents	Instructions	Minimum Retention Period
a) Form "R" Reports and supporting records and documentation	The organization performing repairs and alterations shall retain a copy of the completed "R" Form report on file, and all records substantiating the summary of work described in NBIC Part 3, 5.13.4.1, Item 12, for a minimum of 5 years. When the method of repair described in NBIC Part 3, 3.3.4.8 is used, the record retention period shall be described in b)	5 years

3[2] NBIC Report Form: National Board Form R-1 for Repair, Form R-2 for Alterations, Form R-3 for Fabricated Parts, or Form R-4 Report Supplementary Sheet.

b) Form "R" Report with REPORT OF FITNESS FOR SERVICE ASSESSMENT FORM (NB-403) attached.	When the method of repair described in NBIC Part 3,3.3.4.8 is used, the record retention period shall be for the duration described on the FITNESS FOR SERVICE ASSESSMENT (FFSA) Form required by the repair method and as described in NBIC Part 2, 4.4 Notes: 1. The "R" Certificate Holder should be aware that when used, some of the referenced codes and standards identified in NBIC Part 2,, 1.3 describe requirements for permanent record retention throughout the service life of each equipment item. 2. When the "R" Certificate Holder is not the owner or user of the equipment, the record retention period is limited to the FFSA-results described on line 8 of the Report of Fitness for Service Assessment Form (NB-403)	5 years or as described on line 8 as reported on Form NB-403; whichever period is longer
c) Continuity records for a welder, welding operator, bonder, or cementing technician	Minimally, continuity records for a welder, bonder, or cementing technician within the Certificate Holder's quality system shall be described and established at the time of the applicant's initial certificate review and demonstrated at each triennial review required thereafter.	As applicable to the scope of work identified on the Certificate of Authorization, the continuity records are subject to review during each National Board triennial certificate review.
d) Administrative record review of the "R" Certificate Holder's administrative processes.	Records supporting completed administrative reviews or audits of procedures or processes required by the "R" Certificate Holder's Quality System Manual, or in combination with the applicable part of the NBIC Part 3, Supplementary Section 6 as it applies to the identified scope listed on the "R" Certificate of Authorization.	Subject to review during the triennial evaluation of the certificate holder's Quality System.

Item NB14-0301

New Section ***MANUFACTURER's DATA REPORT***

3.4.3 ENCAPSULATION

Encapsulation is a repair method to restore the pressure retaining capability of an item by building a new pressure containing boundary over the item in the form of a welded leak box.

a) Welded Leak Box

1) Welded leak box design consists of a pressure retaining enclosure used to seal off leaking components or reinforce damaged or thinned components. The use of a leak box is subject to concurrence of the inspector and, when applicable, the jurisdiction.

a. A leak box can take a variety of shapes (e.g., cylindrical, rectangular, with either flat or formed heads), often following the contour of the component being encapsulated. Leak boxes may be fabricated by welding split pipe, pipe caps, or plates to encapsulate a pressure retaining item. Consideration should be given to add centering guides to aid with the installation. An example of a Welded Leak Box is shown in NBIC Part 3, Figure 3.4.3.

b. The annular space between the leak box and the component may be filled with an inert material (i.e., epoxy, sealant, fiber, refractory, etc.) which will support the effectiveness of the repair under pressure.

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

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

3) Design of the box and fabrication welds shall be in accordance with the original code of construction, when practicable or the basis of design shall be acceptable to the inspector and when required, the jurisdiction.

a. Design of the encapsulation shall consider original design conditions, taking into account current service conditions and corrosion mechanisms.

b. The leak box design shall consider the potential introduction of new failure modes including that of the encapsulated component (i.e., encapsulated parts, expansion joints, pressure thrust, temperature differential, differential expansion, additional weight, sealant seepage, etc.).

4) The following are requirements for the leak box design;

a. The welded leak box assembly should be designed with vents and drains to permit venting the leak during assembly.

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

1. Wall thickness shall be verified in the vicinity of the area to be welded.

c. When sealant is injected between the leak box and the component, consideration shall be given to off-gassing of sealant compounds as they cure.

d. The WPS followed shall be qualified in accordance with ASME Section IX. When the code of construction requires post weld heat treatment (PWHT) or the encapsulated component required PWHT, the WPS followed shall be qualified with PWHT. As an alternative and with concurrence of the inspector an Alternate Welding Method may be used in accordance with NBIC Part 3, 2.5.3.

Comment [BB1]: hanged the proposal from a "Repair" to an "Alteration" of the design aspects.

Comment [BB2]: laced the responsiblity on the "R" Certificate Holder responsible for the desing to ensure a FFSA is performed.

Comment [BB3]: Required the FFSA to be attached to the FFSA and forwarded with the Form R-2 to the Certificate Holder performed the work associated with the Alteration.

Comment [BB4]: I remember our discussion of design as it relates to items that may or may not be outside the design aspects of the Code of Constrcution... I look at the Codes, specifically piping as that was of primary concer to you and determined that closures (flat end caps) are addressed within the design aspects of the code. That being said, the way I would interpret paragraph 4 is that if the original code doesn't allow for a specific application or configuration, then it would not be allowed for work under the NBIC.

Comment [BB5]: I removed the term sound metal and replaced it with minimum required metal thickness.

Comment [BB6]: I recall you having concern about an item that is to be encapsulated which required PWHT and the work was to be done while in service... I feel the language in paragraph 5. d. addresses this as I provide an option to use an Alternative Welding Method.

1. 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.
2. The nominal chemical composition of the deposited weld metal shall be compatible with the materials of construction. In addition, the nominal tensile strength of the deposited weld metal shall be equal to or exceed the encapsulated component's specified minimum tensile strength and shall be based on the requirements of the welding consumable.
3. When pressure retaining butt welds of the encapsulated component will be welded over, they shall be ground flush and volumetrically examined in accordance with the code of construction to ensure the existing weld is free from defects.
4. Longitudinal weld seams of the leak box components shall be staggered at a distance of at least five (5) times the thickness of the thicker component.
5. When welding to a component that is under pressure, the following shall be considered in developing the WPS: preheat temperature, exposure to moisture, the effect of process fluid flow on weld cooling rate, the effects of the welding temperature on the strength of the metal under service conditions and the risk of burn through.
    a. Every measure shall be taken to remove the moisture from the weld environment.

5) Welds shall be subjected to the nondestructive examination method used in the original code of construction or an alternative acceptable to the inspector. In addition, all full penetration longitudinal leak box welds shall be volumetrically examined to the fullest extent practicable and evaluated in accordance with the code of construction
    a. Visual examination attributes shall be in accordance with the NBIC, Part 3, Paragraph 4.4.1 e).
    b. The "R" Stamp Holder performing the alteration shall provide detailed information on the Form R-2, describing the extent of the alteration and include the specific location the work was performed on the item. A copy of the completed Form R-2 with the completed FFSA Form attached shall be registered with the National Board, and when required, filed with the jurisdiction where the item was installed.

Comment [BB7]: Added this paragraph to address safety requirements including Owner-User involvement.

Comment [BB8]: Added the verbaige "exposure to moisture" when considering the development of the WPS.

Comment [BB9]: Added paragraph d. 1. which allows for peening the metal in an attempt to minimize or stop moisture.

Comment [BB10]: egister the Alteration with the National Board and where required, the jurisdiction.

Renumber

3.4.4 EXAMPLES OF ALTERATIONS

j) The installation of a welded leak box.

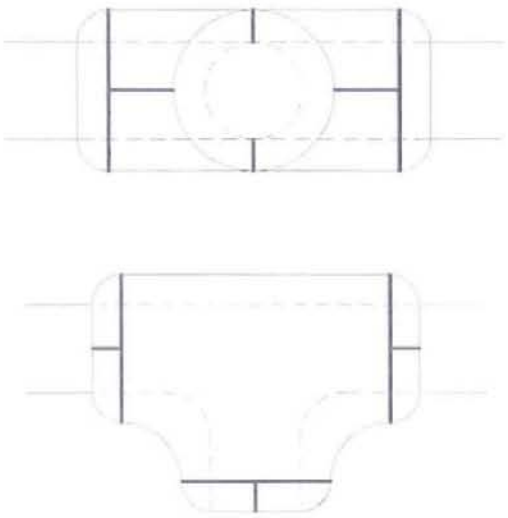
3.4.5 ALTERATIONS OF ASME CODE SECTION VIII, DIVISION 2 or #, PRESSURE VESSELS

3.4.5.1 ALTERATION PLAN

DEFINITIONS

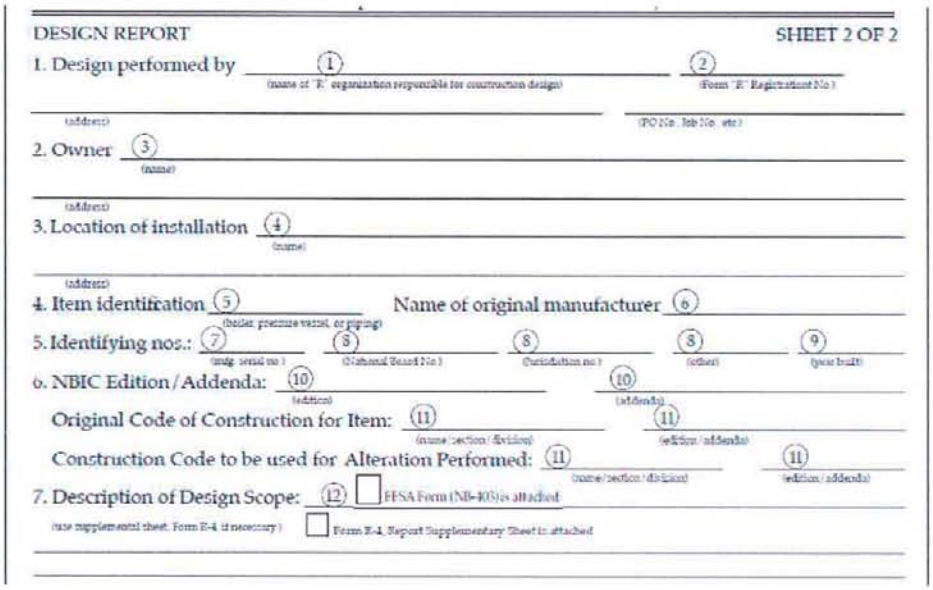
Encapsulation – to enclose, seal off or reinforce a component.

FIGURE 3.4.3
Welded Leak Box



SECTION 5

Page 2 of the Form R-2 will need to be revised to indicate a FFSA Form (NB-403) is attached.



DESIGN REPORT SHEET 2 OF 2

1. Design performed by (1) (name of "R" organization responsible for construction design) (2) (Form "R" Registration No.)

(address) (PO No., Job No., etc.)

2. Owner (3) (name)

(address)

3. Location of installation (4) (name)

(address)

4. Item identification (5) (boiler, pressure vessel, or piping) Name of original manufacturer (6)

5. Identifying nos.: (7) (mfg. serial no.) (8) (National Board No.) (8) (jurisdiction no.) (8) (other) (9) (year built)

6. NBIC Edition / Addenda: (10) (edition) (10) (addenda)

Original Code of Construction for Item: (11) (name / section / division) (11) (edition / addenda)

Construction Code to be used for Alteration Performed: (11) (name / section / division) (11) (edition / addenda)

7. Description of Design Scope: (12) ☐ FFSA Form (NB-403) is attached

(use supplemental sheet, Form R-4, if necessary) ☐ Form R-4, Report Supplementary Sheet is attached

NB 14-0302

5.13.1 FORM R-1, REPORT OF REPAIR

FORM R-1 REPORT OF REPAIR

in accordance with provisions of the *National Board Inspection Code*

1. Work performed by (1) (name of repair organization) (2) (Form Registration No.)
   (53) (PO No., Job No., etc.)
2. Owner (3) (name)
   (address)
3. Location of installation (4) (name)
   (address)
4. Item identification (5) (boiler, pressure vessel or piping) Name of original manufacturer (6)
5. Identifying nos.: (7) (mfg. serial no.) (8) (National Board No.) (8) (jurisdiction No.) (8) (other) (9) (year built)
6. NBIC Edition/Addenda: (10) (edition) (10) (addenda)
   Original Code of Construction for Item: (11) (name/section/division) (11) (edition/addenda)
   Construction Code Used for Repair Performed: (11) (name/section/division) (11) (edition/addenda)
7. Repair Type: (55) ☐ Welded ☑ Graphite Pressure Equipment ☐ FRP Pressure Equipment
8. Description of work: (12) (use Form R-1, if necessary) ☐ Form R-1, Report Supplementary Sheet is attached ☐ PFSA Form (NB-403) is attached

   _____ Pressure Test, if applied (13) _____ psi MAWP (14) _____ psi
9. Replacement Parts. Attached are Manufacturer's Partial Data Reports or Form R-3s properly completed for the following items of this report:
   (14) (name of part, item number, data report type or Certificate of Compliance, mfg. name, and identifying stamp)
10. Remarks: (15)

CERTIFICATE OF COMPLIANCE

I, (16), certify that to the best of my knowledge and belief the statements in this report are correct and that all material, construction, and workmanship on this Repair conforms to the *National Board Inspection Code*.
National Board "R" Certificate of Authorization No. (17) expires on (18)
Date (19) Signed (20) (name of repair organization) (21) (authorized representative)

CERTIFICATE OF INSPECTION

I, (22), 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 (23)
and employed by (24) of (25)
have inspected the work described in this report on (26), _____ and state that to the best of my knowledge and belief this work complies with the applicable requirements of the *National Board Inspection Code*.
By signing this certicate, 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 (19) _____, _____ Signed (27) (Inspector) Commissions (28) (National Board and Jurisdiction No.)

This form may be obtained from The National Board of Boiler and Pressure Vessel Inspectors, 1055 Crupper Ave., Columbus, OH 43229 NB-66 Rev-12

SECTION 5

A13 5.13.2 FORM R-2, REPORT OF ALTERATION

Form R-2 Report of Alteration

in accordance with provisions of the National Board Inspection Code

(Form "R" Registration no.)

(PO No., Job No., etc.)

1a. Design performed by: _____
(name of "R" organization responsible for design)

(address)

1b. Construction performed by: _____
(name of "R" organization responsible for construction)

(address)

2. Owner of Pressure Retaining Item: _____
(name)

(address)

3. Location of Installation: Service
(name) (USA, Canada, Mexico, etc.)

(address)

4. Item identification: _____ (boiler, pressure vessel, or piping) Name of original manufacturer: _____

5. Identifying nos: _____ (mfg. serial no.) _____ (National Board No.) _____ (jurisdiction No.) _____ (other) _____ (year built)

6. NBIC Edition / Addenda: _____ (edition) _____ (addenda)

Original Code of Construction for Item: _____ (name / section / division) _____ (edition / addenda)

Construction Code Used for Alteration Performed: _____ (name / section / division) _____ (edition / 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

Pressure Test, if applied _____ psi MAWP _____ psi

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)

NB-230, Rev. 0, (03/25/13)

FORM R-2 BACK

A13

9. Remarks: _____

DESIGN CERTIFICATION

I, _____, certify that to the best of my knowledge and belief the statements in this report are correct and that the Design Change described in this report conforms to the *National Board Inspection Code*.
National Board "R" Certificate of Authorization No. _____ expires on _____
Date _____ _____ Signed _____
(name of design organization) (authorized representative)

CERTIFICATE OF DESIGN CHANGE REVIEW

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 _____ of _____ have reviewed the design change as described in this report and state that to the best of my knowledge and belief such change complies with the applicable requirements of the *National Board Inspection Code*.
By signing this certificate, neither the undersigned nor my employer makes any warranty, expressed or implied, concerning the work described in this report. Furthermore, neither the undersigned nor my employer shall be liable in any manner for any personal injury, property damage or loss of any kind arising from or connected with this inspection.
Date _____ Signed _____ Commissions _____
(inspector) (National Board and jurisdiction no.)

CONSTRUCTION CERTIFICATION

I, _____, certify that to the best of my knowledge and belief the statements in this report are correct and that all material, construction, and workmanship on this Alteration conforms to the National Board Inspection Code.
National Board "R" Certificate of Authorization No. _____ expires on _____
Date _____ _____ Signed _____
(name of alteration organization) (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 employed by _____ of _____ 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 applicable requirements of the National Board Inspection Code.
By signing this certificate, neither the undersigned nor my employer makes any warranty, expressed or implied, concerning the work described in this report. Furthermore, neither the undersigned nor my employer shall be liable in any manner for any personal injury, property damage or loss of any kind arising from or connected with this inspection.
Date _____ Signed _____ Commissions _____
(inspector) (National Board and jurisdiction no.)

5.13.3 FORM R-3, REPORT OF FABRICATED PARTS

FORM R-3 REPORT OF PARTS FABRICATED BY WELDING
in accordance with provisions of the *National Board Inspection Code*

1. Manufactured by (1) _____ (2) _____
   _____ (53) _____
2. Manufactured for (29) _____
   _____
3. Design Condition specified by (30) _____ Code design by (31) _____
4. Design Code (32) _____ (33) _____ (34) _____ (35) _____
5. Identification of Parts

Name of Part (36)	Qty. (37)	Line No. (38)	Manufacturer's Identifying No. (39)	Manufacturer's Drawing No. (40)	MAWP (41)	Shop Hydro PSI (13)	Year Built (9)

6. Description of Parts

	(a) Connections other than tubes			Heads or Ends			(b) Tubes		
Line No. (38)	Size and Shape (42)	Material Spec. No. (43)	Thickness (in.) (44)	Shape (45)	Thickness (in.) (46)	Material Spec. No. (43)	Diameter (in.) (47)	Thickness (in.) (48)	Material Spec. No. (43)

7. Remarks (15) _____

This form may be obtained from The National Board of Boiler and Pressure Vessel Inspectors, 1055 Crupper Ave., Columbus, OH 43229 NB-230 Rev. 2

Form R-3 (back)

(2) (Form "R" No.)

CERTIFICATE OF COMPLIANCE

I, (16) _____, certify that to the best of my knowledge and belief the statements in this report are correct and that all material, fabrication, construction, and workmanship of the described parts conforms to the *National Board Inspection Code* and standards of construction cited.

National Board "R" Certificate of Authorization No. (17) _____ expires on (18) _____

Date (19) _____, _____ (20) _____ Signed (21) _____

(name of "R" Certificate Holder) (authorized representative)

CERTIFICATE OF INSPECTION

I, (22) _____, holding a valid Commission issued by The National Board of Boiler and Pressure Vessel Inspectors and certificate of competency issued by the jurisdiction of (23) _____ and employed by (24) _____ of (25) _____

have inspected the parts described in this report on (26) _____, _____ and state that to the best of my knowledge and belief the parts comply with the applicable requirements of the *National Board Inspection Code*.

By signing this certificate, neither the undersigned nor my employer makes any warranty, expressed or implied, concerning the work described in this report. Furthermore, neither the undersigned nor my employer shall be liable in any manner for any personal injury, property damage or loss of any kind arising from or connected with this inspection.

Date (26) _____, _____ Signed (27) _____ Commissions (28) _____

(inspector) (National Board and Jurisdiction No.)

5.13.4 FORM R-4, REPORT SUPPLEMENTARY SHEET

FORM R-4 REPORT SUPPLEMENTARY SHEET

in accordance with provisions of the *National Board Inspection Code*

1. Work performed by (1) (49) (name) (2) (49) (Form "R" referenced)
   (address) (53) (49) (PO No., Job No., etc.)
2. Owner (3) or (29) (49) (name)
   (address)
3. Location of installation (name)
   (address)

Reference Line No. (51) Continued from Form R- (50) (52)

Date (19) , Signed (21) (authorized representative) Name (20) (49) (Name of "R" Certificate Holder)

Date (19) , Signed (27) (inspector) Commissions (28) (National Board and Jurisdiction No)

This form may be obtained from The National Board of Boiler and Pressure Vessel Inspectors, 1055 Crupper Ave., Columbus, OH 43229 NB-231 Rev. 2

SECTION 5

5.13.4.1 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, 5.13.1 through 5.13.4. [OR NEW S 6.19.4]

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 1b) and the organization completing the construction activities will complete line 1a).

2. 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, 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. A13

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. (US or Canadian)

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.
Registration

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 flat, 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.

Response to Letter Ballot of February 2015

Revised Proposal: For Sub Group R/A July 14, 2015

c) When ASME 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 *Certification 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;

1) An R Certificate of Authorization holder may fabricate replacement parts without providing ASME Code stamping or completion of an ASME Manufacturer's Partial Data Report for use in the repair being performed by the same R Certificate Holder provided the R Certificate Holder holds an appropriate ASME Certificate of Authorization and the work performed is inspected by an Authorized Inspector qualified in accordance with the ASME Code. The documentation and controls for such activity shall be described in the R Certificate Holder's quality control system.

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;

Commenter	Comment / Negative	Response
Brian Boseo	I disapprove. After further consideration, I am falling back on my original stance. I do see merit in allowing an "R" Certificate holder to adjoin material together to support the Repair/Alteration of a pressure retaining item. However, when dealing with the repair/alteration of a boiler which can be made up of many larger pressure parts (e.g. headers, drums), this issue becomes clouded as I am not confident all "R" Certificate Holders maintain the technical expertise to manufacturer a major ASME Section I pressure part, especially when working to a different Edition/Addenda than what was used during original construction of the boiler. I agree with George Galanes and find merit in Mike Webb's proposed	The proposal has been reworked to require the R stamp holder to hold an ASME Certificate and have the work inspected by an AI. The only real change to the Code, in effect, is how the work is documented. The new version is included herein. RVW 07/12/15

Response to Letter Ballot of February 2015

Commenter	Comment / Negative	Response
	approach. BOSEO 3/12/15	
Rob Troutt	While I agree this issue needs better clarity, I do not agree with the proposal. I have always had concerns with this part of the NBIC. Back when I was an Authorized Inspector, with Hartford, I found it odd that a R stamp holder could basically replace components of a vessel and not have the applicable ASME Code Stamp that the vessel was fabricated under. One of the problems that I have with the proposal is that it is addressing both repairs and alterations. I am not be concerned with a R stamp holder to fabricate a part of a vessel if it is fabricated with the same design of the part it was replacing (i.e. Same material, same thickness and so on). This by definition is a repair. Now if a R stamp holder is fabricating that part, but there is design changes, this is an alteration and now that part should be fabricated by someone holding the applicable ASME Code Certification Mark. I would like to make it clear, I am not saying that a R stamp holder should not be able to make alterations. Instead, I am saying if a "Part" is being fabricated as part of a alteration, then that part should be built to the applicable ASME Code of Construction for which it will be installed on. TROUTT 3/7/15	See response to Brian Boseo. The proposal is now limited to being performed by someone with and ASME Code mark and the work is inspected by an AI. With regard to inclusion of alteration, the R stamp holder, today, does not need to go to an ASME stamp holder to approve any design or fabrication for an alteration. They MUST have this feature in the scope of their own R Certificate. RVW 0712/15
Michael Webb	Disapprove. I am clearly in favor of this item to better profile "R" Certifcate holder activities. However, in my opinion the confusing elements of replacement parts may be better clarified by separating the Part 3 – 3.3.2 c) paragraph into 3 items of distinct context. To address this opinion the attached is offered to the subcommittee for their consideration. WEBB 02/19/15 (NOTE: Webb negative withdrawn)	Thank you for support. And thank you for your additional thoughts on this issue. I have reworded the proposal to take some of your idea into consideration. Please see the attached new proposal. RVW 07/12/15

Response to Letter Ballot of February 2015

Commenter	Comment / Negative	Response
	To ensure my favorable opinion of this item is counted, I change my vote accordingly. Setting my opinion of the 3.2.2 –c) paragraph format and wording aside, comments voiced by Mr. Morelock and Mr. Schulte are well stated and are in concert with the routine vigilance and "monitoring" of a repair organization's activities by the AIA, an expectation of the National Board. The introduction of material into a repair or alteration is an in-process, Quality System-control, for which the holder of a "R" Certificate of Authorization has been dutifully reviewed and accepted by the AIA and national Board. For those users whose experience in the use of the Code has not been patiently augmented by committee meeting participation, the opportunity to mentor is well within the prerogatives of the AIA to better institute other controls as necessary. WEBB 3/4/15	
Brian Morelock	I understand the reasoning for the negatives, but I feel this item has merit and I approve it. Yes, we will need to agree on the wording. This item states, "The controls for this activity shall be described in the quality control system". For the purposes listed in this item, it really boils down to this: an "R" stamp holder can carry out ASME Code materials into the field, weld them, inspect them, perform NDE, and test them as a repair, but if this same "R" stamp holder would want to use the same ASME Code materials, same qualified WPS's, same qualified welders, same inspection, same NDE, etc. in their shop to preassemble this material as a "component" (as stated in this item) prior to installation in the field, this "R" stamp holder must now also have a ASME stamp strictly based upon how the materials are staged prior to welding? MORELOCK 3/3/15	Thank you for your support on this. I have revised the proposal that requires the R stamp holder to have an ASME Code mark if he is going to fabricate ASME parts. Please see revised proposal attached. RVW 07/12/15

Response to Letter Ballot of February 2015

Commenter	Comment / Negative	Response
Paul Edwards	Mr. Galanes' review is well stated, I concur with his concerns on this proposal. EDWARDS 3/2/15	Please see response to Mr. Galanes. RVW 07/12/15
Wayne Jones	The term "Part" is recognized by ASME while NB-23 refers to "Pressure Retaining Item". During my participation with Joint Reviews he was made clear that ASME does not recognize the term "pressure retaining item". Maybe we should take a look at using this term which would provide clarification when the R stamp holder needs to fabricate a replacement. JONES 2/26/15	The term "part" is used throughout the NBIC without definition. In this paragraph, we are dealing with "replacement" parts. There may be some value to defining that term better in the NBIC since it usually means "like-for-like". But not always. For this action, I do not think it will help very much. At the next meeting, I will bring this topic up for discussion and if the committee feels that it should be better defined, an item will be opened to do so. RWV 07/12/15
Brian Schulte	I approve. I believe the additional language provides clarification, however review and acceptance by the AI is the key to precluding Mr. Galanes' concern about abuses by less than sophisticated R stamp holders with no design or fabrication expertise. SCHULTE 2/26/15	Thank you for your support. RVW 07/12/15
George Galanes	I am voting disapprove because if we allow R-Certificate holders to fabricate ASME pressure parts for repairs or alterations even when the parts are installed by the same R-Certificate holder, where does this card blanche end? I am still wrestling with the concept if we need to place restrictions on what an R-Certificate holder can fabricate regarding type of pressure parts, similar to examples for repairs and alterations. For those that cited previous examples, like roll forming a shell and seam welding the formed shell into an existing pressure retaining item (repair) or fabricating butt welds in boiler tube dissimilar metal welds, these are fabricated pressure parts that can be supplied by a typical R-Certificate holder. What I am most	Take note that this activity of R stamp holders fabricating ASME parts has been going on in industry for as long as I can remember. Typical examples are butt welding tubing together before installing the completed tube as a replacement tube in utility boilers, or welding LWN flanges to pipe pieces to form spools for installation in the pressure vessel, or assembling spool pieces on the shop floor to be installed in BEP in the field. All this has typically been performed by an R stamp holder, with the inspection being performed by the NB Commissioned Inspector, and the work recorded on R-1 forms. The "roll forming a shell and seam welding" that you mentioned is another typical part fabricated by an R stamp holder. Same for making dissimilar tubing welds. These are the types of fabrication that

Response to Letter Ballot of February 2015

Commenter	Comment / Negative	Response
	concerned about are abuses by less sophisticated R-Certificate holders trying to reverse engineer ASME pressure parts, like headers or steam drums with no design or headers or steam drums with no design or fabrication expertise. I am not sure that stating "controls for the activity shall be described within the quality control system" will be definitive. The current wording in Part 3. 3.2.2 clearly states pressure parts shall be fabricated by an ASME Certificate holder. I believe, this wording was intentional by the NBIC main committee at the time it was incorporated into the NBIC to avoid having an R-Certificate holder assuming design and fabrication responsibility for another code's pressure part. Simply adding another paragraph seems to provide an alternative approach where shall was originally used to express the intent that fabricated pressure parts will be designed and fabricated to the original code of construction (ASME) regardless of size and function. I am very sympathetic to allowing an R-Certificate holder to fabricate limited ASME pressure parts under their control including installation. If we, as a group collectively, decide to go down the path of allowing an R-Certificate holder to fabricate pressure parts under their control during repair or alteration, we should state that and eliminate 3.2.2 (c) or eliminate shall to allow flexibility. GALANES 2/19/15	is intended in this proposal. As far as reverse engineering pressure parts, that is also done today to some extent, and is pretty much sanctioned by the NBIC, i.e. supplying like-for-like replacement parts. In fact, there is no engineering performed there. So I'm not sure what having an ASME stamp will do in that scenario. However, to respond to your negative, I added the rule that to fabricated parts, the R stamp holder must hold an ASME Code mark. To address your concern about not being definitive enough in the QC System, the revised proposal includes some additional specificity of what needs to be included in the QC system. This additional text is in line with what ASME requires for transfer of parts between ASME stamp holder locations without supplying a Data report or stamping the part. With regard to the comment about what was originally intended by the Code Committee when the words were included, I agree with you. That is exactly what they intended. But it was intended for organizations that were designing and supplying Parts to the R stamp holder. But regardless, this new proposal will require the R stamp holder to hold an ASME mark as well. I think we already allow this fabrication methodology to exist today. The only part that needs clarification is how it is documented. Which is the only intent of this action. I do not believe that we should eliminate 3.2.2 c) since it the heart of the matter, and provides much needed rules to control how replacement parts are treated. With regard to stopping abuse of this, I don't think R stamp holders will generally replace complete drums RVW 07/12/15

Response to Letter Ballot of February 2015

Commenter	Comment / Negative	Response

Previous proposal:

In addition propose revised words in the code, additional a new second paragraph to be added to 3.2.2 c).
"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."

NB14-1102

Action Item Request Form

8.3 CODE REVISIONS OR ADDITIONS

Request for Code revisions or additions shall provide the following:

a) Proposed Revisions or Additions

For revisions, identify the rules of the Code that require revision and submit a copy of the appropriate rules as they appear in the Code, marked up with the proposed revision. For additions, provide the recommended wording referenced to the existing Code rules.

Existing Text:

None

Circulator and thermic syphon neck to diaphragm welds are typically fillet welds and no guidance has been provided on the repair of locomotive boiler fillet welds.

c) Background Information

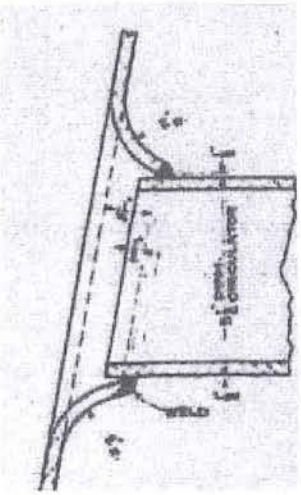
Provide background information to support the revision or addition, including any data or changes in technology that form the basis for the request that will allow the Committee to adequately evaluate the proposed revision or addition. Sketches, tables, figures, and graphs should be submitted as appropriate.

When applicable, identify any pertinent paragraph in the Code that would be affected by the revision or addition and identify paragraphs in the Code that reference the paragraphs that are to be revised or added.

S1.2.9.5.1 CIRCULATOR & THERMIC SYPHON FILLET WELDS

1. The weld to be restored will be ground to bright metal and Visually Inspected for indications prior to welding.
2. Indications will be evaluated to the indication acceptance criteria provided in the ASME Code, Section I (PW51).
3. Any unacceptable indication shall be removed prior to restoring the weld to the installed size.
4. Completed welds shall be Visually Inspected for unacceptable indications. Where repairs are required, the weld may be repaired once, if unacceptable on final inspection the entire weld shall be removed and replaced according to the initial installation criteria.
5. All welding will be conducted by welders qualified to the ASME Code, Section IX, for all positions (6G).
6. When any repair or restoration has been conducted to attachment welds, the boiler shall be hydrostatically tested to 1.25 times the MAWP.
7. A footnote will be attached to all records submitted to the FRA documenting inspections of the fillet weld, noting conditions found along with the signature of the inspector conducting the examination.

S1.2.9.5.1a CIRCULATOR & THERMIC SYPHON NECK TO DIAPHRAGM INSTALLATION



NB14-2401

Action Item Request Form

8.3 CODE REVISIONS OR ADDITIONS

Request for Code revisions or additions shall provide the following:

a) Proposed Revisions or Additions

For revisions, identify the rules of the Code that require revision and submit a copy of the appropriate rules as they appear in the Code, marked up with the proposed revision. For additions, provide the recommended wording referenced to the existing Code rules.

Existing Text:

S6.5 Replacement Parts
d) When the original code of construction is other than ASME, replacement parts subject to internal or external pressure fabricated by welding 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 TR-1 and the 'TR" Stamp applied as described in NBIC Part 3, S6.14.

b) Statement of Need

Provide a brief explanation of the need for the revision or addition.

The need is to be consistent with NBIC part 3 for replacement parts fabricated by a TR stamp holder. The parts should be documented on a separate form similar to the one for an R stamp holder completes. The form referenced on the last line should be a TR-3 not 1.

c) Background Information

Provide background information to support the revision or addition, including any data or changes in technology that form the basis for the request that will allow the Committee to adequately evaluate the proposed revision or addition. Sketches, tables, figures, and graphs should be submitted as appropriate.

When applicable, identify any pertinent paragraph in the Code that would be affected by the revision or addition and identify paragraphs in the Code that reference the paragraphs that are to be revised or added.

Throughout Supplement 6 the work that is done is documented on one form (TR-1). This can be a repair or alteration or modification. To develop a form to also address replacement parts is extremely difficult.

Paragraph S6.5 would be affected.

NB14-2402

Action Item Request Form

8.3 CODE REVISIONS OR ADDITIONS

Request for Code revisions or additions shall provide the following:

a) Proposed Revisions or Additions

For revisions, identify the rules of the Code that require revision and submit a copy of the appropriate rules as they appear in the Code, marked up with the proposed revision. For additions, provide the recommended wording referenced to the existing Code rules.

Existing Text:

S6.3 ACCREDITATION
Organizations performing repairs, alterations, or modifications shall be accredited as in accordance with the National Board "TR" Program.

b) Statement of Need

Provide a brief explanation of the need for the revision or addition.

The need is to discuss in text the accreditation process for a TR program in the supplement.

c) Background Information

Provide background information to support the revision or addition, including any data or changes in technology that form the basis for the request that will allow the Committee to adequately evaluate the proposed revision or addition. Sketches, tables, figures, and graphs should be submitted as appropriate.

When applicable, identify any pertinent paragraph in the Code that would be affected by the revision or addition and identify paragraphs in the Code that reference the paragraphs that are to be revised or added.

S6.3 ACCREDITATION

Organizations performing repairs, alterations, or modifications shall be accredited as in accordance with **NBIC Part 3, Accreditation, Section 1; Major Section 1.5 and Section 1.5.1.** ~~the National Board "TR" Program.~~

NB15-0509; PR15-0156

NBIC Part 3 paragraph: 2.5.3.6 c) 5) d)

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).

NB15-0511

National Board of Boiler and Pressure Vessel Inspectors
National Board Inspection Code
Submission of Public Review Comment
2015 Draft Edition

PLEASE SUBMIT ONLY ONE COMMENT/RECOMMENDATION PER PAGE
Make additional copies as needed

Comments Must be Received No Later Than: October 13, 2014

Instructions: If unable to submit electronically, please print this form and fax or mail. Print or type clearly.

Date: October 1, 2014

Commenter Name: Nathan Carter

Commenter Address: HSB Global Standards, One State Street, PO Box 299
Hartford, CT 06141-0299

Commenter Phone: 860-722-5750

Commenter Fax: _____

Commenter Email: nathan_carter@hsbct.com

Section/Subsection Referenced: Part 3, 5.13.5.1 31.

Comment/Recommendation: *Proposed Solution:* ☐ New Text ☒ Revise Text ☐ Delete Text

What about Category 3 repairs/alterations, etc? What if it was performed to an International Code other than Section III or XI? Per the instruction, there isn't a way to address this situation.

Also, Hyphenate "rerating" to "re-rating" to be consistent with the NBIC.

Source: ☒ Own Experience/Idea ☐ Other Source/Article/Code/Standard _____

Submit Form To: Robin Hough, Secretary, NBIC Committee, The National Board of Boiler & Pressure Vessel Inspectors, 1055 Crupper Avenue, Columbus, OH 43229, fax 614-847-1828, email, rhough@nationalboard.org

NB Use Only

Commenter No. Issued: PR15-01

Comment No. Issued: 20

Project Committee Referred To: SC Repair and Alteration

CARBONSEAL™
INDUSTRIAL COMPOSITE SYSTEMS

STEEL PIPE

STEEL TANKS

PRESSURE VESSELS

Carbon Fiber Reinforced Polymer (CFRP) Reinforcement of High Pressure Metal Pressure Vessels

By: Olley Scholer

NBIC Meetings
Columbus, OH
July 14th, 2015

CARBONSEAL™
INDUSTRIAL COMPOSITE SYSTEMS

OVERVIEW

1. What Is Carbon Fiber Reinforced Polymer (CFRP)?
2. What Tests Are Required To Qualify A CFRP Repair System?
3. How is CFRP Applicable to Repair of Pressure Vessels?
1. What Training & Certification Are Required For Installers?
2. What Quality Control and Quality Assurances are Required During Installation?
1. What Type Of Post-installation Inspection Is Performed?

1) What Is Carbon Fiber Reinforced Polymer (CFRP)?

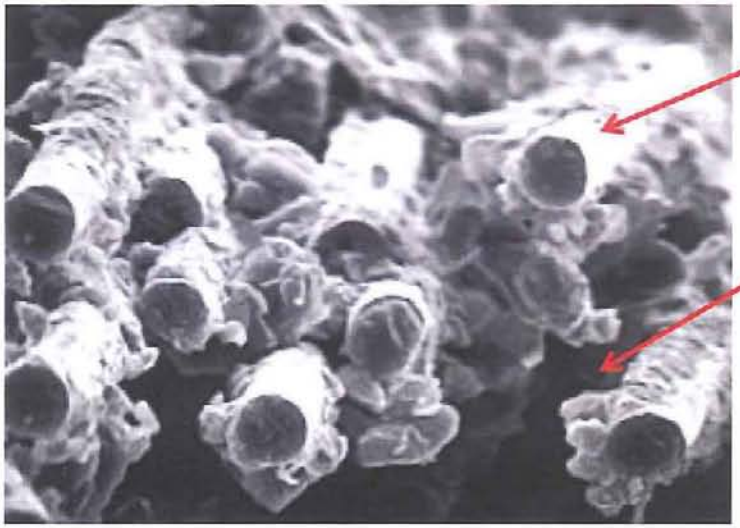
CARBON FABRIC MANUFACTURING

Input Thread

Fabric Weaving

Fabric Rolls

CARBON COMPOSITE CROSS SECTION



Carbon Reinforcing Fiber

Polymer Resin Matrix

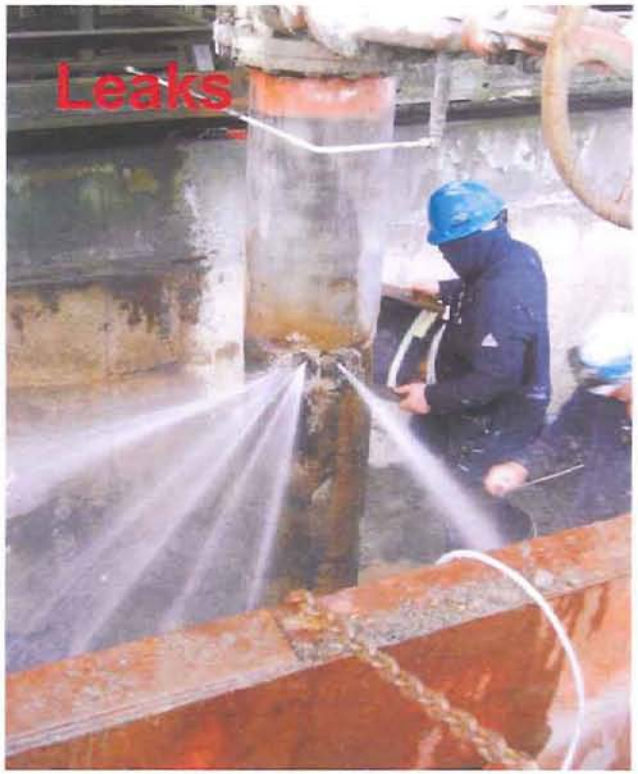
CREATING CFRP

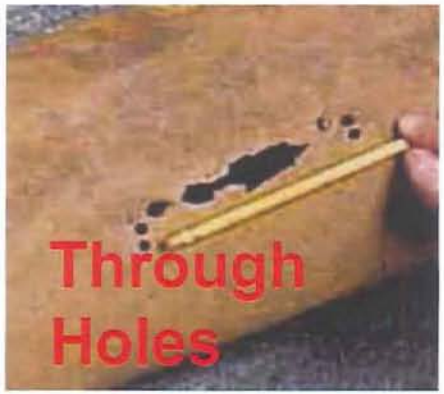
Mixing Resin

Saturating Fabric

Applying Composite

TYPES OF REPAIRS





2) What tests are required to qualify a CFRP Repair System?

MATERIAL TESTING

ASME PCC-2 Article 4.1 Table 1 Requires Material Property Testing

TYPICAL DATA AND PHYSICAL PROPERTIES	
STORAGE CONDITIONS	Store dry
COLOR	Black
GLASS TRANSITION TEMPERATURE Tg (ASTM 4065)	232°F
HEAT DISTORTION TEMPERATURE HDT (ASTM D648)	440°F
TYPICAL VALUE – TENSILE STRENGTH (ASTM D3039)	77,000 psi
DESIGN VALUE – TENSILE STRENGTH (ASTM D3039)	57,750 psi
TYPICAL VALUE – YOUNG'S MODULUS (ASTM D3039)	5,667 ksi
DESIGN VALUE – YOUNG'S MODULUS (ASTM D3039)	4,038 ksi
POISSON'S RATIO (ASTM D3039)	0.091
ELONGATION @ BREAK (ASTM D3039)	1.43%
SINGLE PLY THICKNESS	0.051 inches
COMPRESSIVE STRENGTH (ASTM D695)	11,000 psi
LAP SHEAR (ASTM D3165)	3,417 psi
SHEAR MODULUS (ASTM D5379)	8,600 psi
FLEXURAL STRENGTH (ASTM D790)	17,200 psi
FLEXURAL MODULUS (ASTM D790)	3,611,000 psi
MINUMUM BOND STRENGTH TO PROPERLY PREPARED STEEL	2,000 psi
BARCOL HARDNESS (ASTM D2583)	55
SHORE D HARDNESS (ASTM D2240)	63
THERMAL EXPANSION (ASTM E831)	3.65 x 10^{-6} in/in-deg F

- ✓ ***Independent Lab Testing***
- ✓ ***Strength***
- ✓ ***Stiffness***
- ✓ ***Temperature Limitations***
- ✓ ***Abrasion Resistance***
- ✓ ***Adhesion***

ASME PCC-2 Article 4.1 Mandatory Appendices Require Burst Tests and Impact Testing

BURST TESTS

BEFORE

Burst Test Example:

- API 5L X42 Grade B Pipe
- 60,000 psi SMYS
- Machined Defect to 80% Wall Loss
- Pressure cycles for operating, max and burst
- 5,215 psi burst of original steel pipe

AFTER

DURABILITY TESTING

ASME PCC-2 Article 4.1 Requires Composite Repairs to Be Compatible with Contents

DURABILITY TESTING

Example: 20,000 hrs of durability testing

ASTM C581 Testing specific to exposure and chemicals

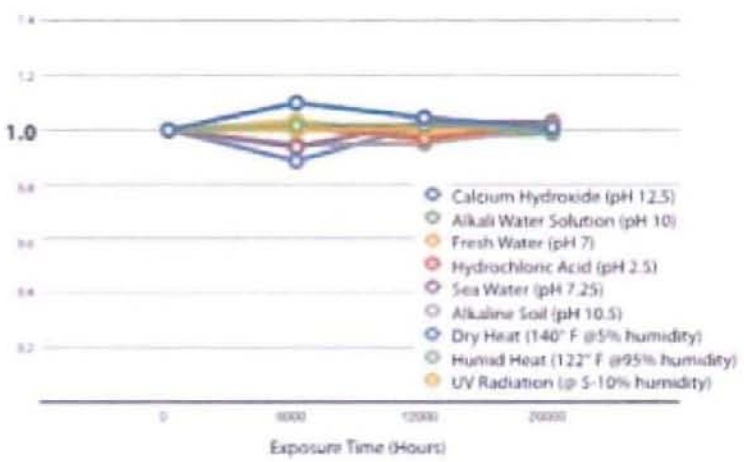
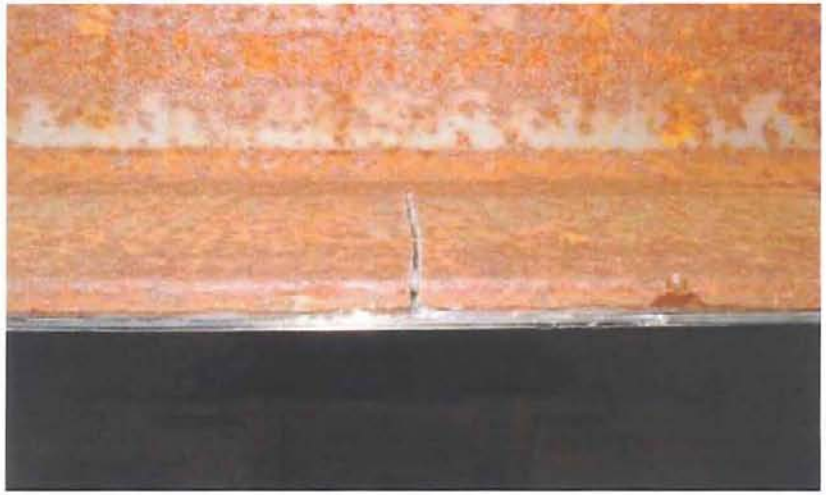


Chart showing the stability of carbon fabrics after exposure to accelerated, aggressive environments.

STEEL BEAM TEST



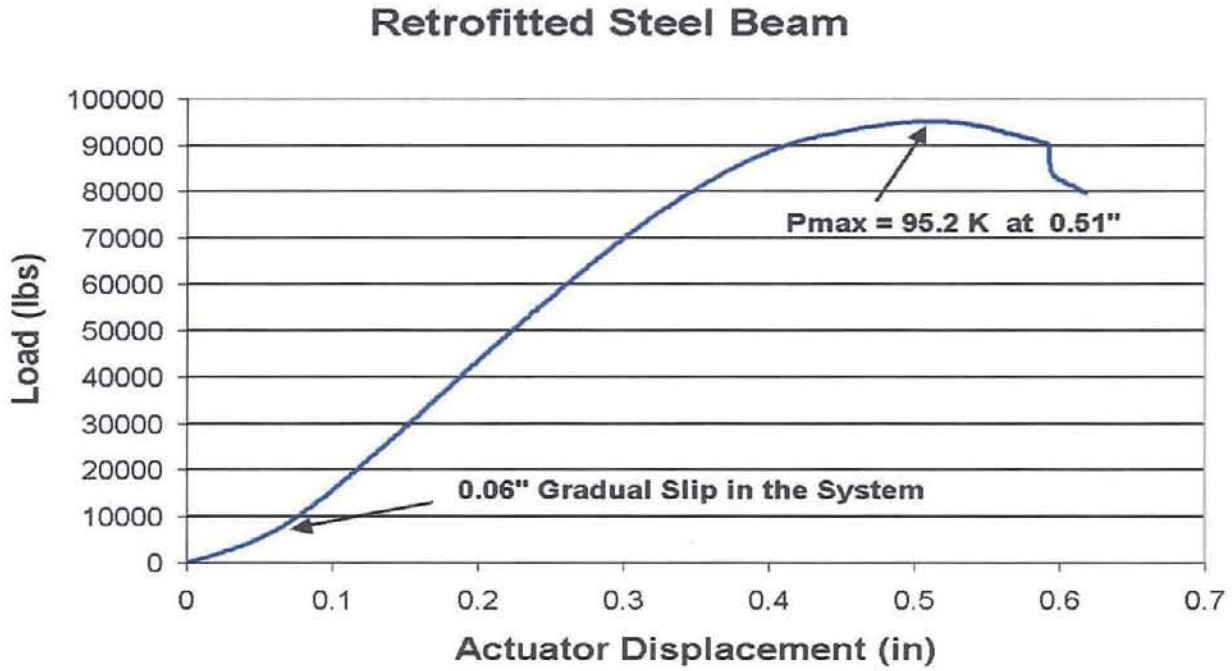
Tension flange cut on both sides of web

Beam shown after experiment

STEEL BEAM TEST

Carbon had enough strength to buckle the compression flange!

STEEL BEAM TEST



Carbon Retrofitted Steel Beam is16% Stronger than Steel Beam

Load vs. Displacement Curve

3) How is CFRP Applicable to Repair of Pressure Vessels?

APPLICABILITY

ASME PCC-2-2015 "Repair of Pressure Equipment and Piping"

Specifically, Article 4.1 "Non-Metallic Composite Repair Systems: High Risk Application" is the section that qualifies the use of carbon fiber reinforced polymers.

Section 1.2 Applicability states" (3) the repair of vessels originally designed in accordance with a variety of construction standards, including ASME BPV Code, BS EN 13121-2, and PD 5500"

4) What Training & Certification Are Required For Installers?

TRAINING PROGRAM

Educational Training
Classroom Setting = 2 days minimum

- Curriculum shall include:
  - ✓ Background of Carbon Fiber Reinforced Polymer (CFRP) Systems
  - ✓ Understanding the Applicable Design Codes
  - ✓ Addressing the Design Basics
  - ✓ Knowledge of Basic Application Procedures
  - ✓ Understanding Basic CFRP Quality Control Measures
  - ✓ Using Quality Control Equipment
  - ✓ Exam with passing criteria

TRAINING PROGRAM

Hands-On Training
Classroom Setting = 1 day minimum

- Curriculum shall include:
  - ✓ Quality Control Data Acquisition
  - ✓ Use of QA/QC Program Forms for each phase of installation
  - ✓ Surface Preparation Milestones
  - ✓ Post-Installation CFRP Inspection
  - ✓ Generate a QC Report

CERTIFICATION WITH 1 YEAR ANNUAL RENEWAL

5) What Quality Control And Quality Assurances Are Required During Installation?

SURFACE PREPARATION

ASME PCC-2 Article 4.1 Considers Surface Preparation as part of the Repair System

Surface Preparation Shall Follow an Industry Standard:

Example: SSPC SP-10 "Abrasive Blast to Near White Metal"

2.1 A near-white metal blast cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dust, dirt, mill scale, rust, coating, oxides, corrosion products, and other foreign matter, except for staining as noted in Section 2.2.

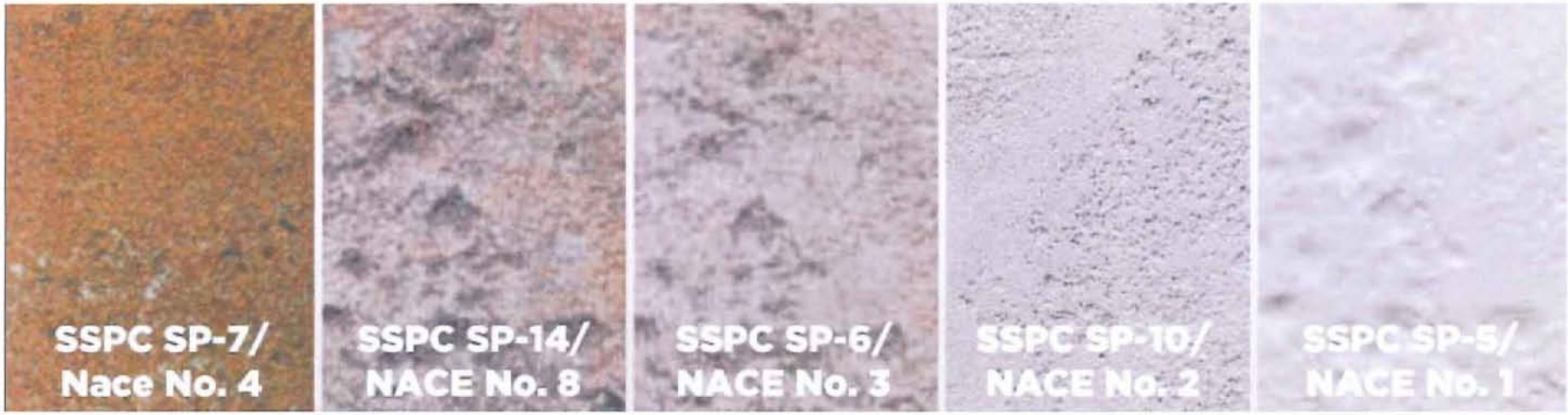
SURFACE PREPARATION

SSPC SP-10 "Abrasive Blast to Near White Metal"

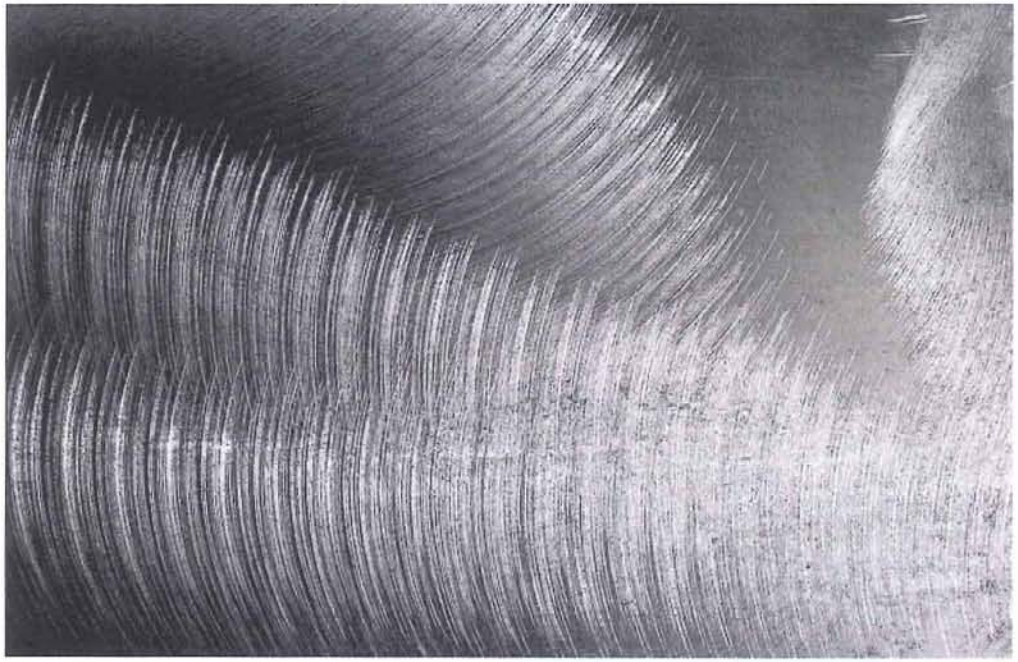
2.2 Random staining shall be limited to no more than 5 percent of each unit area of surface as defined in Section 2.6, and may consist of light shadows, slight streaks, or minor discolorations caused by stains of rust, stains of mill scale, or stains of previously applied coating.

SURFACE PREPARATION

Surface Prep Vis Standards from SSPC / NACE:



SURFACE PREPARATION



Surface Preparation Example:

SSPC SP-11 “Power Tool Clean to Near White Metal”

SURFACE PREPARATION

Critical Milestones:

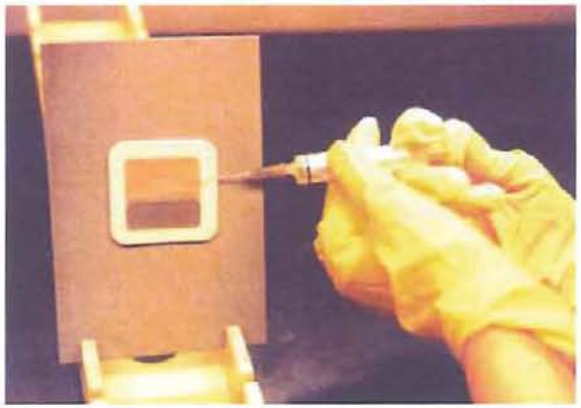
1) Profile
Carbon Fiber Reinforced Polymer (CFRP) requires at least a 3-mil (0.003-inch) anchor profile pattern

Check the surface profile to ensure that 3-mils are sufficient

SURFACE PREPARATION

Critical Milestones:

2) Clean
Chloride Salt Test
Target < 3 micrograms / cm^2
Perform test to make sure that residual salts are removed



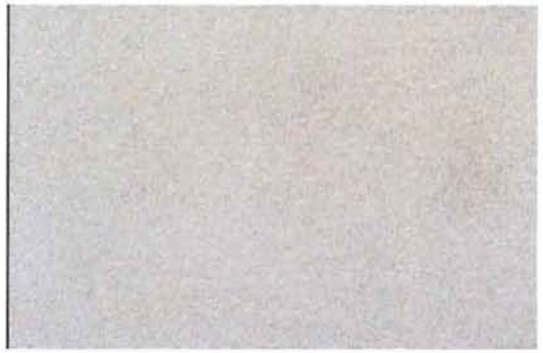
SURFACE PREPARATION

Critical Milestones:

<u>3) Dry</u>
Monitor environmental conditions to make sure surface temperature > 5F above dew point

Measure all environmental conditions

Avoid FLASH RUST!



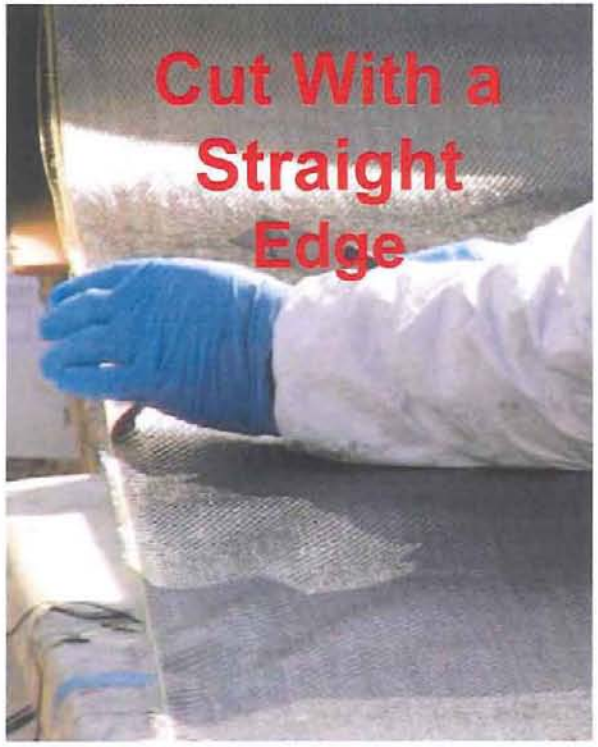
APPLYING PRIMER COAT

- Apply at 5-7 Mils
- Visual Inspection for 100% Coverage
- Wet Film Thickness Readings with Gauge

APPLYING HIGH MODULUS PASTE

- Apply to fill pits and voids in steel
- Use as Load Transfer Paste for Deep Voids
- Visual Inspection for 100% Coverage
- Wet Film Thickness Readings with Gauge

PREPARING AND CUTTING CARBON FIBER



HAND SATURATION

- Visual Inspection for 100% Saturation of Fabric
- Saturation to ensure no dry fibers

SATURATION MACHINE

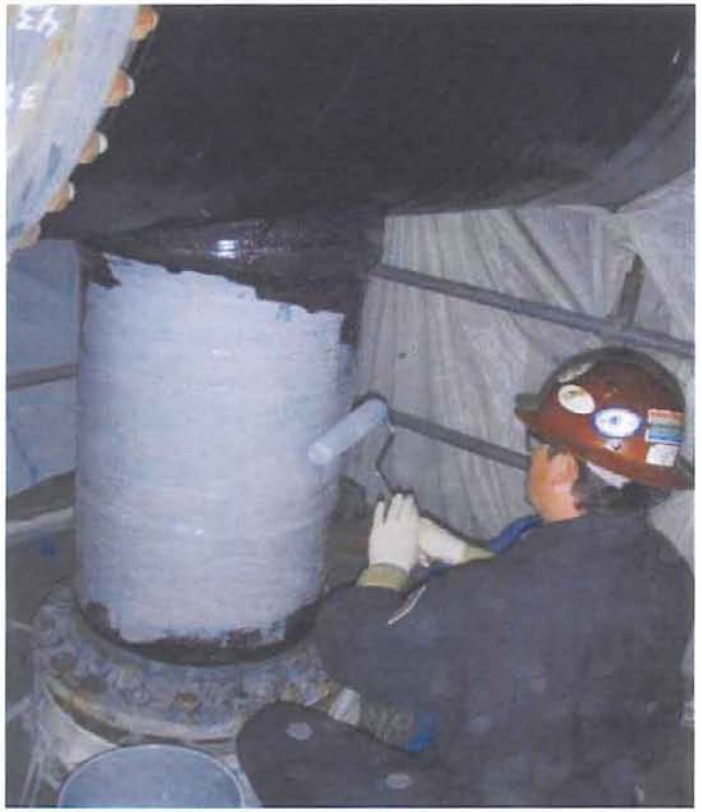
- Carbon Fiber runs through resin bath and is saturated through pinch rollers
- Pinch rollers are calibrated for optimal saturation

APPLYING CARBON FIBER

- Apply evenly to and avoid air encapsulation
- Avoid Fiber Kinks and waviness
- Ensure proper splice of 4" minimum

APPLYING TOP COAT

- Visual Inspection for 100% Coverage
- Wet Film Thickness Readings with Gauge
- Spark Testing to detect Holidays and ensure pinhole free



QA/QC SUMMARY

Surface Preparation

- ✓ Proper Surface Prep - Near White Metal
- ✓ Surface Profile - 3 mils
- ✓ Salt Test < 3 micrograms / cm2

Polymer Mixing

- ✓ Record each batch size, lot # and date
- ✓ QC person to initial for each batch
- ✓ Record time of mixing

Priming Surface

- ✓ Visual Inspection for 100% Coverage
- ✓ Wet Film Thickness Readings

High Modulus Paste

- ✓ Visual Inspection for 100% Coverage
- ✓ Wet Film Thickness Readings

Fabric Placement

- ✓ Fiber Alignment = no waviness in fiber
- ✓ No voids or bubbles between substrate and CFRP
- ✓ Inspect shore D hardness for cure

Top Coat

- ✓ Visual Inspection for 100% Coverage
- ✓ Wet Film Thickness Readings
- ✓ Spark Test for Holiday Detection

6) What Type Of Post-installation Inspection Is Performed?

POST-INSTALLATION INSPECTION

Post-installation inspection shall be performed to assure owners and operators of the following:

- *Repair system was installed properly*
- *Repair materials will perform according to design documents*
- *Ensure safety of workers and plant personnel*
- *Provide owners with a basis for expected service life*

POST-INSTALLATION INSPECTION

Inspection Method	What to Look For
Acoustic Tap Test	voids and air encapsulation between concrete and layers of primer, resin or adhesive, and within the FRP system itself;
Acoustic Tap Test	de-laminations between layers of FRP system;
Visual	broken or damaged edges of the FRP system;
Acoustic Tap Test & Visual	wrinkling and buckling of fiber and fiber tows;
Visual	discontinuities due to fracture of fibers, breakage in the fabric, or cracks in pre-cured shells;
Visual	cracks, blisters and peeling of the protective coating;
Visual	resin-starved areas or areas with non-uniform impregnation or wet-out
Shore D Hardness	under-cured or incompletely cured resin

CARBONSEAL™
INDUSTRIAL COMPOSITE SYSTEMS

SUMMARY

1. **Carbon Fiber Reinforced Polymer (CFRP) is a Post Construction Repair Material**
2. **Material and Pressure Tests Are Required To Qualify A CFRP Repair System**
3. **CFRP is Applicable to Repair of Pressure Vessels per ASME PCC-2 Article 4.1**
1. **Training & Certification Are Required For Installers**
2. **Quality Control and Quality Assurances are Required During Installation**
1. **Post-installation Inspection Can be Performed**

HJ3 Composite Technologies
2440 W Majestic Park Way
Tucson, AZ 85705
(520) 322-0010 tel
oscholer@hj3.com

From: Parrish, David [mailto:david.parrish@fmglobal.com]
Sent: Thursday, September 25, 2014 11:10 AM
To: George Galanes; jpillow@commonarc.com
Cc: bvallance@nationalboard.org; Martinez, David; Barker, Timothy
Subject: Weld Buildup Wasted Areas - Tubes

Thought your committee members might find attached interesting. It is extracted from the BLRBAC October 2013 meeting minutes (posted on the www.blrbac.org website). Wasted areas of tubes are frequently repaired by "pad" welding -- even for leaks. A few operators do not permit pad weld repair if failure could admit water to furnace (smelt-water explosion potential). Some operators replace tube section at next maintenance outage. For remainder, the pad weld becomes a long-term solution that may again leak.

It might be helpful for this industry if a "Welding Method" could be developed for inclusion in Part 3.

Best Regards,

Dave P
Senior Staff Engineering Specialist
FM Global - Engineering Standards, Equipment Hazards
781-255-4734

NATIONAL BOILER SERVICE, INC.

Weld Build Up Research

This report contains the results of *Weld Build Ups* that were performed on the outside diameter of boiler tubes (approx.180 thick) that were turned down (milled) on a lathe to a thickness of .120", .100", .090", .080", .070" thick to simulate boiler tube thinning for this research.

Weld Build Up of Wasted Area is the correct term for this type of repair in the Boiler and Pressure Vessel industry. Other jargon or terms used to describe this type of repair are Pad Welding (which is most frequently used) and Weld Overlay.

The objective of this research is to identify and/or determine what the welding process is doing to the inside of the tubes after weld build up was performed and at what wall thicknesses the tubes were adversely affected.

The Following Welding Processes were used:

- GTAW (TIG) - 3/32" Filler Metal
- SMAW (Stick) - 3/32" Filler Metal
- GMAW (MIG) (Hard Wire) - .035" Bare Wire Filler Metal

Note: The tubes must be cleaned thoroughly before welding.

The Tube positions when the weld build up was performed was about 45° and Vertical positions to simulate different configurations in a boiler such as vertical (Water-wall Tubes), Flat (Floor or Roof Tubes) and approximately 45° (Arch or Sloped Floor Tubes etc.).

The following photos are of weld build up that were performed on tube specimens that were cut in half to view and inspect the inside of the tubes. A description of our findings is under each photo.

Welding Terms:

- Burn-thru – A hole is burned through the base metal.
- Melt-thru – The welding filler metal is melted through to the inside of the base metal (push-thru).
- Sugaring - Oxidation of the weld or base metal.

Base Metal Designations and Terms:

* P1 - Carbon Steel Tubes ,"SA 178, 210 etc."
* P3 - Carbon/Moly Steel Tubes, "SA 209 T1"
* P4 - 1.25% Chrom, Alloy Steel Tubes, "SA 213 T11"
* P5 - 2.25% Chrom, Alloy Steel Tubes , "SA 213 T22
* P8 – Stainless Steel Tubes, "SA 213 TP 304,308,316 etc."

Conclusion

From this research, It is our opinion, the GTAW (TIG) process, is not recommended to perform Weld Build Up on P1, P3, P4 or P5 base metals that are below .100" thick. Burn-thru and melt-thru is virtually inevitable.

The GMAW (MIG) process (downhill progression with .035 Wire Size) can be used to Perform Weld Build Up on Tubes as thin as .080" thick, with minimal melt-thru or burn thru.

For stainless base metals (P8), it is not good practice or recommended to perform Weld Build Up on base metals that are below .120" thick. Extreme oxidization (Sugaring) virtually cannot be avoided on the inside diameter of the tube where no backing or shielding gas is utilized.

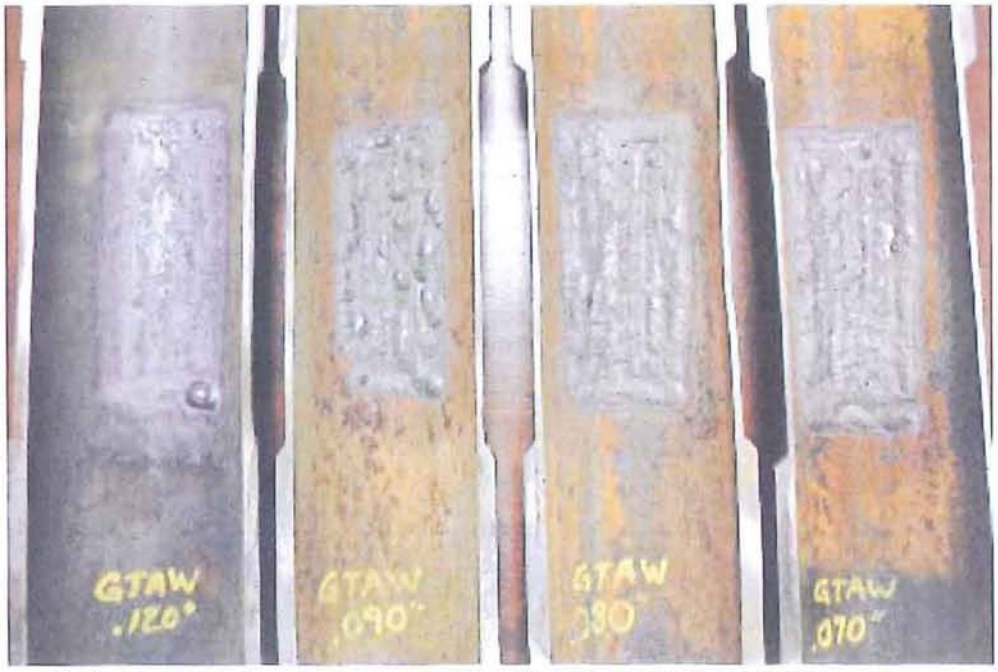
Steve Harville
Corporate Quality Control Manager

176 North Industrial Blvd. PO Box 279, Trenton, GA 30752 P:(706) 657-6200 F: (706) 657-4875
www.nationalboiler.com

OD: Carbon Steel (P1) *SMAW (Stick) process with E 7018 - 3/32"* was used on these samples. The Weld Progression was Uphill. On all 4 of these samples the Welder Burned-thru the base metal, as the samples got thinner, the Burn-thru was more frequent.

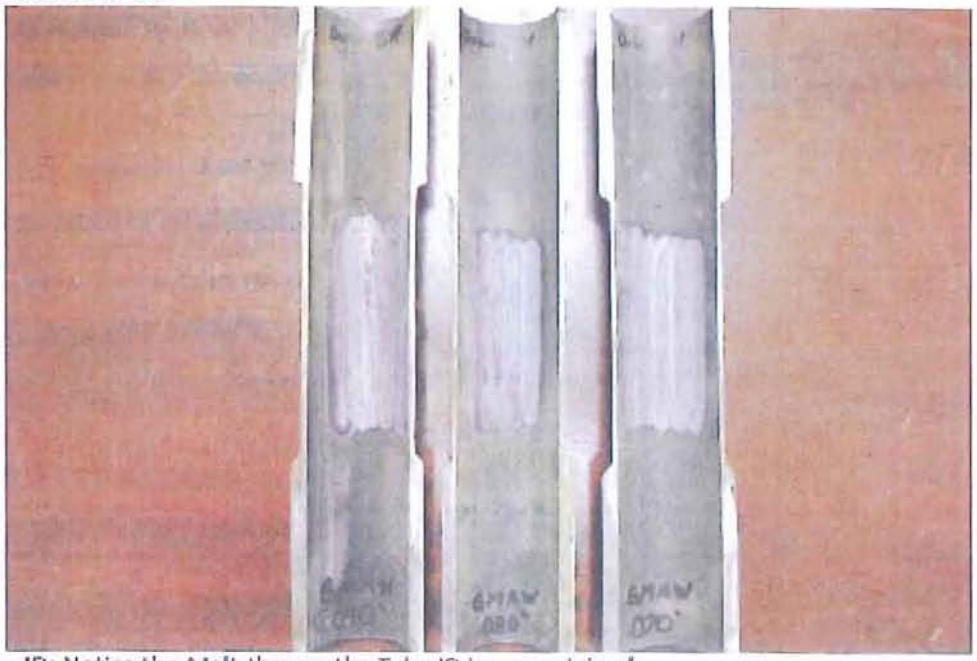
ID: Carbon Steel (P1) The Burn-thru that you see here is not "Melt-thru" it is "Burn-thru." Holes were actually burned in the base metal and filled back up with the SMAW process as the Welder was welding. Note: .070" sample was too thin to Weld.

OD: Carbon Steel (P1), *GTAW (TIG) process with E 70 S2 - 3/32"* was used on these samples. The Weld Progression was Uphill. On all 4 of these samples the Welder Melted-thru the base metal, as the samples got thinner, the Melt-thru was more frequent and excessive.



ID: The Melt-thru here is very excessive on the .090", .080" and .070" Samples

OD: Carbon Steel (P1), *GMAW (MIG) process with E 70 S2 - .035"* Wire was used on these samples. The Weld Progression was Downhill. Uphill is not recommended. On all of these samples the Welder had very minimal Melt-thru on all thicknesses of the base metal. The GMAW Process requires the base metal to be very clean. When applying Weld Build Up on Tubes of approximatly .120" and below, **GMAW (MIG) is the preferred method for Weld Build UP.**



ID: Notice the Melt-thru on the Tube ID is very minimal.

OD: Stainless: *GTAW (TIG) process with E 316L* - 3/32" was used on these samples. The Weld Progression was Uphill. On all 3 of these samples the Welder Melted-thru the base metal, as the samples got thinner, the Melt-thru was more frequent and excessive.

ID: Stainless: The Melt-thru on the .100" & .080" thick samples was excessive and "Sugared" (oxidized) the ID of the Tube. This is because the ID of the Tube is not accessible to use a Backing Gas such as Argon to shield the base metal or weld area.

OD: 1-1/4 Chrome (P4), SA 213 T11: *Superheat Tube Simulation* (with Water in the Tube). *GTAW (TIG) process with ER 80S B3-* 3/32" was used. The Weld Progression was Uphill. Welder Burned-thru the base metal once on the .090" sample and multiple times on the .070" sample.

ID: 1-1/4 Chrome (P4), SA 213 T11 *Superheat Tube Simulation* (with Water in the Tube). With water in the Tube, there is little to no indication it is about to burn though the base metal. With the .070" Tube we had to let it cool 3 to 5 minutes between weld passes or between half a weld pass.

Item NB15-1402

Single Strike-through and single underline: Comments/edits by Walt Sperko and Nathan Carter including NBIC Items 15-0509 and Nb15-1403 from January 2015 NBIC meeting in Orlando, FL

Comment [SJ1]: George, please fill in

Double Strike-through and double underline: Proposed edits by EPRI

2.5.3.6 Welding Method 6

This welding method provides ~~guidance~~ requirements for welding only Grade 91 tube material within the steam boiler setting and when ~~it's~~ it is impracticable to perform local post-weld heat treatment (PWHT). ~~This repair method utilizes a controlled fill technique.~~ When using this welding method, the following ~~is required~~ apply:

(1) 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.

(2) Application shall be limited to only boiler tube repairs at a location internal to the boiler setting.

~~(3) Upon the completion of weld repair, the repair region shall be kept from humid or moist environments until the return to service~~. Upon 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.

Comment [GG2]: The words in blue were revised based on approval of item NB15-1402.

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

(b) The welding shall be limited to the SMAW 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.

(c) The ~~test material for the~~ welding procedure qualification test coupon shall be P-No 15 E, Group 1, Grade 91 ~~for the repair.~~

(d) Qualification thickness limits of base metal and weld deposit thickness ~~for the test plates and repair groove depths~~ shall be in accordance with ASME Section IX, QW-451.

(e) The Welding Procedure Specification (WPS) shall be qualified in accordance with the requirements of ASME Section IX, ~~except that no~~ No postweld heat treatment shall be applied to the test coupon. Additionally, the ~~qualification~~ WPS shall include the following requirements;

1) The minimum preheat for the GTAW process shall be 200 deg F (~~93~~100 deg C). The minimum preheat for the SMAW process shall be 300 deg F (150 deg 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 ~~400 deg F (200 deg C).~~ 550 deg F (290 deg C).

(2) When the SMAW process is specified for a fill pass layer ~~as a controlled filled welding technique,~~ 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 ~~reflected in the qualified PQR and~~ shown on the WPS.

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

(4) 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

Comment [GG3]: The highlighted blue was revised under another action NB15-0509.

and 2734 (e.g., EPRI P87) or
(5) 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.

NB15-1403

NBIC Part 3 PROPOSED SUPPLEMENT

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Supplement X

WELD REPAIR AND POST REPAIR INSPECTION OF CREEP STRENGTH ENHANCED FERRITIC STEEL

SX.1 SCOPE

The technical information provided in this supplement pertains to weld repair options and post repair inspection guidelines which can be used for creep strength enhanced ferritic steels (CSEF).

Creep Strength Enhanced Ferritic alloys (CSEF's) are a family of ferritic steels whose creep temperature strength is enhanced by the creation of a precise condition of micro-structure, specifically martensite or bainite, which is stabilized during tempering by controlled precipitation of temper-resistant carbides, carbo-nitrides, or other stable and/or meta-stable phases. Careful consideration shall be given to pressure-retaining items that are fabricated from CSEF's. The behavior of these materials in low temperature (i.e. fracture toughness and/or fatigue) and in high temperature (i.e. creep and/or creep-fatigue) components can be degraded by not adhering to provided welding procedures and improper application of post-weld heat treatment (PWHT).

During service, weld repairs to CSEF can occur which may not be conducive to weld repairs following original construction fabrication requirements regarding post weld heat treatment (PWHT) and repair weld joint design. This supplement provides guidelines for alternative weld repair options and post repair inspection using a well-engineered approach for CESF steels. The user is cautioned to seek technical guidance for welding and heat treating requirements and attention should be made to temperature cycles required to achieve the micro-structures beyond preheat and post weld heat treatment requirements specified from the original code of construction. A key document that should be solicited in the development of weld repair procedures is:

Comment [GG1]: John:
I don't believe this statement would fly with NBIC committee members. We do not endorse publications other than other Codes and Standards.

SX.2 WELD REPAIR OF GRADE 91 STEEL

SX.2.1 Alternative Weld Repair Options

SX.2.1.1 9Cr-1Mo-VNbN Filler Metal (i.e. matching to Grade 91) + Controlled Fill + Low PWHT (Minimum temperature is 1250°F, 675°C). Acceptable filler materials are referenced in Table 1. The minimum time and maximum heat treatment temperature shall be referenced by the original code of construction.

For reference, where the Ni+Mn content of the filler metal *is not known*, ASME B&PV Code restricts the maximum PWHT temperature to 1425°F (775°C). As general best practice, this maximum should be enforced to avoid over-tempering or exceeding the absolute maximum PWHT temperature. Rules, as specifed by ASME B&PV Code Section I or ASME B31.1 for PWHT are provided below with regard to the required minimum hold time for PWHT.

a. Minimum holding time at PWHT temperature is specified as 1 hour per 1.0 inch (25 mm) of thickness, 30 minute minimum provided the component < 0.5 inches (12.5 mm) in thickness;

b. Minimum holding time at PWHT temperature is specified as 5 hours plus 15 minutes for each additional 1.0 inch (25 mm) over 5.0 inches (125 mm);

SX.2.1.2 9Cr-1Mo Filler Metal + Controlled Fill and No PWHT. Acceptable filler materials are detailed in Table 1.

SX.2.1.3 Ni-base Filler Metal + Controlled Fill and No PWHT. Acceptable nickel base consumables include selected ASME F No. 43 filler metals as detailed in Table 1.

Table 1. Alternative Weld Repair Methods, Filler Metals and Welding Processes for Grade 91 Steel.

Acceptable Weld Repair Method		Welding Process and Filler Metal AWS Classification
Filler Metal	Welding Procedure	
Matching (9Cr-1Mo-VNbN)	Controlled Fill + Low PWHT	• SMAW – E9015-B9 or E9015-B91[A] • FCAW – E91T1-B9 • GTAW – ER90S-B9 or ER90S-B91[A]
9Cr-1Mo	Controlled Fill	• SMAW – E8015-B8 • FCAW – E81T1-B8 • GTAW – ER80S-B8
Ni-base	Controlled Fill	• SMAW – EPRI P87[B], ENiCrFe-2, ENiCrFe-3 • FCAW – None available • GTAW – EPRI P87[C], ERNiCr-3

[A] –B91 AWS classification is pending for the various Grade 91 filler metal product forms (currently –B9)
[B] Incorporated by ASME B&PV Code as Code Case 2734 for classification as an F No. 43 filler material
[C] Incorporated by ASME B&PV Code as Code Case 2733 for classification as an F No. 43 filler material

SX.2.2 Application of Controlled Fill Welding Procedure

SX.2.2.1 The minimum preheat for the repair procedure shall be 300 deg F (150 deg 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 deg F (290 deg C).

SX.2.2.2 In general, to control heat input, it is recommended to weld the excavation using a "controlled fill" technique. In this technique, the first layer in contact with the machined excavation can be identical or smaller in diameter than the fill passes.

SX.2.2.3 The bead-to-bead overlap should be ~50% or greater. The fill passes should be deposited working from the bevel towards the center of the excavation with a minimum overlap of 25% and ideally 50%. As a rule of thumb, if the welder aims for the toe of the previously deposited weld bead, an overlap of at least 40% will be achieved.

SX.2.2.4 For ferritic filler materials, and when the SMAW process is specified for a fill pass layer as a controlled fill welding technique, the electrode diameter is restricted to a maximum size of 1/8" (3.2 mm). When the GTAW process is specified, any limits in filler size is to be reflected in the qualified PQR and WPS.

SX.2.2.5 For ferritic filler materials, and when the SMAW process is specified for a fill pass layer as a controlled fill welding technique, the electrode diameter is restricted to a maximum size of 5/32" (4.0 mm). For weld beads in contact with the machined excavation. The maximum size shall be restricted to 1/8" (3.2 mm). When the GTAW process is specified, any limits in filler size is to be reflected in the qualified PQR and WPS.

Notes:

1. *The excavation should have rounded corners to prevent lack of fusion. It may be advisable to use a smaller diameter electrode (such as 2.5 mm or 3/32 in.) to ensure good tie in.*
2. *The step should be machined at least 10 mm beyond the fusion line of the original weld*
3. *The fill passes along the bevel should be restricted in height so as to not reduce access to the bottom of the excavation for the welder*

Additional Instructions:

- *The fill passes should be conducted working "outside-in", whereby the fill passes are first deposited on either side of the excavation and additional fill passes are deposited welding towards the center of excavation*
- *50% overlap is recommended for all welding passes either in contact with the bevel or fill*
- *Stringer beads only are recommended for all welding passes either in contact with the bevel or fill*
- *A 2.5 mm (3/32 in.) diameter electrode may be utilized for the weld passes in contact with the bevel but is not mandated nor required for acceptable performance*

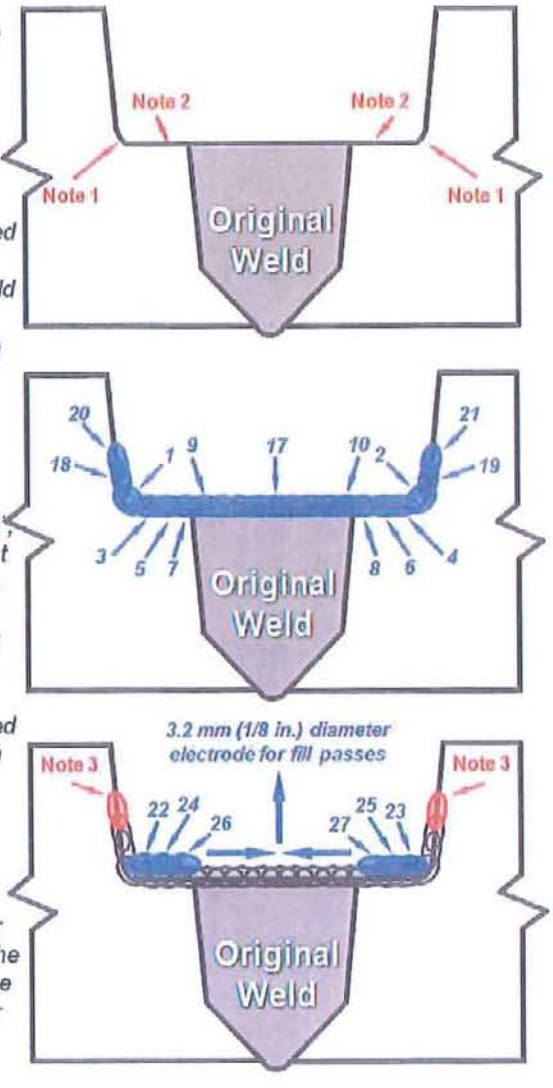

Figure 1. Schematic of the Controlled Fill Welding Procedure for Grade 91 Steel for a Partial Weld Repair of a Circumferential Girth Weld.

SX.2.3 Qualification of Controlled Fill Welding Procedure

SX.2.3.1 The test material for the welding procedure qualification shall be P-No 15E, Group 1, Grade 91 for the repair.

SX.2.3.2 Qualification thickness for the test plates and repair groove depths shall be in accordance with ASME Section IX, QW-451.

SX.2.3.3 The Welding Procedure Specification (WPS) shall be qualified in accordance with requirements of ASME Section IX. If a given procedure does not require post weld heat treatment, none shall be applied.

SX.2.3.4 For qualification of weld repair procedures using 9Cr-1Mo filler metal and in the as-welded condition, the requirements for the bend test shall be relaxed to a test which achieves a minimum of 14% in the outer fibers. Guidance is provided in ASME B&PV Code Section IX QW-466.1 which allows for base materials to be side bend tested that exhibit between 3 and less than 20% elongation values and should be referenced.

SX.3 POST REPAIR INSPECTION

X.3.1 After the completion of weld repairs to CSEF steels, post inspection requirements shall be developed and implement based on approval from the Inspection, and if applicable the Jurisdiction using a well-engineered approach.

X.3.2 Inspection method and intervals shall be developed to ensure safe operation and margin to locate and monitor defect growth in service. The selected non-destructive evaluation method shall have a minimum resolution to detect a flaw size of 0.125 inches (3.2 mm)

X.3.3 Post repair inspection shall not be considered a single event. A recommended base re-inspection interval is every other planned major outage or six years, whichever is less. The Owner/User may expand or compress the re-inspection interval based on trend results from previous inspections.

X.3.4 Where a hydro-test is mandated in lieu of NDE, the guidelines in NBIC NB-23 shall be followed. The water shall be heated to a temperature as recommended in the 2013 Edition of the NBIC Part 3, Table 4.4.2 to prevent risk of low temperature fracture for full penetration or near full penetration repair welds.

For NBIC Committee use only

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Update of Results for NBIC Part 3 Repairs and Alterations

John A. Siefert and Jonathan D. Parker
Program 87 Fossil Materials and Repair

NBIC Meetings, Columbus, OH
July 14/15th, 2015

The EPRI Life Management Strategy

- The overall EPRI recommended approach to Life Management of Complex Components involves:

1. Facilitating **Root Cause Analysis** when problems are encountered and then accurate **Technology Transfer**
2. Ensuring that **Purchase Specifications** and **Guidelines** are based on sound science and engineering
3. Guidance on **Quality Assurance** during **Component Manufacture** and **System Fabrication**
4. Supporting **Life Management Plan – when to look, where to look, how to look**
5. **Evaluating procedures for Repair and Replacement**

The EPRI Code Strategy

- *A good plan **violently executed** now is better than a perfect plan executed next week*
  - General George S. Patton

Changes to: 2.5.3.6 Welding Method 6

Major changes noted below (other minor edits not included)

- 2.5.3.6

  3) ~~Upon the completion of weld repair, the repair region shall be kept from humid or moist environments until the return to service~~. Upon completion of weld repair, the repair area shall be kept above the dew point so that condensation does not form on the repair surface or a moisture-barrier coating shall be applied to the surface.

- 2.5.3.6.e
  - 1) … The maximum interpass temperature shall be ~~400 deg F (200 deg C).~~ 550 deg F (290 deg C).
- 2.5.3.6.e
  - 5) A martensitic, ferritic-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.

Practical Approach to Generate Stress Corrosion Cracking in Welding Method 6 Tests

- 73 mm OD X 9 mm WT
- GTAW and SMAW process
- Ni-base filler metal
- Half of each tube coupon coated with Vaseline
- 1 month exposure to saturated, 97.5% RH at 20 to 25°C
- Dye-pen after testing
- **No cracking** ⬅

We want to crack samples, and especially welds, but are not very successful

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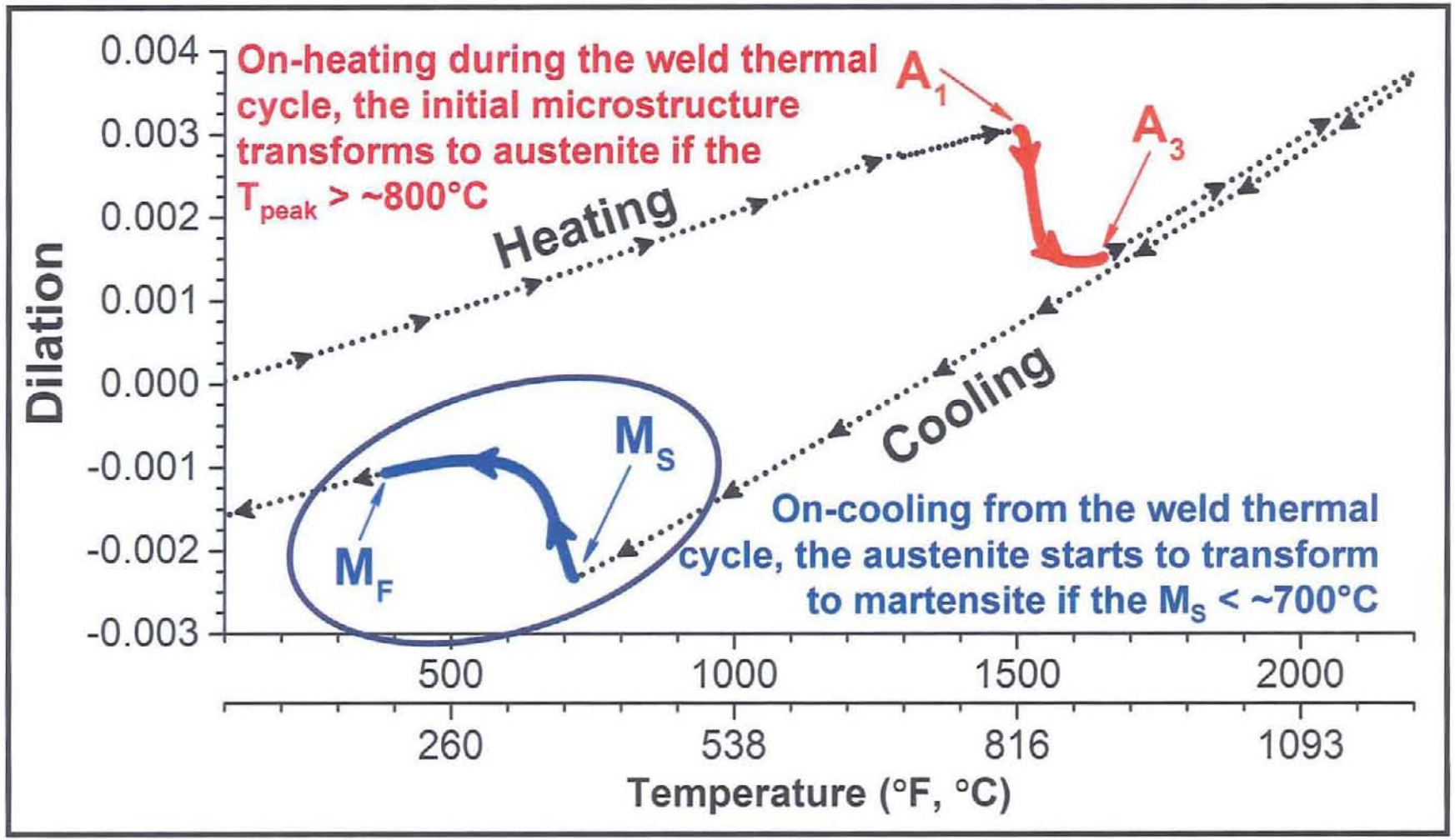
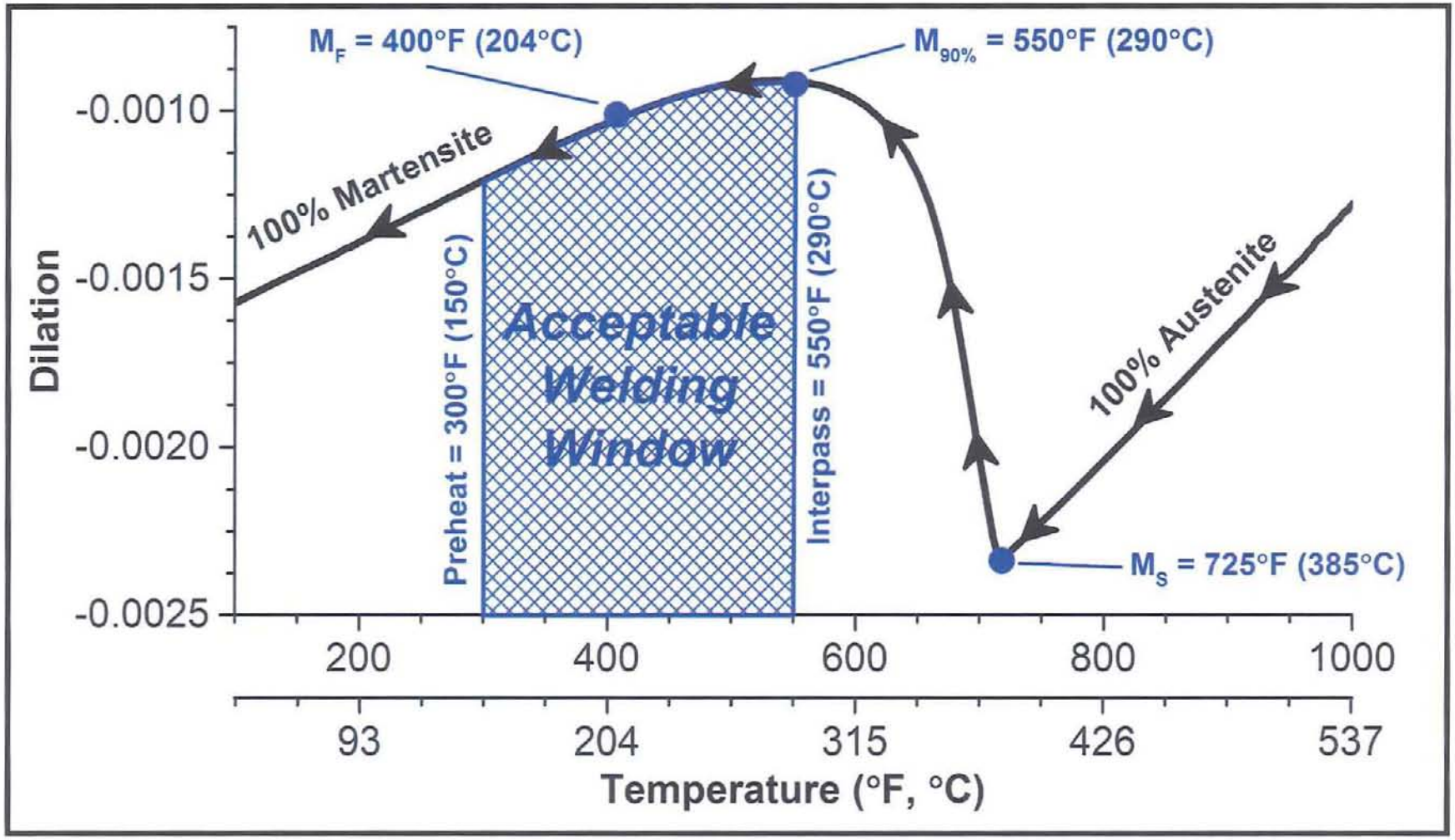
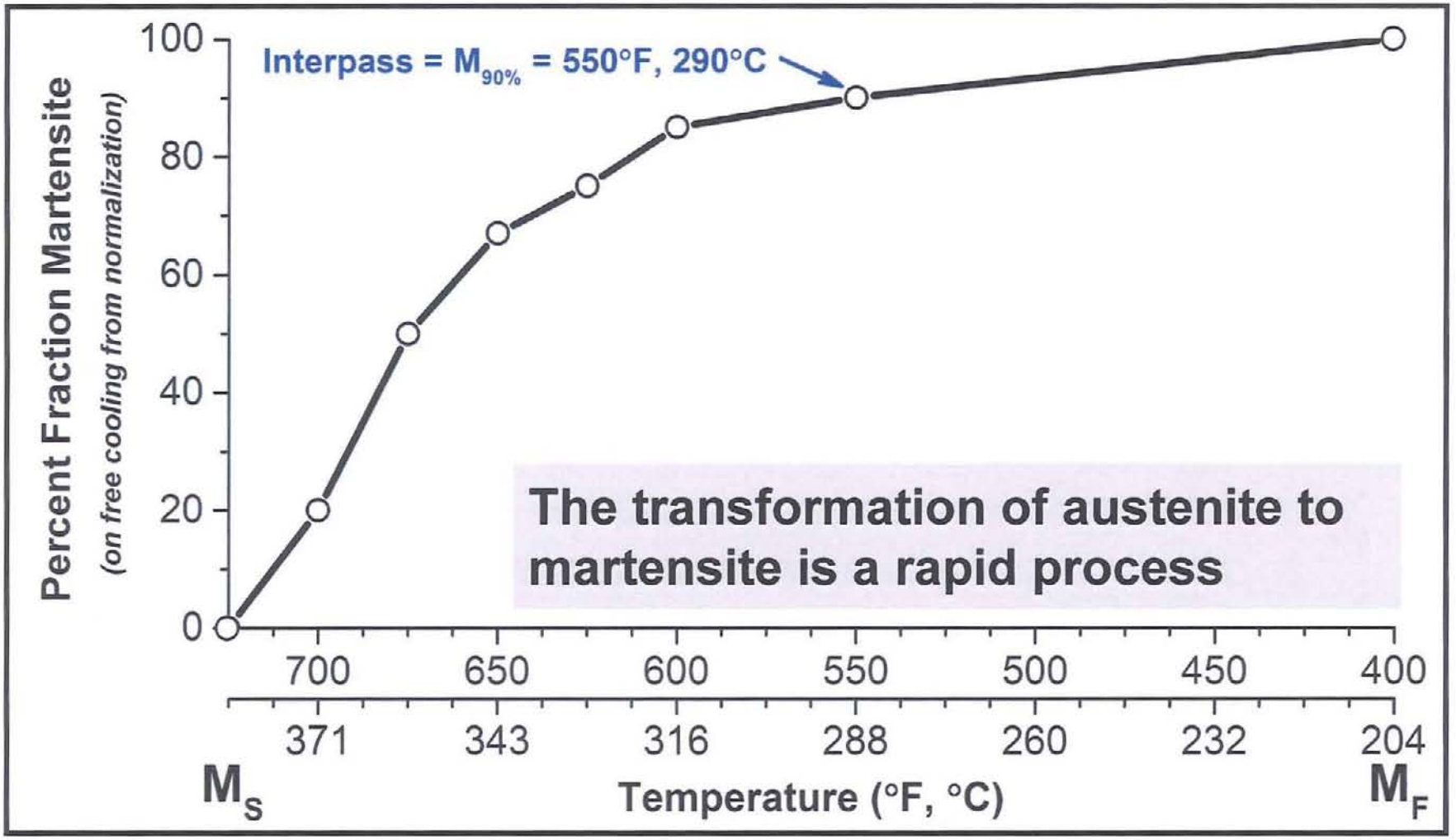
Welding on Grade 91 Steel Results in Phase Transformations in the Parent Material (i.e. HAZ) and Re-heated Weld Metal/HAZ



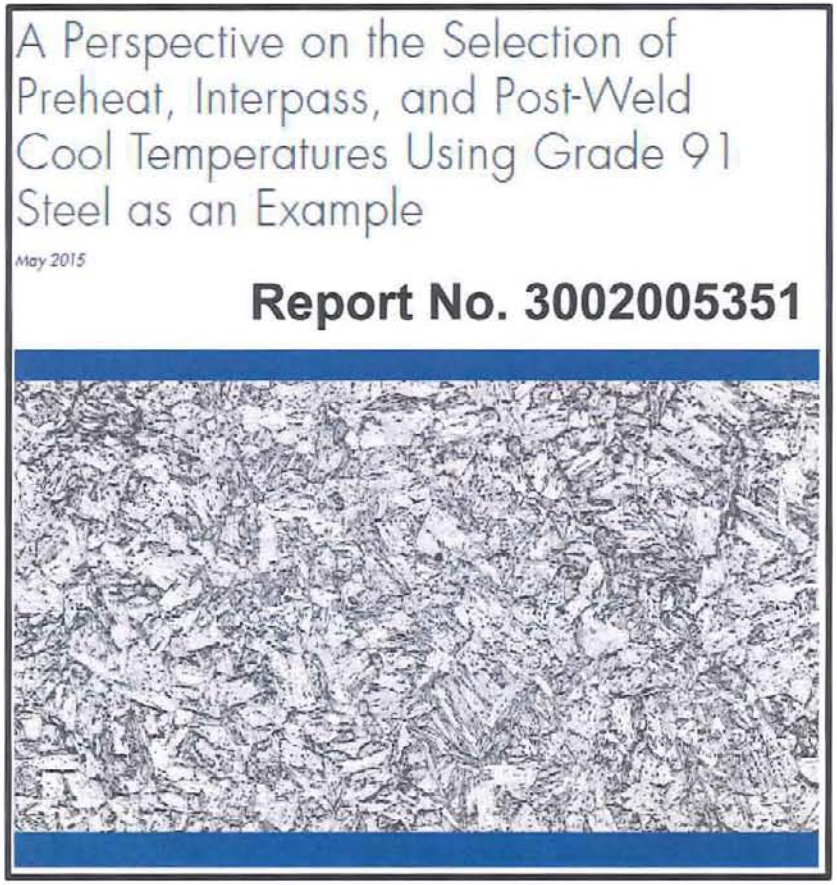
Defining the Acceptable Welding Window for Weld Repair of Grade 91 Steel based in Science and Practicality

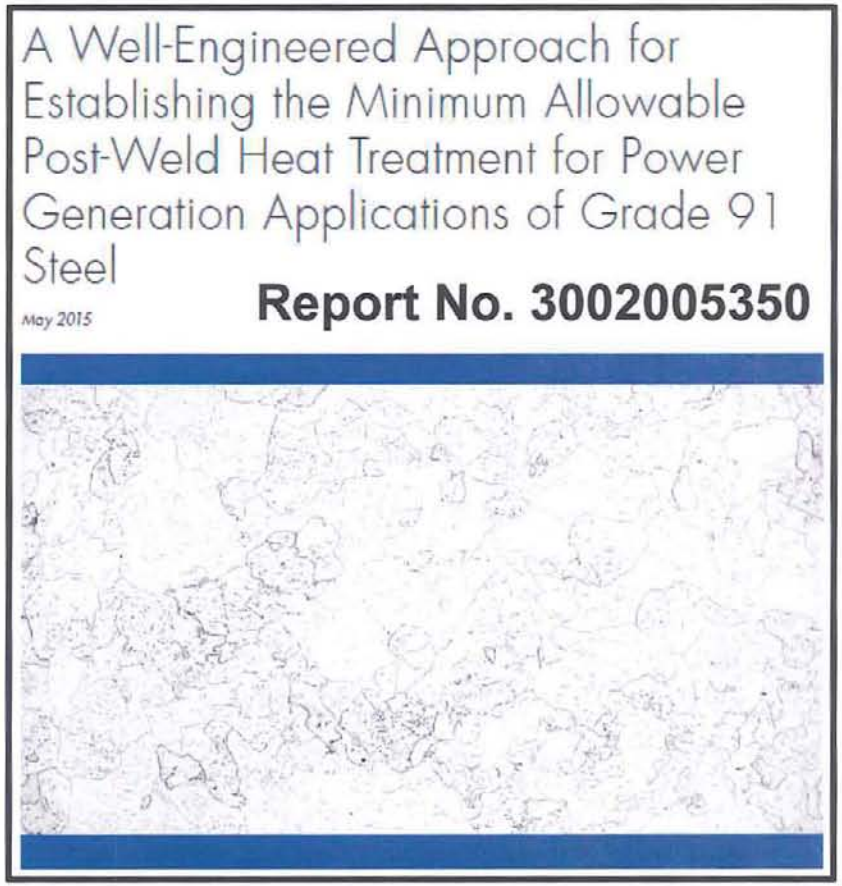


90% of the Austenite on-cooling from Welding Transforms to Martensite 550°F (290°C)



EPRI has Summarized its Position on the Selection of Preheat, Interpass, Post-weld Cool and PWHT Temperatures for Grade 91 Steel in Two Position Papers Available to the Public





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Conclusions on the Effect of the Welding Procedure

- Procedures should be selected which minimize the potential for practical issues, such as
  - Hydrogen induced cracking ➔ Preheat = 300°F (150°C) min. for SMAW process and 200°F (93°C) min. for GTAW process
  - Help promote refinement and tempering ➔ Interpass = 550°F (290°C) max. and limitations on electrode diameter
- **Because any welding process creates a fundamentally altered region in the HAZ that will always be weak in creep, the emphasis on the repair should be to minimize preventable defects**

The EPRI Database for Cross-weld Performance using E8015-B8

- Assessed behavior for 14 weldments in tube, pipe, plate, simulated repairs in pipe and all weld metal pads (4 heats)

Component	No. of Welds	Motivation	Total Time
Tube to Tube	2	Expand Welding Method 6	30k hours
Pipe to Pipe	2	Full Section Repair (No PWHT)	>90k hours
Plate to Plate	2		
Pipe to Pipe	4	Weld Repair Excavation Scenarios	25k hours
All Weld Metal Pads	4	Assess High Temp. Behavior	~50k hours

- Relevant test conditions including:
  - Temperature: 575 to 650°C (1067 to 1202°F)
  - Stress: 50 to 100 MPa (7.25 to 14.5 ksi)

~200k hrs (23 years)

- Assessment of initial microstructure before and after testing
  - A total of 43 tests have been evaluated

Recently Started Uniaxial Tests on Simulated Welding Method 6 Repair using E8015-B8 Filler Metal

Test ID	Temperature		Stress		Rupture Time	Failure Location
	°C	°F	MPa	ksi	hrs	
39333B	650	1202	80	11.6	434	Gr. 91 HAZ
39334B	625	1157	100	14.5	1,223	Gr. 91 HAZ
39335B	625	1157	80	11.6	2,700 →	(Est. 2,500 hrs)
39336B	625	1157	60	8.7	2,800 →	(Est. 5,250 hrs)
39337B	600	1112	100	14.5	2,900 →	(Est. 2,660 hrs)
39338B	600	1112	80	11.6	2,800 →	(Est. 5,280 hrs)
39339B	575	1067	100	14.5	2,800 →	(Est. 13,050 hrs)

Early Failures to Date using E8015-B8 in Tube Weld Repair have been in the Grade 91 HAZ

Initial results for cross-weld creep in E8015-B8 welded tube specimens are near the mean performance of the EPRI HAZ failure database for Grade 91 cross-weld creep samples

Summary on Welding Method 6

- **Practical experiments** show that the as-welded component manufactured to the criterion in the NBIC Part 3 for Welding Method 6 is **resistant to stress corrosion cracking** under ambient conditions. For **tube to tube welds** there should be **less concern regarding SCC** and the proposed wording is more than adequate to reflect this point
- **Relaxation** of the **interpass** from 400 **to 550°F** has been based on a more thorough evaluation of the phase transformation behavior in Grade 91 steel. **90% of the austenite has transformed to martensite at 550°F** allowing for more than sufficient tempering by subsequent welding thermal cycles. **EPRI cannot justify** a more stringent requirement of **400°F** at this time.
- The proposed **addition of E8015-B8** filler metal option is **based on >200k hours** of accumulated **creep testing**. Use of a more "welder-friendly" consumable will minimize fabrication-related defects and increase confidence in repairs

Update on Proposed Supplement to Cover Balance of Plant Applications for Grade 91 Steel (i.e. all scenarios not addressed by Welding Method 6)

The Supporting Evidence for the Proposed NBIC Supplement is Extensive

- **31 collaborators from 9 countries**
  - Australia, Canada, Czech Republic, England, Scotland, South Africa, Taiwan, United States, Italy

Phase	Creep (hours)	Hardness (indents)	Metallographic Mounts	Welding Procedures		
				Number	Base Metal Heats	Excavation Techniques
1	105,218	57,000	52	9	1	1
2/3	229,520	184,000	71	3	5	5
Total	**335,000→**	**280,000**	**123**	**12**	**6**	**5**
	(38 years)	**(140 days)**				

This is the most comprehensive, single evaluation ever conducted for a steel applied in fossil-fired power plants

Comparison of EPRI Databases

Measureable	EPRI Gr. 91 Weld Repair (1-071850 and 1-105343)	EPRI TR-103592 V4 & V5 (Gr. 11/12/22 Weld Repair)
Metallographic Mounts	123 (Factor of 10)	10
No. of Creep Tests	85	149
Creep test hours	>335,000 (Factor of 3)	114,004
Avg. Creep Rupture Life per Creep Test	3,915 hours (Factor of 5)	765 hours
Failed Test Macros	85	None in reports
Hardness indents	>280,000 (Factor of 430)	<650

The EPRI Database for Repair of Grade 91 is larger than that of the original EPRI Database for Repair of Grades 11/12/22. This confirms the comprehensive evaluation of this steel for weld repair scenarios

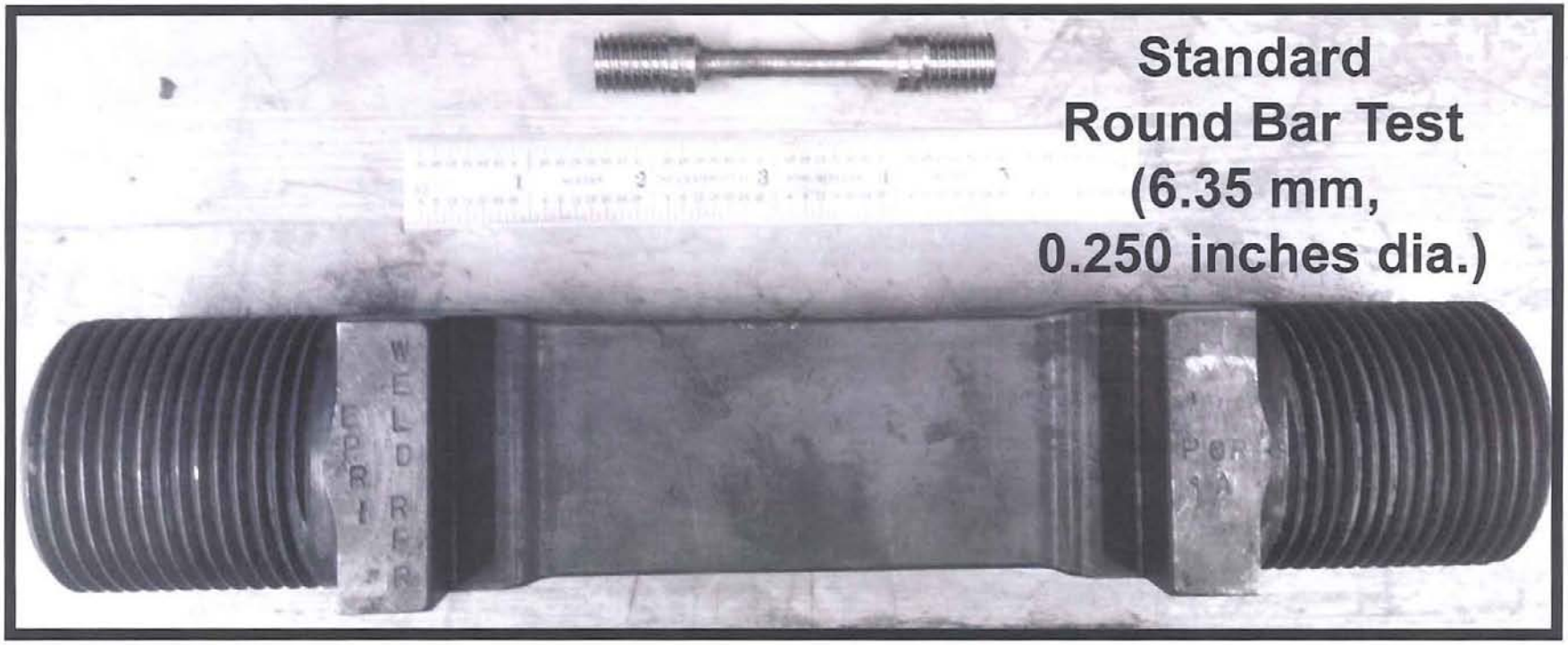
Putting the *Entire* EPRI Grade 91 Database into Context

Database Item	EPRI	ORNL
Total Number of Tests	>126 (increasing daily)	202 (done)
Size of **Relevant** Database (**Stress** ≤ 150 MPa) (550 ≤ **Temp.** ≤ 650°C) (**Time to rupture** > 100 hrs)	>126	95 (47%)
Total test duration	>385k hours	~270k hours
Specimen Sizes	93% of database for large sample tests	100% of database for 0.250" diameter
Metallography[1]	All samples sectioned	Unknown

- [1]EPRI has evaluated the as-welded, as-PWHT (where applicable) and post-test samples for metallography

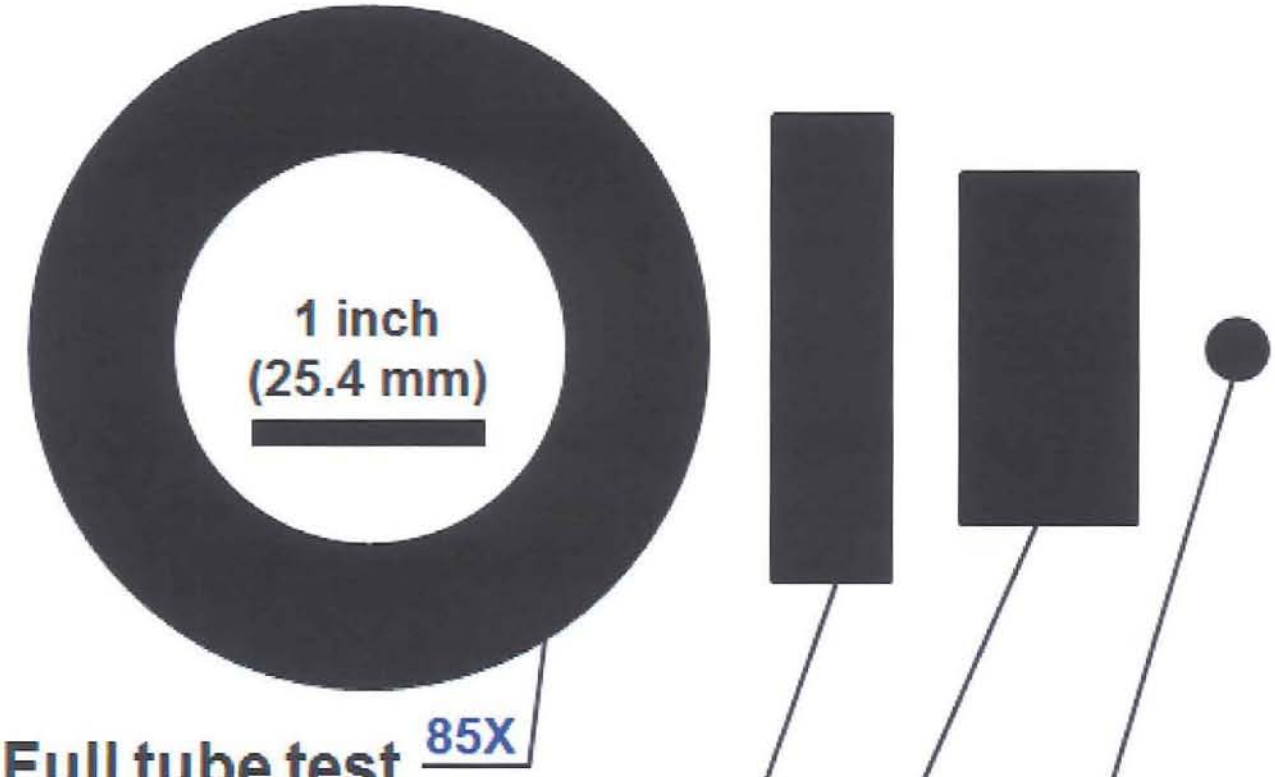
The EPRI Database for REPAIR is larger than that of the original Code Case submission for Grade 91 Steel

Comparison of Standard and Feature Tests



Standard Weld Repair Feature Test
(50 X 12.7 mm, 2.0 X 0.5 inches gauge)

Comparison of Cross-sectional Gauge Areas for Recent EPRI Feature Test Geometries



**Indicates the increase in gauge cross-sectional area*

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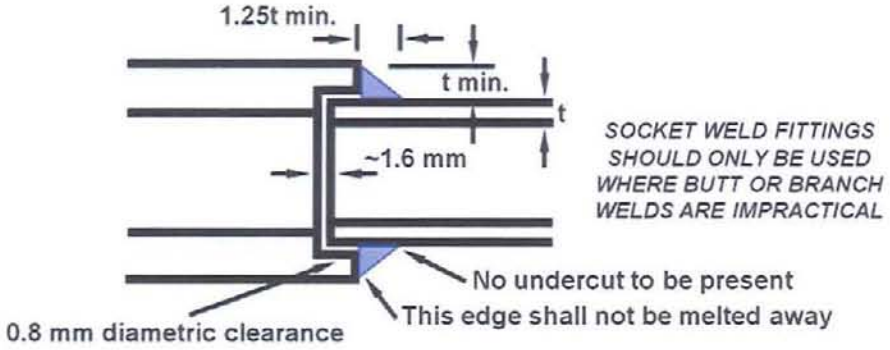
Real-world Examples of Well-Engineered Weld Repair of Grade 91 Steel using Alternative Weld Repair Techniques

Weld Repair of Grade 91 Steel is being Performed or Planned Using Procedures without PWHT

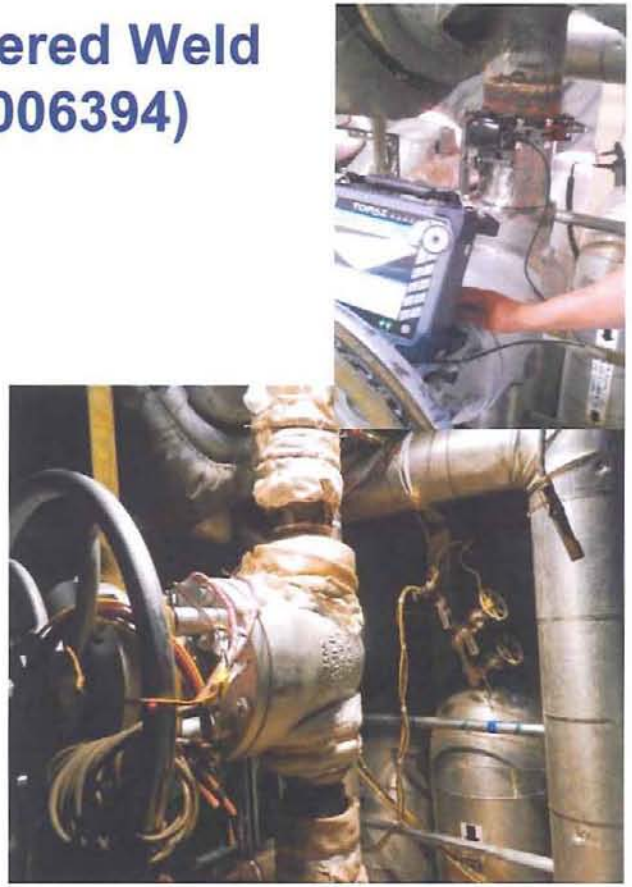
- An HRSG unit was brought off load shortly before a planned outage as a result of a steam leak from a small diameter HP superheater outlet pressure impulse line (incorrect material). Temporary repairs to three lines were carried out using nickel-based GTAW socket welds to allow rapid return to service.



From: *Cold Weld Repair of Ferritic Components – Case Studies of UK Power Stations*. EPRI, Palo Alto, CA: 3002003362. 2014.

TVA Applies an Alternative Well-Engineered Weld Repair Method for Grade 91 Steel (3002006394)

- *TVA used new EPRI guidelines (EPRI Report 3002003833) for alternative weld repairs for Grade 91 steel*
- Inspection at first outage did not find defects associated with weld repair
- Benefits:
  - Eliminated PWHT (risk of over-tempering, mal-PWHT and damage to the valve)
  - Eliminated the cost of PWHT (~$5k USD savings)
  - Significantly reduced outage time (3 days)
  - **Estimated cost savings from outage time alone is ~$1 million USD**



World's first application of an alternative weld repair procedure in Gr. 91 steel using E8015-B8 filler metal

For more information: ***Best Practice Guideline for Well-Engineering Weld Repair of Grade 91 Steel. EPRI, Palo Alto, CA, 2014: 3002003833***

AEP Successful Application of Welding Method 6

- State of Ohio approved application of WM6 in February 2015
- Initial issues with qualification of welders (added requirements imposed by State included RT and bend tests)
- Specific issues with existing repair approach:
  - Weld with matching filler metal
  - Perform PWHT
  - Perform Radiography
  - Move to next tube
- To date, applied three times for tube to tube repair, internal to boiler and within a single unit
  - Goal: Repair to bridge the gap to component replacement in Fall 2015
- Other plants in AEP system now interested in application of WM6
- **Days of outage time have been avoided**

SCANA Successful Small Bore Repair

- 24" Reheat valve drain line failure in an HRSG unit (1000F, 600 psi); 304H drain line welded to Grade 91 valve body
- Specific issues with existing repair approach:
  - Use of a "bullet" PWHT is NOT a good idea
  - PWHT of the valve and/or band around the area can compromise the internals, or more time to remove the internals and hope you don't fry the seat….
  - PWHT is time consuming, perhaps technically inadvisable, and expensive.
- Approach, local repair with GTAW and ENiCr-3 (Filler Metal 82) using a socket/fillet weld and left in as-welded condition
  - Goal: bridge gap to "permanent fix" in 2016 when all SS lines will be replaced with Grade 91
  - Very similar to RWE approach detailed previously

Continued Examples of "Hard" Grade 91 Weldments made with Matching Filler Metal in HRSGs

- There continue to be cases provided to EPRI where "hard welds" are identified during routine inspection. As an exemplar:
  - Tee to pipe weld
  - Weld metal measured to be 390 HBW (this is in the range of "as-welded" condition)
  - Weld had been in service for 13 years prior to identification
  - VT, MT and positive material ID performed to find gross defects; testing did not identify crack or macro defect(s)
- Such examples provide useful data points in the context of repair since two welding procedures use Fe-base filler metals and either no PWHT or reduced PWHT. Not surprisingly, these welds are clearly passing hydro-testing (potentially multiple times)!

Conclusions

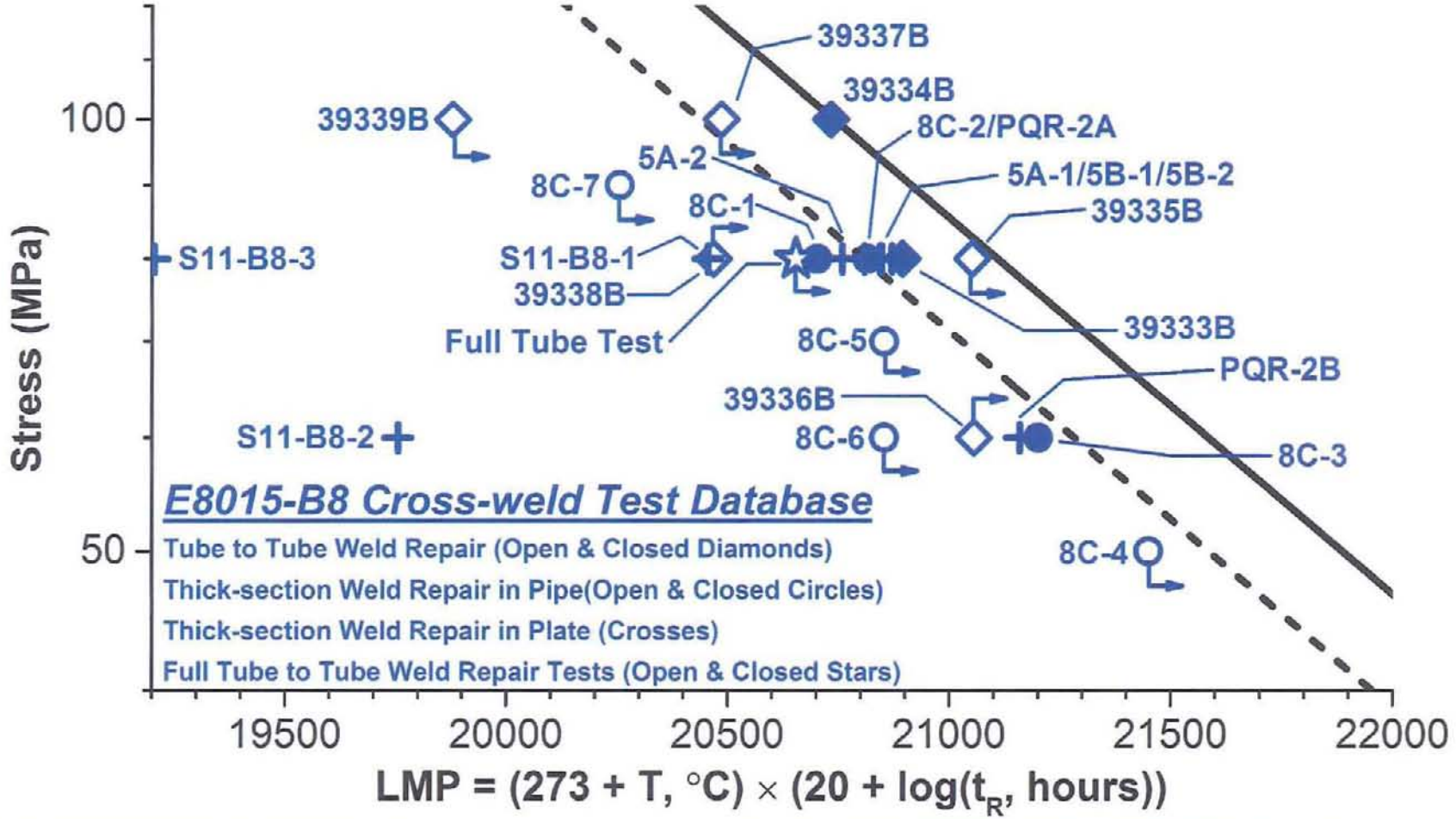
- When appropriate and in selected cases, there are real-world repair examples that EPRI is databasing which provide added confidence in the proposed alternative weld repair procedures covered in the draft Supplement
- Where it is possible, EPRI is conducting feature and structural creep tests
  - Full tube to tube tests for Welding Method 6
  - Testing of ex-service Welding Method 6 repairs in AEP power plant once removed from service
  - Exploration of component pressure vessel test with Doosan in the UK
- **Continued collaboration with industry and development of innovative welding procedures is critical to the development of a well-engineered life management strategy for complex materials**

Future Work and Suggestions

- EPRI 1-day workshop co-hosted by NBIC specific on weld repair of CSEF steels (10-12 total talks with an interactive discussion period at the end of the day defining future industry needs)
  - EPRI to provide 1 or 2 presentations
  - NBIC to provide a presentation
  - EPRI to arrange for 7-8 other application-specific, invited presentations from industry
  - Maybe earliest potential venue is either 2016 in Columbus, OH or 2017 Winter Meeting (location TBD?)
  - NBIC could publish a proceedings?
- George G. to pull up proposed NBIC Welding Supplement
  - Comments submitted by EPRI Membership for consideration
  - Comments submitted by Jim Pillow for inclusion
  - Other input? **Would like a finalized draft for balloting by Winter 2016 meeting**

Together…Shaping the Future of Electricity

The EPRI Database for Cross-weld Performance using E8015-B8 is Extensive and Includes a Number of Weldments



Full section tube to tube test started in June 2015

The position paper links are available below for download:

1. A Well-Engineered Approach for Establishing the Minimum Allowable Post-Weld Heat Treatment for Power Generation Applications of Grade 91 Steel

http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=000000003002005350

2. A Perspective on the Selection of Preheat, Interpass, and Post-Weld Cool Temperatures Using Grade 91 Steel as an Example

http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=000000003002005351

3. The Benefits of Improved Control of Composition of Creep-Strength-Enhanced Ferritic Steel Grade 91

http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=000000003002003472

4. The Influence of Steel Making and Processing Variables on the Microstructure and Properties of Creep Strength Enhanced Ferritic (CSEF) Steel Grade 91

http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=000000003002004370

Guideline/Summary Documents

5. Best Practice Guideline for Well-Engineered Weld Repair of Grade 91 Steel

http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=000000003002003833

15-1404

CURRENT WORDING

Par 1.6.1 (i) Materials

The manual shall describe the method used to ensure that only acceptable materials (including welding material) are used for repairs and alterations. The manual shall include a description of how material used in the original fabrication of the pressure-retaining item in the weld preparation area is identified and new material is ordered, verified, and identified. The manual shall identify the title of the individual(s) responsible for each function and a brief description of how the function is to be performed.

PROPOSED WORDING

Par 1.6.1 (i) Materials

The manual shall describe the method used to ensure that only acceptable materials (including welding material) are used for repairs and alterations. The manual shall include a description of how material in the weld preparation area is identified and new material is ordered, verified, and identified. The manual shall identify the title of the individual(s) responsible for each function and a brief description of how the function is to be performed.

CURRENT WORDING

3.2.1 MATERIAL REQUIREMENTS FOR REPAIRS AND ALTERATIONS

a) The materials used in making repairs or alterations shall conform insofar as possible to the original code of construction or construction standard or code selected, including the material specification requirements used for the work planned. Carbon or alloy steel

having a carbon content of more than 0.35% shall not be welded unless permitted by the original code of construction. The "R" Certificate Holder is responsible for verifying identification of existing materials from original data, drawings, or pressure-retaining item records, and identification of the materials to be installed. Consideration shall be given to the condition of the existing material, especially in the weld preparation area. If the existing material cannot be verified (unknown),the "R" Certificate Holder shall perform a chemical analysis and hardness testing, as a minimum, of the unknown material to verify its weldability and strength or may elect to qualify a weld procedure. If there is a question with regard to the weldability characteristics of the material, then competent technical advice should be obtained.

b) For corrugating rolls manufactured per the requirements of paragraph UF-7 of ASME Section VIII, Div. 1, weld overlay of the surfaces is permitted for all classes of SA-649 forging material and an exception to the 0.35% carbon limit is permitted. The requirements to qualify welding procedures and welder performance shall be in accordance with ASME Section IX for hard facing (wear resistance) and/or corrosion resistant overlays. Preheat or post weld heat treatment is neither required or prohibited.

3.2.1 MATERIAL REQUIREMENTS FOR REPAIRS AND ALTERATIONS

a) The materials used in making repairs or alterations shall conform insofar as possible to the original code of construction or construction standard or code selected, including the material specification requirements used for the work planned. Carbon or alloy steel having a carbon content of more than 0.35% shall not be welded unless permitted by the original code of construction. The "R" Certificate Holder is responsible for the material in the weld preparation area from original data, drawings, or pressure-retaining item records, and identification of the materials to be installed. Consideration shall be given to the condition of the material used in the original fabrication of the pressure-retaining item particularly in the weld preparation area. If the weld preparation area cannot be verified or is unknown, the "R" Certificate Holder shall perform a chemical analysis and hardness testing, of the unknown material to verify its weldability and strength or may elect to qualify a weld procedure, as a minimum. Competent technical

advice should be obtained if there is a question with regard to the weldability characteristics of the material.

CURRENT WORDING

S2.7 MATERIALS

a) Materials used in making repairs shall conform to the original construction standard15, if known, or to a construction standard acceptable to the Jurisdiction. Carbon or alloy steels having carbon content greater than 0.35% shall not be welded. The repair organization is responsible for verifying identification of the material used in the original fabrication in the weld preparation area of the pressure-retaining item and replacement materials.

b) The older steels used in historical boiler construction could have been supplied as either rimmed steel, flange or firebox quality steel. Rimmed steel may be higher in carbon, sulfur, phosphorus and hydrogen contents that will adversely affect weldability.

c) If welding is to be used to repair a pressure-retaining item where the existing material used in the original fabrication weld preparation area of the pressure-retaining item cannot be verified or is unknown, the requirements of NBIC Part 3, Part 3 3.2.1 shall be met. Specific quantities of carbon, manganese, sulfur, phosphorus, and aluminum shall be identified and included in the analysis. The result of the analysis shall be acceptable to the Inspector and, when required, the Jurisdiction.

PROPOSED WORDING

S2.7 MATERIALS

a) Materials used in making repairs shall conform to the original construction standard, if known, or to a construction standard acceptable to the Jurisdiction. Carbon or alloy steels having carbon content greater than 0.35% shall not be welded. The repair organization is responsible for verifying the material in the weld preparation area of the pressure-retaining item and replacement materials.

b) The older steels used in historical boiler construction could have been supplied as either rimmed steel, flange or firebox quality steel. Rimmed steel may be higher in carbon, sulfur, phosphorus and hydrogen contents that will adversely affect weldability.

c) If welding is to be used to repair a pressure-retaining item where the existing material weld preparation area of the pressure-retaining item cannot be verified or is unknown, the requirements of NBIC Part 3, Part 3 3.2.1 shall be met. Specific quantities of carbon, manganese, sulfur, phosphorus, and aluminum shall be identified and included in the analysis. The result of the analysis shall be acceptable to the Inspector and, when required, the Jurisdiction.

Footnote

15 SA-212 and SA-201 were re-designated to SA-515 and SA-516, respectively, in the 1968 edition of the ASME boiler and pressure vessel code.

NOTE - A new action item has been opened to determine all materials that may need to have cautions etc. brought to the attention of the stamp holder.

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) Organizations performing repairs shall be accredited as described in NBIC Part 3, 1.6, as appropriate for the scope of work to be performed.

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.

PROPOSED WORDING

SUPPLEMENT 3

REPAIR AND ALTERATION OF GRAPHITE PRESSURE EQUIPMENT

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) Organizations performing repairs shall be accredited as described in NBIC Part 3, 1.6, as appropriate for the scope of work to be performed.

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 of material in the cement preparation area of the pressure-retaining of the pressure retaining item from original data, drawings, or unit records and identification of the materials to be installed.

S4.8 MATERIALS

The materials used in making repairs or alterations shall conform to the requirements of the original code of construction. All resins and reinforcements must be properly stored and prevented from being contaminated by water, soil, or other impurities. The certificate holder is responsible for verifying identification of existing materials from original data, drawings, or units records, and identification of the materials to be installed. Consideration shall be given to the condition of the existing laminate, especially in the secondary bond preparation area.

ADDITIONAL OCCASIONS OF THE USE OF "EXISTING MATERIAL" IN PART 3

SUPPLEMENT 4

REPAIR AND ALTERATION OF FIBER-REINFORCED THERMOSETTING PLASTIC PRESSURE EQUIPMENT

S4.8 MATERIALS

The materials used in making repairs or alterations shall conform to the requirements of the original code of construction. All resins and reinforcements must be properly stored and prevented from being contaminated by water, soil, or other impurities. The certificate holder is responsible for verifying identification of materials in the secondary bonding preparation area of the pressure-retaining item from original data, drawings, or units records, and identification of the materials to be installed. Consideration shall be given to the condition of the existing laminate, especially in the secondary bond preparation area.

S6.4 MATERIALS

The materials used in making repairs, alterations, or modifications shall conform to the original code of construction including the material specification requirements. Carbon or alloy steel having a carbon content of more than 0.35% (0.30% for ton tanks) shall not be welded unless permitted by the original code of construction.

The "TR" Certificate Holder is responsible for verifying identification of existing materials from original data, drawings, or unit records and identification of the material to be installed.

SUPPLEMENT 6

REPAIR, ALTERATION, AND MODIFICATION OF DOT TRANSPORT TANKS

S6.4 MATERIALS

The materials used in making repairs, alterations, or modifications shall conform to the original code of construction including the material specification requirements. Carbon or alloy steel having a carbon content of more than 0.35% (0.30% for ton tanks) shall not be welded unless permitted by the original code of construction. The "TR" Certificate Holder is responsible for verifying identification of materials in the weld preparation area of the pressure-retaining item from original data, drawings, or unit records and identification of the material to be installed.

S7.4 MATERIALS for pressure relief devices

The materials used in making repairs shall conform to the requirements of the original code of construction.

The "VR" 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.

SUPPLEMENT 7

REQUIREMENTS FOR REPAIRS TO PRESSURE RELIEF DEVICES

S7.4 MATERIALS FOR PRESSURE RELIEF DEVICES

The materials used in making repairs shall conform to the requirements of the original code of construction. The "VR" Certificate Holder is responsible for verifying identification of materials used in the weld preparation area of the pressure relief device from original data, drawings, or unit records and identification of the materials to be installed.

S7.12 WELDING FOR PRESSURE RELIEF VALVES

a) Welding shall be performed in accordance with the requirements of the original code of construction used for the pressure relief valve.

b) Cast iron and carbon or alloy steel having a carbon content of more than 0.35% shall not be welded.

c) Defects in pressure relief valve parts such as cracks, pits, or corrosion that will be repaired by welding shall be completely removed before the weld repair of the part is performed. Removal of the defect shall be verified by suitable NDE as required.

d) Consideration shall be given to the condition of the existing material, especially in the weld preparation area.

S7.12 WELDING FOR PRESSURE RELIEF DEVICES

a) Welding shall be performed in accordance with the requirements of the original code of construction used for the pressure relief valve.

b) Cast iron and carbon or alloy steel having a carbon content of more than 0.35% shall not be welded.

c) Defects in pressure relief valve parts such as cracks, pits, or corrosion that will be repaired by welding shall be completely removed before the weld repair of the part is performed. Removal of the defect shall be verified by suitable NDE as required.

d) Consideration shall be given to the condition of the material used in the original fabrication of the pressure relief device, particularly in the weld preparation area

NB15-1410

NBIC Part 3 paragraph: S6.14.1 f)

f) The non-embossed Code Symbol stamping, when directly applied on the item or when a nameplate is used shall be applied adjacent to the original manufacturer's stamping or nameplate. A single repair~~, alteration, or modification~~ stamping or nameplate may be used for more than one repair to a Transport Tank, provided the repair ~~, alteration, or modification~~ activity is carried out by the same certificate holder;

National Board of Boiler and Pressure Vessel Inspectors
National Board Inspection Code
Submission of Public Review Comment
2015 Draft Edition

PLEASE SUBMIT ONLY ONE COMMENT/RECOMMENDATION PER PAGE
Make additional copies as needed

Comments Must be Received No Later Than: October 13, 2014

Instructions: If unable to submit electronically, please print this form and fax or mail. Print or type clearly.

Date: October 1, 2014

Commenter Name: Nathan Carter

Commenter Address: HSB Global Standards, One State Street, PO Box 299
Hartford, CT 06141-0299

Commenter Phone: 860-722-5750

Commenter Fax: _____

Commenter Email: nathan_carter@hsbct.com

Section/Subsection Referenced: Part 3, S6.14.1 f)

Comment/Recommendation: *Proposed Solution:* ☐ New Text ☒ Revise Text ☐ Delete Text

I understand the intent for numerous repairs throughout the life of a Transport Tank using one nameplate under the conditions listed. Do you ~~really mean for infinite "alterations and modifications" to be allowed~~ under a single nameplate/stamping? Please reconsider this.

Source: ☒ Own Experience/Idea ☐ Other Source/Article/Code/Standard

Submit Form To: Robin Hough, Secretary, NBIC Committee, The National Board of Boiler & Pressure Vessel Inspectors, 1055 Crupper Avenue, Columbus, OH 43229, fax 614-847-1828, email, rhough@nationalboard.org

NB Use Only

Commenter No. Issued: PR15-01

Comment No. Issued: 22

Project Committee Referred To: SC Repair and Alteration

Subject:	Leak tightness by seal welding a designed inspection or maintenance access opening

NB-Item number:	NB15-1801

Explanation of assignment needed:	Is it reasonable to add as a routine repair activity, the replacement of a seal weld when the pressure retaining item's design and leak tightness are derived in combination from using a seal weld of limited size?

Assigned to:	M. Webb

Background:	Inspection and maintenance openings are routinely designed to allow access to assess equipment condition and exercise maintenance activities in concert with reliability and safety. By design, pressure retention is assured by mechanical interface. By design, some openings include a seal weld to assure leak tightness and the weld is not considered to add strength or to enhance the item's pressure retaining capability. Routinely, the Manufacturer provides time-proven instruction for their replacement, routinely following the governing rules from the original code of construction, exempting the seal weld and weldment from PWHT and citing VT-examination throughout the installation, both within the established parameters of a routine repair. *See the Interpretations 07-10, 01-09, PCC-2, Article 2.3 (2011) on pg-2, and an example of Instructions on pg-3 supporting this proposed action as a routine activity …*

Current Wording:	NBIC, Part 3, paragraph 3.3.2 (e) items 1-4: *Not recognized currently as a routine repair.*

Proposal: ***double underline***	New paragraph 3.3.2. (e) 5): 5) *Designed closures of full thickness* requiring a seal weld for leak tightness where by the Code of Construction or by Mfg.-instruction, the closure's pressure retaining capability is not contingent on the weld for strength and requires no PWHT. (B. Wiegoszinski's original proposal, 1-21-15: Seal welding of mechanical connections provided postweld heat treatment is not required by the Code of construction.")

INTERPRETATION 11-01

Subject: Part 3, 3.3.2

Edition: 2011

Question: In Part 3, 3.3.2 d), is the replacement scope or the number of valves, fittings, tubes, or pipe NPS 5 in diameter and smaller, or sections thereof, a consideration when determining if the work is a routine repair?

Reply: No. The NBIC does not address the magnitude of work or scope in qualifying repairs as routine but rather addresses the exceptions representing routine repairs as noted within Part 3, 3.3.2 d) 1).

INTERPRETATION 07-10

Subject: Part 3, 3.3.2 and 3.3.3

2007 Edition with 2009 Addendum

Question: Is it the intent of the NBIC that weld build-up of a damaged gasket surface on a flange where neither PWHT no NDT is required by the code of construction considered a routine repair?

Reply: Yes, provided the "R" Certificate Holder's quality system program describes the process for identifying, controlling and implementing routine repairs.

INTERPRETATION 01-09

Subject: RC-2031(a)(1) Routine Repairs

1998 Edition with 2000 Addendum

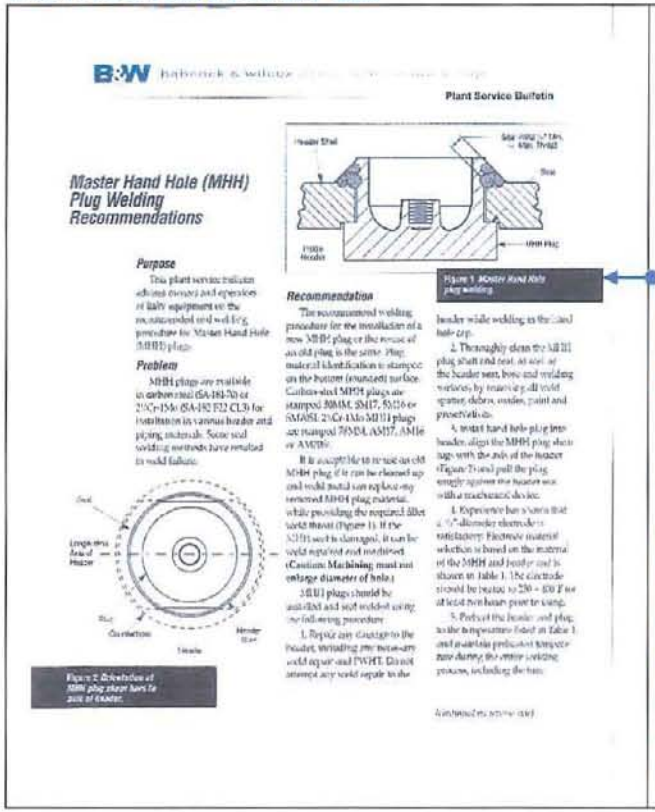
Question: Is the seal welding of tubes which are five NPS in diameter and less considered a routine repair?

Reply: Yes.

NBIC Part-3,
3.2.6 REFERENCE TO OTHER CODES AND STANDARDS (can provide useful guidance)
(c) ASME PCC-2, Repair of Pressure Equipment and Piping-

ASME PCC-2, Article 2.3, (2011)- seal welded threaded connections and seal weld repairs
3.1 (a) The seal weld shall only be used to provide the hermetic seal, not the mechanical strength to the joint.

INSTRUCTION EXAMPLE:



B&W babcock & wilcox

Plant Service Bulletin

Master Hand Hole (MHH) Plug Welding Recommendations

Purpose

This plant service bulletin advises owners and operators of B&W equipment on the recommended seal welding procedure for Master Hand Hole (MHH) plugs.

Problem

MHH plugs are available in carbon steel (SA-181-70) or 2¼Cr-1Mo (SA-182 F22 CL3) for installation in various header and piping materials. Some seal welding methods have resulted in weld failure.

Figure 2. Orientation of MHH plug shape bars to axis of header.

Figure 1. Master Hand Hole plug welding.

Recommendation

The recommended welding procedure for the installation of a new MHH plug or the reuse of an old plug is the same. Plug material identification is stamped on the bottom (rounded) surface. Carbon-steel MHH plugs are stamped 30MM, SM17, SS316 or SMASL. 2¼Cr-1Mo MHH plugs are stamped 7PMA, AM17, AM16 or AW016.

It is acceptable to re-use an old MHH plug if it can be cleaned up and weld metal can replace any removed MHH plug material, while providing the required fillet weld throat (Figure 1). If the MHH seat is damaged, it can be weld repaired and machined. (Caution: Machining must not enlarge diameter of hole.)

All U plugs should be installed and seal welded using the following procedure:

1. Repair any damage to the header, installing any necessary weld repair and PWHT. Do not attempt any weld repair to the header while welding in the new hole cup.

2. Thoroughly clean the MHH plug shaft and seat, as well as the header seat, bore and welding surfaces, by removing all weld spatter, debris, oxides, paint and preservatives.

3. Install hand hole plug into header, align the MHH plug shaft tags with the axis of the header (Figure 2) and pull the plug straight against the header seat with a mechanical device.

4. Experience has shown that a ⅛" diameter electrode is satisfactory. Electrode material selection is based on the material of the MHH and header and is shown in Table 1. The electrode should be heated to 250 - 300 F for at least two hours prior to using.

5. Preheat the header and plug to the temperature listed in Table 1 and maintain preheat temperature during the entire welding process, including the root

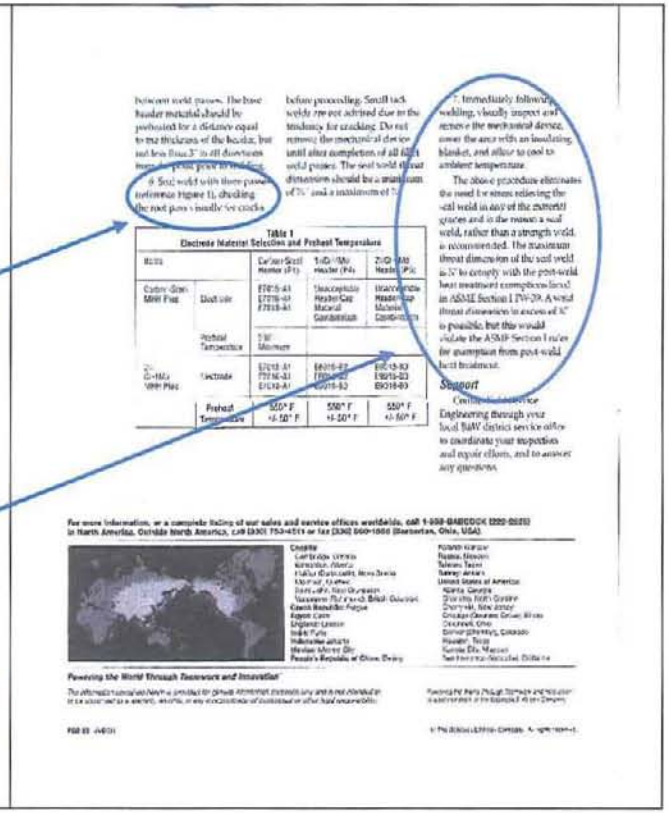
(continued on reverse side)

EXAMPLE:
Page 1 and 2 of instructions offered by Babcock & Wilcox for installing Master Hands Hold illustrating a seal weld of limited size;

"6. Seal weld with three passes (reference Figure 1) checking the root pass visually for cracks …The seal weld throat dimension should be a minimum of 5/16" and maximum of 3/8"."

"7. Immediately following welding, visually inspect…"

The above procedure eliminates the need for stress relieving the seal weld in any of the material grades and is the reason a seal weld, rather than a strength weld, is recommended. The maximum throat dimension of the seal weld is 3/8" to comply with the post-weld heat treatment exemptions listed in ASME Section I PW-39. "



before proceeding. Small tack welds are not advised due to the tendency for cracking. Do not remove the mechanical device until after completion of all fillet weld passes. The seal weld throat dimension should be a minimum of 5/16" and a maximum of 3/8".

6. Seal weld with three passes (reference Figure 1), checking the root pass visually for cracks

7. Immediately following welding, visually inspect and remove the mechanical device, cover the area with an insulating blanket, and allow to cool to ambient temperature.

The above procedure eliminates the need for stress relieving the seal weld in any of the material grades and is the reason a seal weld, rather than a strength weld, is recommended. The maximum throat dimension of the seal weld is 3/8" to comply with the post-weld heat treatment exemptions listed in ASME Section I PW-39. A weld throat dimension in excess of 3/8" is possible, but this would violate the ASME Section I rules for exemption from post-weld heat treatment.

Table 1
Electrode Material Selection and Preheat Temperatures

Base		Carbon Steel Header (P1)	½Cr-½Mo Header (P4)	2¼Cr-1Mo Header (P22)
Carbon Steel MHH Plug	Shell side	E7015-A1 E7016-A1 E7018-A1	Unacceptable Header/Cap Material Combination	Unacceptable Header/Cap Material Combination
	Preheat Temperature	150° Minimum		
2¼Cr-1Mo MHH Plug	Electrode	E7015-A1 E7016-A1 E7018-A1	E8015-B2 E8016-B2 E8018-B2	E8015-B3 E8016-B3 E8018-B3
	Preheat Temperature	550° F +/- 50° F	550° F +/- 50° F	550° F +/- 50° F

Support

Contact your service Engineering through your local B&W district service office to coordinate your inspections and repair efforts, and to answer any questions.

For more information, or a complete listing of our sales and service offices worldwide, call 1-800-BABCOCK (800-0225) in North America. Outside North America, call (330) 753-4511 or fax (330) 860-1886 (Barberton, Ohio, USA)

Powering the World through Resource and Innovation

Initially presented by Bob Wielgoszinski, 1-21-15:
During the inspection activity of some high pressure header type boilers, it is necessary to remove handhole covers or handhole plugs to access the inside of the header for inspection of tubes. The subsequent closure of the handholes by reinstalling the handhole covers or plugs sometimes necessitates the cover or plug being seal welded to its seat.

The seal weld is solely for the purpose of preventing leakage at the seat. The strength of the connection is based on back pressure applied to the cover or plug from boiler internal pressure. This seal welding constitutes a repair by welding as defined in the NBIC, and therefore requires inspection by a NB Commissioned Inspector, completion of an R-1 form, and attachment of a repair nameplate by the R stamp holder.

This repair activity has been interpreted as a routine repair, which would allow for the NB Inspector to waive in-process inspection and rule out the attachment of a repair nameplate by the R stamp holder (if permitted by the Inspector and the Jurisdiction). It would still, of course, require the completion of an R-1 form for the work performed. Although this seal welding process seems inconsequential to the structural integrity of the boiler, the problem here is that this type of repair is not mentioned specifically in "the list of 4" categories allowed by the NBIC, Part 3, 3.3.2(e). In fact, seal welding is not mentioned at all for routine repairs, even though interpretation 01-09 specifically addresses it for seal welding of tubes. Also, interpretation 95-35 addresses seal welding of tubes and confirms that it is a repair.

So, as a result of this, it would be helpful to the industry if the NBIC Committee could provide an interpretation of the rules to address seal welding of handhole covers or plugs as a routine repair. And if the Committee were to determine that such a repair is permitted as a routine repair, then a revision to the rules to address it would be equally as helpful to the public. Included below is a proposed question and reply for an interpretation.

IN15-0101-
Subject: Seal welding of handhole covers
Question: Is seal welding of inspection opening covers, such as handhole plates or plugs, considered a routine repair in accordance with NBIC, Part 3, paragraph 3.3.2 (e)?
Reply: No.

If the Committee feels that a repair such as described herein SHOULD be considered as a routine repair, then I will offer the following revision to the NBIC to clarify it. If the Committee does not believe it should be considered as a routine repair, then no revision would be necessary since the interpretation confirms that it is not permitted.

(Proposed 1-21-15) New paragraph 3.3.2. (e) 5):
5) Seal welding of mechanical connections provided postweld heat treatment is not required by the Code of construction."

THE NATIONAL BOARD
TRAINING AND CONFERENCE CENTER

NB15-1801

I would remove Code of Construction or by Mfg.-instructions. Also, I would use the language "secured by physical means" in lieu of current verbiage.

B. Bell

614.888.8320
nationalboard.org

THE NATIONAL BOARD
TRAINING AND CONFERENCE CENTER

NB15-1801 Seal Welding Negative. As worded the proposal says that the closures are routine repairs, not the seal welding of the closure.

Jim Pillow
7/14/2015.

614.888.8320
nationalboard.org

7/15/15

Bill Valance - National Board Secretary

I hereby rescind my negative vote for proposed paragraph 3.3.2(e)5.

After further thought on the proposal I vote for the proposed new paragraph.

David Martinez

Request for NBIC Revision

Robert V. Wielgoszinski
Hartford Steam Boiler of CT

NB15-2601

Purpose	To provide minimum radius dimension for corners of a flush patch
Scope:	Repairs and alterations to pressure retaining items that contain a flush patch, 3.3.4.6 a)2).
Background	In the performance of repairs by installation a flush patch, the treatment of the corners often becomes controversial because of the lack of specificity in the NBIC. The Code (Part 3 – 3.3.4.6 a)2), says in part, simply that "... If the patch is rectangular, an adequate radius should be provided at the corners. Square corners should be avoided..." The issue is the guidance "should be provided". Usually most R stamp holders provide an ample radius at these corners. A radius helps to avoid any undue stresses at the corner by eliminating a potential stress riser of a sharp right angle weld configuration. At a recent flush patch repair, it was reported that a radius was not provided and the subsequent pressure test revealed leaks at three of the four corners of the patch. Further investigation with LP examination discovered cracks at all three corners. This situation was clearly the result of poor application of the repair method, but could have been prevented by applying a radius at the corner, which was the corrective action in this case. So, the recommendation here is to revise the NBIC by requiring a minimum radius at corners of square or rectangular flush patches. A prescribed minimum, of say ½", would not cause any hardship on an R stamp holder that performs such repairs. And it does not preclude providing a larger radius if necessary. If there is a question of measurement, I also don't think this is a problem. A US quarter has about a ½" radius. UPDATE: 07/14/15: At the SG meeting it was pointed out that Supplement 1 of Part 3 already has some criteria for a minimum radius for patches in paragraph S1.2.11.2 d). This requires a 3x the plate thickness minimum radius. This is more conservative than ½". The SG voted to accept this revision with ½" changed to 3x the plate thickness.
Proposed Revision	Revise NBIC, Part 3, Paragraph 3.3.4.6 a) 2) to require a minimum of 3 times the plate thickness radius at the corners of square or rectangular flush patches. Before installing a flush patch, the defective material should be removed until sound material is reached. The patch should be rolled to the proper shape or curvature. The edges should align without overlap. In stayed areas, the weld seams should come between staybolt rows or riveted seams. Patches shall be made from a material whose composition and thickness meet the intended service. Patches may be any shape or size. If the patch is rectangular, an adequate radius ~~should~~ of at

	least 3 times the plate thickness shall be provided at the corners. Square corners ~~should~~ shall be avoided. The completed welds shall meet the requirements of the original code of construction.

IN15-0401
Phased Array UT

Mr. Besserman:

This email is being sent for the purpose of requesting a Code Interpretation regarding the use of PAUT for final examination of boiler tube repair welds, as detailed below.

Purpose:

Code Interpretation

Inquiry:
Subject: Part 3, 4.2 a), 4.4 a, b, c, d)
Edition: 2013
Question: May Phased Array UT (PAUT) examination be used for verification of final circumferential weld repair integrity in lieu of pressure testing or other typical NDE methods (MT/PT/RT) involving boiler tubes where the thickness is below ½ inch, with NPS of 4 inch and less?

Reply: Yes

Background: A Midwestern energy company expressed desire to use PAUT in this application, foregoing any other examination or testing method. This was presented to past Iowa Chief, who gave his approval upon reviewing proposed PAUT procedure to be used by a qualified NDE company, using certified examiners. Newly installed Iowa Chief has taken exception to past Chief's decision, and will not allow use of this NDE method, stating that it does not meet requirements of ASME I, Table PW-11 General Note (g).

Regards,

Jamie Walker
Director of Quality Control
Hayes Mechanical
O: 773.292.2707
C: 773.910.5892
jwalker@hayesmechanical.com

Item NB15-1902

Single Strike-through and single underline: Comments/edits by Walt Sperko and Nathan Carter including NBIC Items 15-0509 and Nb15-1403 from January 2015 NBIC meeting in Orlando, FL

Comment [SJ1]: George, please fill in

Double Strike-through and double underline: Proposed edits by EPRI

2.5.3.6 Welding Method 6

This welding method provides ~~guidance~~ requirements for welding only Grade 91 tube material within the steam boiler setting and when ~~it's~~ it is impracticable to perform local post-weld heat treatment (PWHT). ~~This repair method utilizes a controlled fill technique.~~ When using this welding method, the following ~~is required~~ apply:

(1) 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.

(2) Application shall be limited to only boiler tube repairs at a location internal to the boiler setting.

~~(3) Upon the completion of weld repair, the repair region shall be kept from humid or moist environments until the return to service.~~ Upon 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.

Comment [GG2]: The words in blue were revised based on approval of item NB15-1402.

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

(b) The welding shall be limited to the SMAW 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.

(c) The ~~test material for the~~ welding procedure qualification test coupon shall be P-No 15 E, Group 1, Grade 91 ~~for the repair.~~

(d) Qualification thickness limits of base metal and weld deposit thickness ~~for the test plates and repair groove depths~~ shall be in accordance with ASME Section IX, QW-451.

(e) The Welding Procedure Specification (WPS) shall be qualified in accordance with the requirements of ASME Section IX, ~~except that no~~ No postweld heat treatment shall be applied to the test coupon. Additionally, the ~~qualification~~ WPS shall include the following requirements;

1) The minimum preheat for the GTAW process shall be 200 deg F (~~93~~100 deg C). The minimum preheat for the SMAW process shall be 300 deg F (150 deg 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 ~~400 deg F (200 deg C).~~ 550 deg F (290 deg C).

(2) When the SMAW process is specified for a fill pass layer ~~as a controlled filled welding technique,~~ 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 ~~reflected in the qualified PQR and~~ shown on the WPS.

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

(4) 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

Comment [GG3]: The highlighted blue was revised under another action NB15-0509.

and 2734 (e.g., EPRI P87) or
(5) 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.

NB15-1903

Draft

5.3 DISTRIBUTION OF FORM R-1

a) Legible copies of completed Form R-1, together with attachments, shall be distributed to the owner or user and Jurisdiction , if required, and shall be provided to the Inspector and the inservice Authorized Inspection Agency of the pressure retaining item upon request. ~~the Inspector, the Jurisdiction, if required, and the Authorized Inspection Agency responsible for inservice inspection.~~

5.4 DISTRIBUTION OF FORM R-2

b) Legible copies of the completed Form R-2, together with attachments, shall be distributed to the owner-user, the "R" Certificate Holder responsible for design, and the Jurisdiction, if required, and shall be provided to the Inspector and inservice Authorized Inspection Agency of the pressure retaining item upon request

From:	Richard Stone <richardbstone@verizon.net>
To:	"rferrell@nationalboard.org"< rferrell@nationalboard.org>
Date:	06/30/2015 06:25 PM
Subject:	NBIC: Two Proposed New Documents For Repair Sub-Group - Installing Tubes In Water Tube Boilers By The Expanding Method

NB15-2502

Hello Bob;

1) I've prepared two new documents for the NBIC Repair Sub-Group to review for addition to the NBIC Part 3, Section 3 "Repair". Both documents describe the method of expanding (rolling) boiler tubes into water tube boilers.

I recommend these new documents be added to the NBIC Part 3, Repair either as 'Recommended Procedures' or as 'Guidelines' since there are some variations in the tube rolling process for different design boilers.

Both documents can be edited by the Repair Sub-Group as they consider necessary.

2) My reason for submitting these documents to the Repair Sub-Group is to provide all NBIC inspectors, state boiler inspectors and code users a basic procedure for installing and expanding boiler tubes by rolling. The present NBIC does not have any guidelines or procedures for tube rolling and this lack of information has caused problems to inspectors and code users who are not familiar with the work. I have discussed this problem with several inspectors and decided to prepare these draft document for the Repair Sub-Group to review.

In addition, I've also encountered in the power industry a number of defective boiler repair jobs caused by poor quality tube rolling. These problems show a general lack of knowledge and understanding of the tube rolling process by many power industry staff and workers.

3) I request you assign an NBIC item number to each document and then forward both documents to the Chairman of the Repair Sub-Group.

4) My primary reference document for both documents is: Technical Association Pulp & Paper Institute (TAPPI) - Technical Information Paper (TIP) #0416-08 "Guidelines For Replacement Of Generating Bank Tubes With Expanded Joints In Two Drum Boilers", dated 2002. I've attached a scanned copy of it with my documents for the Repair Sub-Group's use during the review process. My other reference is the tube rolling practices used by Combustion Engineering.

Subgroup: Repair & Alteration - Section 3

National Board Item No. **NB15-2502**

Current Level: Subgroup discussion

NBIC Part 3 Section 3 Paragraph(s): 3.4.5 *(Recommended)*

Title: **Guidelines For Installation Of Boiler Tubes In Water Tube Boilers**

Date Opened: *To Be Determined By Subgroup*

Background:
To provide guidance for the inspection, repair and replacement of the tubes in water tube boilers when OEM procedures are not available.

Proposed Action:
Boiler tubes shall be installed in accordance with the directions of the original equipment manufacturer (OEM). If this information is not available, the following procedures shall be used.

a. Boiler tubes installed by the expanding method shall use either a roller-type expander, a prosser-type expander or use the hydraulic expanding method.

b. The length of the tube expander or process shall be sized to expand the tube across the width of the drum wall and into the tube body. The expander rollers, expander mandrels, or prosser segments shall have smooth surfaces with smooth rounded corners or ends to prevent cutting or damaging the tube and drum wall surfaces. Tube expanders, including the rollers and mandrels, and prossers that become worn or damaged during the work shall be replaced.

c. The method of installing, attaching, expanding and flaring the boiler tubes into the drums or tube sheets shall equal the original design method and dimensions. Changing the tube installation and attachment method of any boiler tube from the original method is an alteration. This includes adding or deleting flaring the tube end and seal welding.

   When tubes are expanded into thick wall drums the tube expansion process may be performed on the tube in one stage or in two stages by first expanding the upper or lower section and then the remaining section.

d. The thickness of boiler tubes shall equal the original design values. Changing the boiler tube thickness from the original value is an alteration.

e. The shape and arrangement of boiler tubes shall equal the original

design. Changing the shape or arrangement of any boiler tube from the original design is an alteration.

f. Boiler tubes shall be cut, bent and formed to the correct length and shape required for installation when the boiler and tubes are at equal temperature. The use of heating or stretching the tube during installation to obtain the required length by thermal or mechanical expansion is prohibited.

g. Tubes that are cut too short shall not be used unless repaired by re-ending. Tubes shall be cut to the final required length by a mechanical cutting method such as sawing or by use of a roller pipe cutter. Cutting the tube to the required length by use of any torch or electric cutting process is prohibited. If tubes are to be cut to the rough length by either the torch or electric cutting process, the cut line from these process shall be located at least 1 in. (25.4 mm) from the final cutting edge length and the tube shall be cut to its finished length by use of a mechanical cutting method.

h. Tube ends that are found to be too long after expanding into the tube sheet or drum shall be cut down to their required length by milling back the tube end using a tube milling cutter tool.

i. Tube bends shall be made to create smooth surfaces and smooth curves across the entire bend length. Bending shall be performed using dies or other mechanical methods. Tubes that are bent incorrectly or formed to the wrong configuration shall not be used unless the defect is repaired by re-bending the tube to the required configuration.

j. When the ends of boiler tubes are swedged to a smaller or larger diameter as required to fit the drum wall holes ,the swedging shall create smooth surfaces, smooth curves, and a uniform diameter reduction across the entire swedged length. Swedging shall be performed using dies. Machining the tube end to a smaller diameter to obtain the required swedge diameter is prohibited. When tubes are swedged to a larger diameter, the new reduced wall thickness of the enlarged tube end shall be reviewed to confirm that upon completion of the tube expansion process the new wall thickness will be sufficient for the MAWP.

k. Prior to installing the boiler tubes all cut or damaged tube holes and retention groves shall be repaired as required. Tube sheets shall be straightened or braced in their required position to prevent flexing in the event this is necessary such as by using removable braces or strong-backs. All surfaces of the hole shall be clean, dry, and free of all grease, tube rolling lubricant and oil prior to installing the tube and expanding it. If the hole surfaces are cleaned using grinding or polishing wheels, these shall be the fine grade type to prevent cutting the surfaces. The cleaning shall be performed to prevent cutting longitudinal grooves or cuts on the hole surfaces because this type of damage can serve as a pathway for leaks. The cleaning shall be performed in the circumferential direction whenever

possible.

l. The clearance between the tube OD and the drum or tube sheet hole ID shall not exceed 0.040 in. (1.0 mm) unless the original design requires a different value be used.

m. The exterior and interior surfaces of the tube end shall be clean, dry, and free of all preservative and dirt prior to installing the tube and expanding it. If the tube surfaces are cleaned using grinding or polishing wheels, these shall be the fine grade type to prevent cutting the tube surfaces. The cleaning shall be performed to prevent cutting longitudinal grooves or cuts on the tube surfaces because this type of damage can serve as a pathway for leaks. The cleaning shall be performed in the circumferential direction whenever possible.

n. If a lubricant is used to lubricate the tube expander during use, the lubricant shall be a water soluble-type to aid its removal and surface clean up.

o. Sharp edges on both sides of each drum or tube sheet hole shall be removed prior to installing the tube unless the original design requires a different method be used. When the hole edges are required to have a radius to prevent it cutting into the tube surface upon expansion, the dimension range of the radius shall be between 1/32 in. -1/16 in. (0.794 mm - 1.59 mm) unless the original design requires that a different value be used.

p. Each tube during installation shall be placed in its required position in both drum or tube sheet walls and at the furnace exterior. The tube shall then be temporarily locked or fixed in place to prevent it from moving as it is expanded. This locking work may be performed by use of removable blocks, wedges, fixtures or gages.

q. The ends of tubes that are flared shall project through the hole not less than 1/4" (6 mm) nor more than 3/4" (19 mm) before flaring. Where tubes enter at an angle, the maximum limit of 3/4" (19 mm) shall apply only at the point of least projection.

r. Each tube shall have both ends expanded into its mating holes using the required amount of expansion or wall thickness reduction required by the design. If the original design expansion values are not known, the expansion shall be in the 8% - 12% wall reduction and not exceed 15% upon completion of all subsequent re-expansion work such as flaring the tube end. Tubes expanded in excess of 25% wall reduction are classified as "over-rolled" and shall be replaced.

The percentage of tube wall reduction shall be measured using go-no go gages, tube micrometers or ultrasonic thickness (UT) testing. To calculate the percentage of tube reduction required for a specific hole ID see "Guideline For Calculating Tube Expansion By Wall Thickness Reduction".

s. Tubes that are expanded and flared without seal welding shall be flared to an outside diameter of at least 1/8" (3.0) greater than the diameter of the tube hole and shall not exceed 3/4" (19 mm).

t. When tubes ends are flared, the flaring work shall be performed and the depth limited to prevent the bottom of the flare from contacting the surface or edges of the drum or tube sheet.

u. When tubes are to be beaded the beading shall be performed to prevent damaging the drum wall or tube sheet by cutting or grooving it. Upon completion of the beading work the bead OD shall contact the drum or tube sheet surface around the entire tube circumference. The tube shall then be lightly re-expanded to confirm the beading process has not loosened it in the drum or tube sheet hole. If the tube bead is to also be seal welded, this light re-expansion of the tube shall be performed upon completion of seal welding. Repair of a defective or incorrectly formed tube bead by welding is prohibited. Tube shall not be heated to assist forming the bead during the beading process. If ferrules are used in the drum or tube sheet hole, no part of the ferrule shall interfere with the forming of the bead.

v. When beaded tubes are to be seal welded to the drum or tube sheet, the tube shall first be expanded either partially or completely into the hole and then be beaded around its entire circumference. Next, all oil or lubricant shall be removed prior to seal welding. The drum or tube sheet temperature shall not be less than 70°F (21°C) during the seal welding process. The seal weld size shall range between 1/8 in. - 1/4 in. (3 mm - 6 mm) and be applied as a fillet weld of the equal leg or unequal leg type unless the original design requires a different weld size or weld type be used. Upon completion of seal welding the tube shall either be expanded to its final setting or re-expanded lightly to confirm that the seal welding has not loosened it in the hole. If ferrules are used, no part of the ferrule shall protrude from the bead and come into contact with the seal weld.

w. When tubes are installed by expanding straight and seal welding without beading, each tube shall first be expanded either partially or completely into the hole then all accessible oil or lubricant shall be removed prior to seal welding. The drum or tube sheet metal temperature shall not be less than 70°F (21°C) during the seal welding process. The seal weld size shall range between 1/8 in. - 1/4 in. (3 mm – 6 mm) based on the tube thickness unless the original design required different values be used. Upon completion of seal welding the tube shall either be expanded to its final setting or re-expanded lightly to confirm that the seal welding has not loosened it in the hole. If ferrules are used, no part of the ferrule shall protrude from the bead and come into contact with the seal weld.

x. If it is necessary to determine the workmanship of the tube installation prior to seal welding the tubes, the boiler shall be tested hydrostatically to either MAWP or to a lower value. If this test is done, the boiler shall be given its required

hydrostatic test to MAWP upon completion of the seal welding work.

y. Any tube that show cracks within the expanded section, the flare, the bead or the seal weld upon completion of the tube installation process shall be replaced.

z. Cracks in seal welds shall be repaired by grinding out the crack and then reapplying the seal weld. These cracks often result from oil contamination of the weld seal. The metal temperature of the drum or tube sheet shall not be less than 70°F (21°C) during the seal weld crack repair process. Upon completion of seal welding the tube shall be re-expanded lightly to confirm the seal welding has not loosened it.

Notes To Reviewers:

1. *This document is based on Technical Association Pulp & Paper Institute (TAPPI) - Technical Information Paper (TIP) #0416-08 "Guidelines For Replacement Of Generating Bank Tubes With Expanded Joints In Two Drum Boilers", dated 2002.*

2. *If this document is approved for inclusion into the NBIC I recommend that an NBIC version of ASME B&PVC Figure PWT-11 "Examples Of Acceptable Forms Of Tube Attachment" be included with it. This addition of this figure will aid inspectors to understand the different designs of rolled tube joints.*

From:	Richard Stone <richardbstone@verizon.net>
To:	"rferrell@nationalboard.org"< rferrell@nationalboard.org>
Date:	06/30/2015 06:25 PM
Subject:	NBIC: Two Proposed New Documents For Repair Sub-Group - Installing Tubes In Water Tube Boilers By The Expanding Method

NB15-2503

Hello Bob;

1) I've prepared two new documents for the NBIC Repair Sub-Group to review for addition to the NBIC Part 3, Section 3 "Repair". Both documents describe the method of expanding (rolling) boiler tubes into water tube boilers.

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3) I request you assign an NBIC item number to each document and then forward both documents to the Chairman of the Repair Sub-Group.

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Thanks.

Dick Stone
NBIC Locomotive Boiler Sub-Group

Thanks.

Dick Stone
NBIC Locomotive Boiler Sub-Group

TIP 0416-08

ISSUED – 2002

Guidelines for replacement of generating bank tubes with expanded joints in two-drum boilers

Scope

This Technical Information Paper provides guidelines for the removal and replacement of generating bank tubes with expanded joints in two-drum power and recovery boilers. In a two-drum boiler, the seal between the generating tubes and the drums is created by either mechanically rolling or hydraulically expanding the tubes into the tube seats. Replacement of the tubes requires removal of the existing tubes, reconditioning the tube seats in the drum, and rolling or expanding in new tubes. There are numerous problems that can result from this process. These include:

- Leaking tube seats due to tube seat damage, or insufficient expansion or wall reduction of the tubes
- Shoulders on tube counter bores, providing stress risers for tube cracking
- Severe cutting from rolling equipment, providing stress risers for tube cracking
- Non-concentric tube counter boring resulting in inconsistent tube wall thickness and reduced corrosion allowances

The objective of these guidelines is to minimize the potential for these and other problems by providing mill personnel with the information necessary to develop a well-defined material specification, project scope, and necessary quality control measures for proper execution of this work.

These guidelines include discussion of both the traditional mechanical rolling method for expanding generating tubes into drums as well as recent developments in the use of hydraulic expansion.

Safety precautions

Beyond normal safety precautions undertaken when performing work on a boiler, there are no additional precautions required for tube rolling.

Early contractor involvement

Involvement of the installation contractor during the early stages of a project can significantly improve the chance for having a successful project. Because of the long lead times for replacement tubing, mills will often order tubing before getting input from the installation contractor. Contractors know the limitations of the rolling or expanding equipment and can provide valuable input on various tubing parameters such as recommended grades of material, maximum wall thickness, preferred method of swaging, and maximum material hardness. Matching the tube material to rolling/expanding equipment will minimize the potential for problems during tube installation or during future operation. If it is necessary to order material before selecting a contractor, the material specifications should still be reviewed with the perspective contractors to obtain their input.

Project scope

A well-defined project scope is necessary for a successful project. All project participants including the original equipment manufacturer (OEM), the tube supplier, and the boilermaker contractor should be involved in scope planning and review. The project scope should include detailed descriptions and specifications. The use of generic, subjective or descriptive terminology, such as "snug, secure, tight, clean, round," etc. should be avoided and replaced by quantitative measures wherever practical.

Contractor selection

Contractor qualifications and how the contractor trains and qualifies the workers employed on the project are extremely important. Detailed discussions with each potential contractor should cover the following points:

- *Contractor performance on previous projects of similar scope.* This is the most effective method of evaluating a contractor. References for previous projects should be contacted directly. A check of the contractor's safety record should be included.

- *Supervisors and their previous relevant experience.* The experience and qualifications of the on-site supervision is one of the most important criteria for selection of a contractor.

- *Work force size and experience.* This includes proposed crew sizes, number of supervisors per crew and worker qualification procedures.

- *Use of mock-ups.* Mock-ups that simulate conditions in the boiler can be used to great advantage, especially for qualifying workers for removal of tube stubs and for tube rolling.

- *Written procedures and documented training.* The contractor should have written procedures covering the following process steps:

    - New tube inspection
    - Tube removal including physical removal from boiler
    - Drum hole cleaning and inspection
    - Drum hole measurement
    - Drum hole repair procedures, including applicable welding procedures
    - Tube end cleaning
    - Tube placement and alignment
    - Tube expansion and quality control methods

    These written procedures should be used for training of the work force.

- *Quality procedures and staffing.* It is important that the owner and contractor are in agreement on the QA procedures. The technique dependence of most of the procedures employed makes it highly advisable to require a complete QA staff on all shifts. Lack of adequate QA staffing on the night shift can have an adverse affect on the project schedule.

- *Amount and condition of the equipment to be provided.* An adequate number of properly functioning tools such as expanders, replacement rollers, mandrels, rolling motors, tuggers, etc. must be on hand to meet the job schedule. Equipment should be inspected and tested prior to shipment to the job site.

- *Subcontracted work.* The owner should retain the right to approve all subcontractors.

Once a contractor has been selected, a detailed job plan and schedule should be developed and agreed upon. The job plan should include a detailed safety program.

Tube material specification

The tubing specification should contain two sections – one covering manufacture of the straight tubing and the second covering fabrication into generating bank tubes. The tube material specification applies to manufacture of the straight tubing by the tubing manufacturer and covers basic tube material properties and quality requirements. The tube fabrication portion of the specification covers fabrication of the straight tubing into generating bank tubes and covers the bending, swaging and annealing processes. Normally the generating tubes are ordered from the fabricator who in turn orders straight tubing from a tubing manufacturer. The specification should emphasize that it is the fabricators responsibility to insure that the tubing meets the tube material specification, however the owner should maintain an active involvement in the QA/QC program including tube manufacturing.

When developing the tube material specification, consideration should be given to upgrading the tube material and/or increasing the wall thickness to address the specific problems that made tube replacement necessary. (Check with the contractor for any issues related to changes in material grade or thickness.) TAPPI TIS 0402-13, "Guidelines for specification and inspection of electric resistance welded (ERW) and seamless boiler tube for critical and non-critical service," should be consulted if ERW tubing is to be used. The tube material specification should include:

- Material type, per ASME/ASTM standards
- Wall thickness
- Tubing supplier restrictions, if any
- Acceptability of unscheduled butt welds to achieve length (generally not accepted)
- Quality requirements, including non-destructive examination (NDE) procedures and acceptance criteria
- Requirements for on-site inspection by the Owner or Owner's representative during the manufacturing process.

Generating bank tube fabrication

The specification for fabrication of the generating bank tubes should include the following:

Scope

The scope should specify how much of the generating bank is to be replaced, whether the generating bank side wall tubes are to be included, and how much spare tubing should be ordered. (Spare tubing is required in case of problems during fabrication or damage during shipping or installation.) The scope should also include quantity and materials of construction of required non-pressure parts such as vibration bars, lugs, U-bolts, casing, etc.

Drum dimensions, drum centerlines, tube hole details

Fabricators other than the OEM will require information including drum dimensions, drum centerlines, tube hole dimensions, use of counterbores, etc. in order to design and fabricate replacement generating bank tubes. Detailed drawings should be included in the specification if they are available.

Tube lengths

Tubes must be accurately characterized with respect to their true length, which may differ from the nominal length on the drawings if the drums have shifted. The most direct method to determine this is to measure actual tube lengths with a tape measure down the inside of different tubes at several locations along the length of the drum. An alternative method is to survey the drums. If there is any uncertainty regarding the length of replacement tubes, it is good practice to add an inch or two of length. Once some of the tubes are stuck in the drum and the required length is determined, the other matching tubes should be trimmed prior to staging rather

than trimming them after they are in the drum. The length of the swaged portion of the tube at the steam drum end may be increased for ease of installation. This should be discussed with the contractor before the tubing is ordered.

Schedule

The specification should include the date of the outage as well as the date that the material is required on site. The on-site date should include sufficient time for inspection and staging of the material prior to the start of the outage. Penalties for late delivery of material should be specified.

Swaging

The swaged portion of the tube should be drawn to the desired dimensions. The use of an internal mandrel during the swaging process is recommended to help assure dimensional uniformity for the completed swages. Manufacturing procedures that require counter-boring the ID or machining the OD are not recommended because of the potential for internal shoulders at the end of the counter bore and problems with eccentricity of the bored ends. The tube ends shall be square. All burrs, sharp edges, gouges, surface laminations and other potential stress risers shall be removed. The swaged portion shall be free of all oils or other compounds used in the swaging process.

Annealing

There is normally some work hardening of the tube ends during the swaging process. After swaging, the tube ends shall be annealed to a maximum hardness specification. One hundred percent of the tube ends should be hardness tested following the annealing process to insure that the material is suitable for expanding.

Tube bend tolerances

Bends shall be free of dents, kinks (collapsed wall) and excessive wrinkling. Wrinkle (corrugation) size (amplitude) in the bend intrados must not exceed 12.5% of the wall thickness. Tube dimensions should be checked before and after bending. A full sized, side view template of the generating bank should be laid out on the shop floor to verify tube length and bend angles for the complete set of tubes. Laying out one of each tube pattern on the template will insure that no errors were made during detailing or manufacturing and that the tubes will nest together correctly when installed.

Dimensional, finish, and hardness tolerances

Note: Items in italics in Table I are for example only.[1]

[1] Metric conversion: in. × 2.54 = cm.

Table 1. Specifications

Item	Example Specification
Method of Swaging. The swaged portion of the tube should be drawn to the desired dimensions. Manufacturing procedures that require counter boring the ID or machining the OD are not recommended because of the potential for internal shoulders at the end of the counter bore and problems with eccentricity of the bored end. Swaged area OD variance:	*± 0.010 in.*
Swaged area length variance	*+⅛ in.*
Tube thickness in swaged area	*0.180 in. max.*
Tube thickness in swaged area variance	*0.010 in.*
Swaged area OD finish	*250 microns min.*
Swage ovality variance	*0.010 in. max.*
Swage eccentricity variance	*0.010 in. max.*
Bend angle tolerance	*± 1/2 in. from vertical*
Lubricant used during swaging	*Easily removed during boil-out*
Tube ends	*Square and free of burrs*
Swaged area heat treatment	*Rockwell B hardness, 75 maximum*
Gouges inside of swaged area	*None*
Gouges outside of swaged area	*<0.20 in. deep with round bottom & < 2 in. long*
Shop sounding of all tubes	*Yes*
Shop non-destructive testing	*Owner retains copy of records*
Dimensions checked before and after bending. A full sized, side view template of the generating bank should be laid out on the shop floor and a complete set of tubes should be checked against the template to verify tube length and bend angles. This eliminates the possibility that an error was made in calculating tube length, bend angle, or bend location, which could result in a tube correctly matching a template but not fitting into the generating bank.	*Results documented*
Bends	*Free of kinks (collapsed wall) and dents. Corrugations (wrinkles) must be less than 12.5% of the minimum wall thickness. Ovality and wall thickness tolerances must be maintained.*
Fabricators QA requirements	*Procedures documented and followed*
Owners QA requirements	*Sampling frequency, shop visits, etc.*

Inspection and quality

The Owner's project leader should review the quality requirements of the Owner, installation contractor, and tube fabricator. A final, consolidated set of quality requirements, procedures and schedules for tube procurement, for tube handling and for installation in the drums should be established, fully documented and agreed to by all three parties. Sampling methods and frequencies for tests and other quality-related activities should be clearly defined in advance, with contingency actions also prescribed.

At a minimum, an Owner's representative should verify layout of the fabricated tubes on the shop template, as described above in the Section on "Tube Bend Tolerances."

Tube capping and corrosion protection

Swaged portions of the tubes must meet the cleanliness requirements agreed to by the owner and installation contractor.

Tube ends should be capped (with either metal or plastic end caps) to protect them against nicks and dings and to keep the tube bore and the ends clean. Caps should not fall off or be easily dislodged in handling or storage.

External corrosion protection, (e.g. paint) and internal corrosion protection (e.g., vapor phase inhibitor) should be specified by the owner.

Documentation and tagging

Every tube should be individually tagged and marked as defined in the job quality requirements.

The "Manufacturer's Partial Data Report" (Form P-4), "Material Test Reports" (MTR) and other code-related material traceability documentation (as required by the NBIC) must be provided to the owner in a timely manner, and in any case, before the tubes are installed in the boiler.

Shipping and handling

All shipping and handling issues should be discussed and agreed upon ahead of time with the tube installation contractor.

Upon arrival at the job site, the tubes should be inventoried and inspected. The end caps and piece identification should be in place. Dimensions should be spot-checked and the tubes checked for damage.

Non-compliance issues discovered during the inspection at the job site should be resolved in a timely manner so as not to affect the job schedule.

Tube removal

General considerations

Prior to tube removal, the Owner should ensure that the tubes slated for removal are correctly identified both inside and outside each drum. The Owner and the contractor should agree to the method to be used for tube identification prior to the start of the job. Tube identification methods should be reviewed with the shift superintendent at the start of each shift.

The indicated tubes should be carefully cut and removed from the boiler. This typically involves sectioning the tubes at each end so that short stub ends remain in the drums. Any remaining tubes should be inspected for signs of damage while they are readily accessible.

Generating bank tubes, as well as downcomers, header riser tubes, etc., that will not be replaced must be adequately covered or plugged before any work is performed inside the drums to prevent foreign material from entering these tubes. Responsibility for this should be clearly assigned and how it is done should be approved and checked by the owner.

Mud drum support

A specified number of generating bank tubes must always be present in defined locations to adequately support the mud drum during the re-tubing process. Before starting tube removal, drum support tube requirements should be clearly defined and the critical tubes identified and marked.

Stub removal methods

The various methods for removing stub ends from drums should be discussed with the contractor during the qualification process to identify the best method for each job.

Three methods most commonly used are:

- Torch cutting (with an oxy-acetylene torch with brazing tip) to collapse
- Hydraulic tube pulling
- Drilling to collapse.

Torch cutting is significantly faster than the other two procedures and is the most widely used procedure. It is also requires the most operator skill and care to avoid damaging the tube seats, so only qualified craftsmen should be employed to do this work. The other two methods are typically employed to reduce the chances for tube seat damage. The key to a successful project is pre-qualification of the craftsmen and diligent supervision and inspection once the job is underway.

Generating bank tubes that have been both rolled and seal welded will require removal of the seal weld prior to removal of the stub ends. Special milling tools are available for removal of the seal welds. The milling operation will remove a small amount of drum metal on the front and rear side of the tube seat because of the curvature of the drum plate. The expected reduction in drum thickness should be reviewed with the authorized inspector (AI) prior to using this procedure.

The tube seats should be inspected with liquid penetrant after removal of the tube to check for any cracks associated with the seal weld. Seal welding of the replacement tubes should be performed in accordance with the National Board Inspection Code requirements. Special attention should be given to the preheat requirements, especially the method of preheat and the procedure for verifying that preheat is maintained throughout the weld procedure. Completed seal welds should be liquid penetrant inspected for cracks.

Torch cutting removal of stub ends can be done by either of two basic methods. One method is to axially score (torch-cut) the stub, collapse it, and drive it from the outside into the drum. The other method is to score the stub and then drive it outwards from inside the drum, using a mandrel and hammer.

The "score, collapse and drive" inward method uses a torch to make two or three longitudinal scores the length of the stub end, which is then collapsed and driven out of the hole with a punch and hammer.

In the "score-and-drive" method, two torch-cut scores are made through the tube wall, 180 degrees apart. The bell (flared end) of the tube inside the drum is removed from the stub end, which is then driven outwards with a mandrel and hammer.

The "score, collapse, and drive" method is the preferred method to avoid damaging grooved or serrated holes. Conversely, the "score-and-drive" procedure works better on tube holes without locking grooves or serrations.

Conventional oxy-acetylene torch cutting (with oxygen lever) and air-arc gouging to score the tubes both have an unacceptably high risk of tube seat (hole) damage and are not recommended.

Hydraulic tube pulling is the least operator skill dependent method of all the stub removal methods. It usually does not involve cutting and collapsing of the stub end and therefore eliminates the potential for tube seat damage associated with those actions.

Hydraulic pulling equipment is expensive, the removal process is slower, and this method is not generally suitable for tubes in grooved holes due to the potential to damage the drum holes during removal.

Drilling-to-collapse involves using drilled holes to axially score the tube end. This is done by firmly inserting a three-hole drill guide into a tube stub end. Two of the three holes are drilled to a depth equal to the depth of the rolled joint. To avoid overhead work, the drill guide usually is inserted from inside the steam drum and from outside the mud drum. An acetylene torch with a brazing tip is used to cut the remaining tube wall at the end of

one of the drilled holes/scores. A punch and a hammer are then used to collapse the tube and drive it from the hole.

This procedure requires experienced craftsmen specifically trained in this work. It is a slow process because the drill guides tend to break and drill bits must be sharpened frequently, and the tube hole may still be damaged when the final torch cut is made.

Hole cleaning and inspection

Drum holes should be inspected as soon as the stub ends are removed, prior to cleaning, to detect hole damage as soon as possible. If damage is noted, appropriate corrective action should be taken immediately and repairs scheduled.

After tube removal, drum holes should be cleaned with an emery flapper wheel to bright metal and re-inspected. Grooves and counter-bore areas should be free of debris but do not need to be cleaned to bright metal. In certain instances, careful use of an abrasive stone may be required to remove hard scale from the surface of the tube seat, especially if the tube was not originally expanded for the full length of the hole.

The edges of the drum hole should be free from burrs or upset metal. Any sharp-bottomed nicks should be rounded out. Weld repair of gouges or grooves is necessary if their depth exceeds the depth of the machined grooves (or exceeds 0.030 in. if there are no grooves). Gouges should also be repaired if their length on the seating surface extends more than ½ the distance between the edges of any seating surface. See **Appendix A**.

Weld repairs should be performed in accordance with the National Board Inspection Code requirements using ASME qualified welding procedures (WPS) and welders. Special attention should be placed on the preheat requirements, especially the method of preheat and the procedure for verifying that preheat is maintained throughout the weld procedure. Repaired holes should be re-cleaned and re-inspected.

Tube-end cleaning and placement ("Sticking")

Once the tube holes are verified by inspection to be ready for tube end insertion, the properly cleaned tube ends are ready to be placed into the holes. Tubes should be "stuck" and soft-rolled within 8 hours of cleaning and inspection. However, before any tube ends are inserted, the mean diameter of the tube holes must be determined. Measuring the diameter of approximately 10% of non-repaired drum holes, selected at random, in two directions 90 degrees apart accomplishes this.

This mean diameter value is used to determine the increase in tube ID (inside diameter) required during tube end expansion. Any drum holes with a diameter 0.041 in. greater than the tube OD are considered "oversize" and should not be included when establishing the mean. If a significant number of sampled holes are oversized, readings should be taken for each hole and those values used to calculate rolling requirements rather than using an average value. All repaired drum holes should be individually measured, as there is a greater likelihood that those holes are oversize. If the generating bank has been re-tubed previously, all drum holes must be measured and the drum mapped in its entirety.

Similarly, the OD and ID of at least 5% of the tube ends, randomly selected, should be measured to establish the respective mean values. Two diameters at 90 degrees should be made on each tube end. These numbers are used to calculate the original wall thickness and the amount of wall thickness reduction required during expansion.

Steam-drum tube ends usually are inserted first. The steam-drum end of the tube should be cleaned over the full length of the swage. (If there is no swage, this end of the tube should be cleaned over a length equal to the thickness of the steam-drum plus six inches.) This is to avoid dragging foreign material into the tube hole when the tube is inserted. The mud-drum end should be cleaned over a length equal to the thickness of the drum plus an extra three inches.

9 / Guidelines for replacement of generating bank tubes with expanded joints in two-drum boilers ***TIP 0416-08***

A properly cleaned tube end has:

- Surfaces that appears "metal clean" when examined without magnification under normal lighting conditions.
- No particulate contaminants such as sand, metal chips, welding slag, etc.
- No organic films and contaminants such as oils, paints, rust-preventive oils, etc. This should be as determined both by visual examination and by wiping with a solvent-dampened white cloth. If the cloth exhibits indications of contamination, the surface should be re-cleaned.

Per ASME Code, the tube ends shall project into the drum space by not less than ¼ in. and not more than ¾ in. before flaring. Where tubes enter at an angle, the maximum limit of ¾ in. shall apply only at the point of least projection. The tubes shall be expanded, and flared to an outside diameter of at least $^{1}/_{8}$ in. greater than the diameter of the drum hole. If the tube is to be seal welded, it should not be flared during the rolling process.

Tubes should be aligned using hardwood spacer blocks cut for precise side-to-side spacing. These spacer blocks are inserted between the rows of tubes before soft rolling. Spacing in the direction of the gas flow is normally set and monitored visually.
After proper positioning of the tube ends, they are expanded into the drum holes to lock them in place and to obtain pressure-tight tube-to-drum joints.

There are two methods for expanding tube ends: mechanical rolling and hydrostatic pressurization (also called Hydroswaging®). Each of these is described in more detail below.

Mechanical rolling or expanding

Mechanical rolling involves cold working the end of a tube in contact with the hole in the drum so that the tube is mechanically locked in place in the hole. The residual expansion pressure from rolling the tube provides a stable, pressure-tight joint almost as strong as the tube as long as the rolling operation is properly carried out. This is evaluated by measuring the critical dimension changes.

Normally, tubes in boiler generating bank drums are rolled to an 8 to 12 % wall reduction. In some instances, the upper end of this range may be difficult to attain depending on tube metallurgy and variations in tube-to-tube hole clearances. Some owners make rolled joints of generating tubes in recovery boilers to a fixed tube wall reduction rather than a percent wall reduction in the belief that this provides more uniform, stronger joints. When rolling to a significant amount of fixed wall reduction, flaking of tube metal may occur. A heavier roll also causes more work hardening of the tube surface. Over-workhardened surfaces may crack and produce spalled metal flakes. (The metal beneath the flaked surface is unaffected.)

Below is an example calculation to determine the increase in tube diameter required to achieve a 12 % tube wall reduction for a 2 in. OD tube with 0.180 in. original wall thickness. This example assumes the drum hole is between 0.016 to 0.031 in. larger than the tube OD. (For oversize drum holes, the Final ID should be adjusted accordingly.)

(A) Drum hole ID (in.)	2.016 to 2.031
(B) Tube OD (in.)	2.0
(C) ID increase required to fill holes (in.)	(A - B) = 0.016 to 0.031
(D) Wall thickness (in.)	0.180
(E) Calculated tube ID (in.)	(B – 2D) = 1.640
(F) ID expansion - 12% wall reduction (in.)	(D x 2) x 12% = 0.043
(G) Total ID increase required (in.)	(C + F) = 0.059 to 0.074
Final ID (in.)	(E + G) = 1.699 to 1.714

A typical tube-rolling tool contains hard metal rolls set at a slight angle to the body of the tool. These rolls develop enough radial force inside the tube – pushing the ID outwards – to deform the tube end, even to the extent of forging some of the tube wall into the locking grooves in the drum holes.

Tube rolling is normally accomplished in a two-step process, a soft roll and a hard roll. Normally, all tubes are soft rolled before beginning the hard rolling process. The soft roll expands the tube until it contacts the tube seat and holds the tube in position. Usually, the bell is formed during the soft rolling process. The soft roll should not extend more than ¼ in. beyond the drum OD end of the OEM designed tube seat.

The purpose of the hard roll is to set the final wall reduction to ensure a tight, leak free joint. The hard roll should not extend more than ¼ in. beyond the drum OD end of the OEM designed tube seat. Hard rolling causes rapid wear of expander rollers and mandrels. It will be necessary to have sufficient replacement rollers and mandrels on the job site. Approximately 75 tubes can be hard rolled per set of rollers and mandrel. The working forces are less severe on the rollers used during the initial soft roll. Approximately 200 to 250 tubes can be soft rolled per set of rollers and mandrel.

The OEM drum design drawing should be consulted to determine the tube seat lengths so as to specify the proper tooling and the depth of tube rolling. The length of the tube seat is not always the same as the drum plate thickness. The manufacturers will sometimes counter bore the tube hole on thick drums to keep the length of the tube seat within reasonable limits so the drawings must be checked to determine actual tube seat length. The required roller length is defined by the length of the OEM designed tube seat, plus the length of tube projection into the drum, plus the ¼ in. beyond the drum OD end of the tube seat.

Expanders should have sufficient length to expand the tube the entire length of the tube seat. (This may not be a constant value everywhere in a drum.) The mandrel should match the expander as to taper and size. The standard taper is $^{1}/_{32}$ in. per inch of length.

Four problems are commonly associated with the use of roll expanders. The most prominent problem is that this process is very operator dependent. This can lead to significant variability in the rolling effect or quality from tube to tube. Diligent training and inspection of results can help minimize this problem.

The second problem is that to obtain parallel rolling, the rolls must be tapered. Consequently, the rolls slip on the tube surface being expanded. This slippage occurs at pressures significantly above the yield point of the tube and any surface irregularity in the tube or roll will produce flaking of the tube surface. To prevent slippage-related damage, friction between the roll and the tube must be kept to a minimum with a lubricant. The lubricant should be completely removable (preferably water soluble) and should be selected with the help of the boiler water treatment chemical supplier. It is also important that the ID of the tube and the roller surfaces be kept clean during the rolling operation. Hard roll expanders therefore usually should be cleaned after 3 or 4 tubes are rolled.

The third problem that occurs with the use of roll expanders is the temperature difference developed between the tube and the tube seat. The tube ends get hot as a result of cold working the tube plus frictional heat developed by roller slippage. A reduction in tube end tightness occurs when the tube subsequently cools to equilibrium with the tube seat. Controlling roller insertion rate and limiting slippage help reduce tube end heat-up.

Tubes - especially old, operationally stress-relieved tubes - adjacent to newly rolled tubes may become loose during the new tube rolling operation. "Touch-up" rolling of these tubes is recommended. The tube wall thickness should be reduced at least 0.002 in. in effective "touch-up" rolling.

Hydraulic expanding

Tubes can be expanded into drum holes by direct application of internal hydraulic pressure. The required pressure is determined in qualifying testing and then set and controlled to repeatedly achieve the desired degree of expansion. The tube is installed in two stages, positioning and then full hydraulic expansion.

There is no operator "feel" or exertion involved. Expansion pressure is confined within the tube and drum, with appropriate safety protection if a seal should fail. Operator training is simple and the expansion pressure cycle is automatic.

Advantages of hydraulic expansion include:

- Water is used to pressurize the tube end and no oil is involved. No surface damage is done to the tubes and no work hardening of the material results.
- The expansion is done over the full length at one time, producing a smooth, ridge-free transition from expanded to unexpanded areas.
- Adjacent tube seals are not affected.
- Distorted holes are readily accommodated (within allowable tolerances).

Wall thickness (and tube length) does not change after the tube is in contact with the surface of the drum hole. This makes it important to define the expanding pressure by appropriate testing before the job is done. Additional equipment is also available to carry out a localized hydrostatic test on each expanded joint to verify the effectiveness of the seal.

Concerns with hydraulic expansion include:

- Tube swages have to be pulled with an internal and external mandrel to control the inside diameter and wall thickness.
- Tubes must be smooth on the ID with no abrupt seams on electric resistance welded (ERW) tubes that could damage the O-ring seals on the expander and mandrel assembly.
- Tube end annealing is a necessity to control hardness and yield strength.

Some of the earlier limitations and problems with hydraulic expansion have been addressed by improvements in the equipment. The maximum operating pressure of the equipment has been increased to allow for expansion of thicker, higher strength tubing and the O-ring seals have been upgraded to improve reliability. There is still limited experience using hydraulic expanding equipment, so it is especially important to check on contractor qualifications and experience before making the decision to use this method.

Expansion measurement

For mechanically expanded tubes, several methods exist to see if the amount of tube expansion into the tube seat meets the job requirements. It is critical to check every tube for proper expansion to ensure all the joints are tight and leak-free. Frequent checks of the wall reduction in each shift help to prevent systematic rolling errors.

As the tube is expanded in the radial direction, it also expands in the axial direction. In theory, measurement of the tube length extension would provide a method of monitoring tube ID expansion. However, in practice, monitoring tube length extension has proven to be an unreliable method of determining tube expansion into the seat unless every hole in both drums are measured and the entire rolling process is mapped.

A compound tube gage or three-point digital micrometer is currently the best mechanical methods of measuring the amount of tube expansion. Other mechanical methods that can be used for measuring tube expansion include: a simple go/no-go gauge; a 3-point micrometer, and a snap gage and associated micrometer. Due to the variability of the drum hole diameter, tube expansion and measurements do not accurately measure tube wall reduction unless every tube hole is measured.

Ultrasonic measurement techniques are available to accurately determine wall reduction after mechanical rolling. This technique can be used to assure that the specified wall reduction is obtained and that no tube defects are being produced by the rolling procedure. The ultrasonic technique can be used in conjunction with conventional measuring techniques to optimize the quality and speed of the rolling process. The use of UT can impact the job schedule and close coordination between the tube rolling contractor and the NDT contractor is required to minimize the impact.

Expander specification

The OEM's drum drawing should be consulted to determine the proper tooling and depth of tube rolling. Expanders should have sufficient length to expand the tube the entire length indicated by the drum drawing.

The required roller length is established by the length of tube seat as determined by the OEM's drum drawing plus the length of tube projection into the drum and the amount of roll beyond the tube seat.

Example:

Length of tube seat	1½in.
Projection into the drum	$^{3}/_{8}$ in.
Maximum roll beyond tube seat	+ ¼ in.

Length of effective rolling area of rollers $2^{1}/_{8}$ in. (total)

The mandrel should match the expander as to taper and size. The standard taper is $^{1}/_{32}$ in. per 1 in. of length.

Sounding

Sounding tubes is a method to assure that there is no obstruction in the tubes. All generating bank tubes should be sounded, including tubes that were not replaced. Other tubes entering the drum should be visually inspected for obstruction and debris.

Sounding can be accomplished by passing steel balls from the steam drum to mud drum. Lighter objects (ping pong balls, cups, sponges, etc.) can be used, but normally require the use of air to blow them through the tubes. **Each projectile passed through every tube must be accounted for.** Sounding should be done on completion of all work and just prior to hydrostatic testing.

Hydrostatic testing

Ideally, the drum tube sheets will be completely dry upon hydrostatic testing. In reality, this is often not the case. Actual conditions may range from significant leakage to minor "dampness" or "weeping" around a tube seat. If there is leakage, the options are to re-roll or seal weld. Expansion measurements for leaking tube seats can be checked and the tubes can be re-rolled if the tube has not been expanded to the maximum limit at which point work hardening of the surface occurs and there is little additional wall reduction. If significant leakage is still found, then seal welding may be required. Seal welding of the replacement tubes should be performed using the OEM's welding procedure or equivalent. Special attention should be given to the preheat requirements, especially the method of preheat and the procedure for verifying that preheat is maintained throughout the weld procedure. All seal welds should be liquid penetrant inspected to check for cracking. If a tube is seal welded, it should be re-rolled after welding. In addition, the tubes around it should be "bump" rolled in case they were loosened during the welding process.

The Owner and the Authorized Inspector are ultimately responsible for determining what constitutes an acceptable hydrostatic test by weighing experience and risk. It is important that the Owner and Contractor have an understanding of expectations.

Chemical cleaning

Prior to putting the boiler back in service, the generating bank should be chemically cleaned to remove any lubricant remaining from the tube swaging and rolling operations. The water treatment company, chemical cleaning consultant, and the boiler manufacturer should be consulted to help determine the proper procedure. An alkaline boil-out is normally recommended.

Keywords

Boilers, Recovery furnaces, Tubes, Replacement

Additional information

Effective date of issue: March 27, 2002
Working group members:

Joan Barna - Chairman, Alstom Power
Don Erickson, Harold Beck & Sons, Inc.
Charlie Guzi, Retired
Dave Streit, Buckeye Technologies
Glenn Darnall, Darcon International
Karl Morency, Georgia-Pacific

Tube holes require repair when:

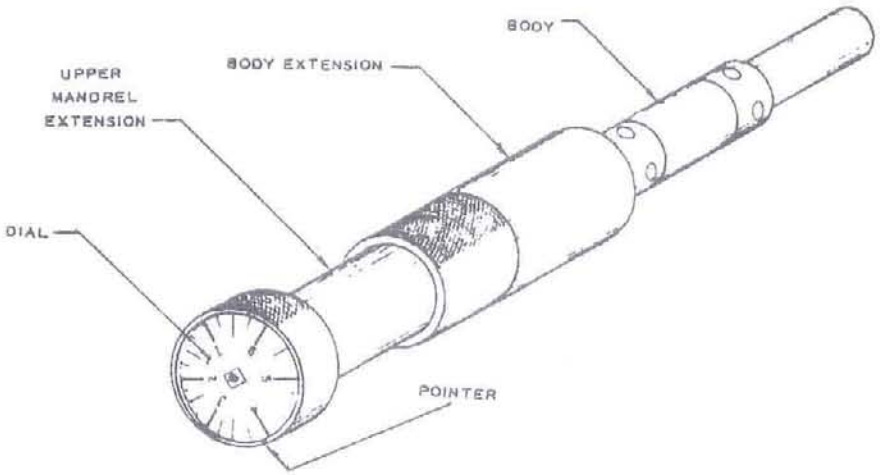
A. Gouge exceeds the length of any area between the edges of the tube seat area.
B. Gouge depth exceeds the depth of the machined groove.
C. Gouge length exceeds ½ the length of any area between the edges of the tube seat area.
D. Gouge is sharp and is located on the waterside edge of the tube seat and exceeds the depth of the machined grooves.
E. Gouge is greater than ¼ in. long and $^{3}/_{8}$ in. wide and deeper than the machined groove.

Date _____
Shift _____
Total Removed _____
Require Repair _____
Require Repair/Total Removed x 100 _____

Appendix B: Compound tube gage

The tube gage

The compound tube gage, shown below, mechanically measures the amount of expansion that has occurred on the inside of an expanded tube end, regardless of the original inside tube diameter. This measurement is one of the best indications of a properly expanded tube.



The gage consists of a cylindrical body containing two sets of three balls disposed in radial cavities at two predetermined dimensions from the shoulder created by the juncture of the body and body extension. A tapered mandrel extending to the outside of the cylindrical body is inserted between each set of balls and acts as an actuating ram for the balls. The mandrels are so oriented that the linear motion between the mandrels and their resulting positions can be translated into inside tube dimensions. This is accomplished through a mechanism that converts the amount of linear motion to rotary motion, thereby producing a reading on the dial gage. The dial is calibrated in inches of mandrel travel, although it is possible to adapt other dials to read in decimals or various other systems.

In operation, the lower set of balls will seat against the unexpanded portion of the tube and upper set of balls will seat against the expanded portion of the tube. The differential will then be indicated on the gage.

Operation of compound tube gage

- Before inserting the gage in the tube, check that the upper mandrel extension is fully retracted.
- Insert the gage into the tube until it is firmly seated against the tube end.
- Depress the upper mandrel extension to its fullest extent, thereby causing the mandrel mechanism to seat firmly against the inside of the tube. Experience indicates that a sudden forward thrust on the upper mandrel will result in more accurate readings.

- The dial gage will indicate the amount of mandrel travel (in inches) that has taken place in comparison to the original ID of the tube.
- To remove the gage, pull out the upper mandrel extension to its fully retracted position and remove the entire gage from the tube.
- The gage is furnished according to the tube OD and calibrated to these limits:

Clearance between tube and tube hole:		*0.031 in.*
Tube thickness:	*2 in. OD tube:*	*0.130 in. to 0.240 in.*
	2½ in. OD tube	*0.094 in. to 0.219 in.*

- Tube thickness must actually be gauged in the field in order to establish actual expanded increase in ID.
- Any variation from the above requires an adjustment to the mandrel travel.

Example: A compound tube gage for a 2½ in. OD with 0.031 in. clearance between tube and tube hole. Tube hole is 2.531 in. maximum and 2.516 in. minimum. Assume the tube OD is 2 $^{15}/_{32}$ in. instead of 2½ in. Inspection shows an additional $^{1}/_{32}$ in. on the OD must be expanded to meet satisfactory expansion values. Therefore, the reading of the gage (mandrel travel) must be increased 1 in. as the mandrel taper is $^{1}/_{32}$ in. per in.

NBIC Subcommittee R&A Action Block

Subject Remove revision of ACCP Program in Paragraph 4.2 b)

File Number NB15-2801 **Prop. on Pg.**

Proposal Explanation

In NBIC Part 3, Paragraph 4.2 b), a year and date is listed for ACCP (i.e. "Rev. 3, Nov 1997"). This is an improper way to reference the ACCP Program. The correct way is to adopt the program and list solely, "ASNT Central Certification Program (ACCP)" without a date and revision. The ACCP-CP-1 document used by ASNT is not a standard. It is an internal program document used solely by ASNT and their Authorized Examination Centers (AEC) for the Central Certification of NDT Personnel. ASNT is currently working to Rev 8 of this document. There are multiple problems that can arise from listing a Revision and Year for this document.

First, if a NB Team Leader were to request proof that an ACCP Professional Level II or III performing work to the NBIC, was certified to "Rev. 3, Nov 1997" of the ACCP Program, there would be no direct way to do so. The two certification documents issued by ASNT (i.e. wallet card and wall certification) do not reference the ACCP-CP-1 document or its revision and date. ASNT's online "certification check" also doesn't reflect a revision and date for the ACCP-CP-1 document used to certify the ACCP Professional by ASNT. This potentially would be a finding, which is an unfair burden to place on the R-Certificate Holder with no direct way to clear.

Also, by listing "Rev. 3, Nov 1997", literal interpretation would mean that ONLY ACCP Professionals Certified by ASNT when they used Rev 3 of the ACCP-CP-1 document are valid for performing work to the NBIC. Therefore, if an ACCP Professional Level II or III was initially certified to Rev 1, 2, or 4-8, then they can't perform work to the NBIC, including people being certified today. Also, ACCP Professionals are recertified by ASNT, if they meet the requirements on a 5-year cycle. When you consider this and since Rev. 3 went into effect in Nov. 1997, which was roughly 18 years ago, and since Rev 7 is dated 7/17/2010, literal interpretation of Paragraph 4.2 b) would beg the question if there are any ACCP Professional Level II or IIIs technically eligible to perform work to the NBIC today?

This proposal recognizes that as long as the ACCP Professional is properly certified by ASNT and maintains that certification, then the adoption of the ACCP Program in itself is sufficient. It also includes "ANSI" as part of the title for CP-189.

Project Manager Nathan Carter

Task Group Negatives **TG Meeting Date**

NBIC Subcommittee R&A Action Block

NBIC Part 3, Paragraph 4.2 b)

Current

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 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, Rev. 3, Nov. 1997) 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.

Proposed

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. The ASNT Central Certification Program (ACCP~~, Rev. 3, Nov. 1997~~) 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.

Comment [NAC1]: Insert

Comment [NAC2]: Deleted

ASNT Central Certification Program

ASNT Document ACCP-CP-1

Revision 8

Approved 3/21/12

The American Society for Nondestructive Testing, Inc.

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FOREWORD

This document establishes the requirements for the ASNT Central Certification Program (ACCP). The ACCP has been developed to improve NDT reliability by providing standardized requirements administered by an accredited certification body. The program will provide prospective employers with NDT personnel that have achieved a high level of performance and competency within the NDT profession.

Individuals that successfully meet the training, experience and examination requirements of this document for a specified level of qualification covered by this document will have met or exceeded the same time requirements as listed in the following documents:

ASNT Recommended Practice No. SNT-TC-1A, *Personnel Qualification and Certification in Nondestructive Testing*

ANSI/ASNT Standard CP-189, *ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel*

CP-106:2008, *Nondestructive Testing - Qualification and Certification of Personnel*

NOTE: Wherever gender specific words such as "his", "her", "he" or "she" appear in this document the other gender is also applicable.

Inquiries related to this document should be directed to the following address:

Certification Management Council Chairman
c/o Senior Manager, Technical Services Dept.
The American Society for Nondestructive Testing
1711 Arlingate Lane
P.O. Box 28518
Columbus, Ohio 43228-0518

Table of Contents

1.0 **Scope**

This document establishes the system for central certification of nondestructive testing (NDT) personnel administered and maintained by the American Society for Nondestructive Testing (ASNT). The purpose of the ASNT Central Certification Program (ACCP) is to provide the NDT industry with personnel who have achieved a high standard of NDT qualifications by examination, and independent, transportable NDT certifications. The program will promote national and international acceptance of NDT certification and reduce the need for multiple audits of certification programs. This program has no restrictions relative to the gender, creed, race or nationality of applicants.

The following nondestructive test methods are covered by this document. The abbreviation used for each test method is shown in parentheses.

a) Magnetic Particle Testing (MT)

b) Liquid Penetrant Testing (PT)

c) Radiographic Testing (RT)

d) Ultrasonic Testing (UT)

e) Visual and Optical Testing (VT)

f) Electromagnetic Testing (ET)

Other NDT test methods may be added to this program as industry need is identified.

2.0 **Definitions**

2.1 **ACCP certification:** The process whereby ASNT certifies that an individual has met the requirements of this document for the levels of qualification designated herein as ACCP Level II or ACCP Professional Level III in a given NDT method, technique or industrial sector.

2.2 **ASNT NDT Level III:** An individual who, having passed ASNT administered Basic and Method(s) Examinations, holds a current, valid ASNT NDT Level III certificate in at least one method.

2.3 **Authorized examination center (AEC):** An organization with facilities and personnel, independent of the employer, approved by the ASNT Certification Management Council (CMC) to administer NDT qualification examinations.

2.4 **Authorized qualifying body (AQB):** A third-party certification body, approved by the ASNT CMC in accordance with the CMC Program Comparison Procedure document PCP-1.

The ASNT Certification Management Council (CMC) shall be responsible for the comparison of 3rd-Party Bodies through the use of audits/surveys, review of program documents, written and operational examination data, and other pertinent information as described in the PCP-1 document.

2.5 **Candidate:** An individual seeking certification in accordance with this document.

2.6 **Certificate:** Documentation provided by ASNT attesting that the holder has met the qualification requirements detailed in this program document.

2.7 **Certification Body:** An organization accredited in accordance with ISO 17024 to verify the competence of persons against specified requirements.

2.8 **Employer:** The corporate, private, or public entity that directly employs NDT personnel for wages or salary.

2.9 **Employer authorization:** The process whereby an employer's NDT Level III reviews the ASNT central certification certificates of the employer's NDT personnel, determines if further examination is required (see job specific examinations in 7.4), and then, on behalf of the employer, authorizes personnel to perform NDT for that employer.

2.10 **Examination, Basic:** An ASNT Level III written examination covering nationally recognized certification procedures, materials science and processes technology, and the basic principles of NDT methods as required for level II.

2.11 **Examination, General:** a Level II written examination covering the principles, fundamentals and theory of an NDT method.

2.12 **Examination, Job-specific:** any additional examination concerned with the application of an NDT method to a specialized product not commonly involved in a particular industrial sector.

NOTE: *Job specific examinations are outside the scope of this document.*

2.13 **Examination, Method:** A Level III written examination which assesses the overall knowledge of the Level III candidate in the NDT test method for which certification is sought.

2.14 **Examination, Practical:** An examination designed to assess the candidate's actual application of a specific NDT method or technique to test specimens to detect, identify and record discontinuities in those samples.

2.15 **Examination, Procedure Preparation:** A Level III examination in which an ACCP Professional Level III candidate demonstrates the ability to write an NDT procedure for the applicable test method based on a code or specification.

2.16 **Examination, Renewal:** An abbreviated written or practical examination requiring the candidate to demonstrate their continued knowledge or ability in the applicable test method or technique.

2.17 **Examination, Specific:** A written examination concerned with the application of an NDT method in a particular industrial sector or sectors, which includes knowledge of the product and related codes, standards, specifications and acceptance criteria.

2.18 **Experience:** The time period during which the candidate performs the specific NDT method or technique under general supervision, including personal application of the NDT method to materials, parts or structures.

2.19 **Industrial Sector (IS):** A particular area in industry or technology where specialized NDT practices are utilized requiring specific skill, knowledge, equipment or training to achieve satisfactory performance.

2.20 **NDT instruction:** A description of the steps to be followed when performing an NDT technique; developed in conformance with a procedure.

2.21 **NDT Instructor:** a person able to demonstrate the skills and knowledge to plan, organize, and present classroom, laboratory, demonstration, and/or on-the-job NDT instruction, training, and/or education programs.

2.22 **NDT method:** Application of a physical principle in non-destructive testing (e.g. ultrasonic testing)

2.23 **NDT procedure:** A written description that establishes minimum requirements for performing an NDT method on any object, written in accordance with established standards, codes, or specifications.

2.24 **NDT technique:** specific way of utilizing an NDT method (e.g. water-washable penetrant testing technique).

2.25 **NDT training:** process of instruction in theory and practice in the NDT method in which certification is sought, which takes the form of training courses to an approved syllabus, but shall not include the use of specimens used in practical examinations.

2.26 **On-the-job training:** The practical application of an NDT test method in production or field conditions under the direct supervision of a Level II or Level III person in the applicable test method.

2.27 **Period of validity:** The time period for which ACCP certification is considered valid as detailed in this document.

2.28 **Practical training:** Instruction in which the personnel being trained are instructed in the hands-on set-up and use of equipment in the applicable test method.

2.29 **Qualification:** Demonstration or possession of education, skills, training, knowledge, and experience required for personnel to properly perform NDT to a qualification level as specified in this document.

2.30 **Renewal by Application:** The renewal of an ACCP certificate at the end of the first period of validity after examination and at 10 year intervals thereafter as specified by this document.

2.31 **Renewal Points:** Credits accumulated as detailed in this document that demonstrates that the certificate holder has remained current in the field of NDT.

2.32 **Renewal by Examination:** The renewal of an ACCP certificate by examination at the end of the second period of validity after examination as specified by this document and at 10 year intervals thereafter.

2.33 **Scheme Committee:** The group of subject-matter experts responsible for the development and maintenance of the ACCP that fairly and equitably represents the interests of all parties significantly concerned with the certification scheme without

any particular interest predominating. The ASNT scheme committee is the Certification Management Council (CMC).

2.34 **Significant interruption:** A period of time in which a person does not perform the NDT activities using the test method or technique in the industrial sector for which certification is held as defined by this document.

2.35 **Supervision, direct:** line-of-sight supervision during the inspection process by a person qualified to Level II or Level III in the applicable test method

2.36 **Supervision, general:** the act of directing the application of NDT test methods performed by other NDT personnel which includes the control of actions involved in the preparation of the test, performance of the test and reporting of the results.

2.37 **Technical Services Department:** The ASNT department responsible for overseeing the administration of ASNT examinations and for the security and maintenance of ASNT examinations developed by the CMC.

2.38 **Test specimen:** a sample of a product form containing known discontinuities used in practical examinations.

NOTE: Test *specimens should be representative of products typically tested in the applicable industrial sector and may include more than one area or volume to be tested.*

2.39 **Trainee:** an uncertified individual who works under the supervision of certified personnel but who does not conduct any tests independently, does not interpret test results and does not write reports on test results.

NOTE: *A trainee may be registered as being in the process of gaining appropriate experience to establish eligibility for qualification to direct access to Level II*

3.0 Categories of Qualification

The categories of qualification for the ACCP are defined as the job skills, necessary to adequately perform the NDT activities required within a given test method for the level of qualification indicated. Qualified personnel shall be cognizant in the subject material contained in the test method body of knowledge for the applicable test method and level of qualification.

3.1 **Level I:** Level I qualification is not offered under the ACCP.

3.2 **Level II:** An ACCP Level II shall have the skills and knowledge to set up and calibrate equipment, to conduct tests, and to interpret, evaluate, and document results in accordance with procedures approved by an ACCP Professional Level III or ASNT NDT Level III. An ACCP Level II shall be thoroughly familiar with the scope and limitations of the method to which certified and should be capable of directing the work of trainees and Level I personnel. An ACCP Level II shall be able to organize and report NDT results. An ACCP Level II shall be capable of developing an NDT instruction in conformance with a procedure. An ACCP Level II shall be knowledgeable in the NDT subject matter contained the NDT Body of Knowledge for Level II in the applicable test method(s).

3.3 **Professional Level III:** An ACCP Professional Level III shall have the skills and knowledge to establish techniques, to interpret codes, standards, and specifications, to designate the particular technique to be used, and to prepare or approve procedures and instructions. An ACCP Professional Level III shall also have general familiarity with other NDT methods. An ACCP Professional Level III shall be capable of conducting or directing the training and examination of NDT personnel in the methods for which the ACCP Professional Level III is qualified. An ACCP Professional Level III shall have knowledge of materials, fabrication, and product technology in order to establish techniques and to assist in establishing acceptance criteria when none are otherwise available. An ACCP Professional Level III shall be knowledgeable in the NDT subject matter contained the NDT Body of Knowledge for Level III in the applicable test method(s).

3.4 **Limited Certification:** This category of qualification is available to ACCP Level II personnel who wish to gain certification in specific testing techniques within a given test method.

4.0 Responsibilities

4.1 ASNT

4.1.1 ASNT shall maintain their status as an accredited certification body in accordance with American National Standards Institute (ANSI) and ISO 17024 requirements;

4.1.2 ASNT shall initiate, maintain and promote the ACCP as specified in this document;

4.1.3 ASNT shall oversee procedures for, and operation of, the ACCP in accordance with this document; and

4.1.4 ASNT shall maintain ultimate responsibility for the ACCP.

4.2 Certification Management Council (CMC)

The ASNT Certification Management Council is the ASNT scheme committee and shall be made up of NDT subject matter experts that serve as the certification committee for ASNT. Their role shall be as follows:

4.2.1 The CMC shall develop and maintain the content of all ACCP qualification examinations;

4.2.2 The CMC shall develop procedures for the ACCP including establishment of ACCP requirements for AQBs and AECs;

4.2.3 The CMC shall determine, define and implement Industrial Sectors (Iss) within the ACCP; and

4.2.4 The CMC shall approve all AQBs and AECs.

4.3 Authorized Qualifying Bodies (AQBs)

4.3.1 AQBs may perform those functions of the ACCP for which they have been authorized by the CMC under the Program Comparison Procedure PCP-1.

4.3.2 AQBs may authorize AECs when permitted to do so by the CMC, only if the CMC provides final approval of the AECs.

4.4 **Authorized Examination Centers (AECs)**

4.4.1 AECs, when authorized by the CMC, may be established at the same site as that of AQBs.

4.4.2 AECs may perform those examination functions of the ACCP for which they have been authorized by the CMC.

4.4.3 AECs may schedule examinations at locations other than at their own facility (i.e. "remote" locations) provided all of the requirements of Procedure CP-12, ***Procedure for the Administration of ASNT Examinations by AEC Personnel at Sites other than at an AEC.***

4.5 **ASNT Technical Services Department**

4.5.1 Shall implement all requirements related to ACCP activities as developed or approved by the CMC.

4.5.2 Administer procedures for, and operation of, the ACCP including administration of ACCP requirements for AQBs and AECs.

5.0 **Industrial Sectors**

Industrial sectors (Iss) may be established when it can be shown that specific NDT skills or demonstrated knowledge above and beyond the standard NDT certification procedures is required and that the development of such a Sector is viable and will be supported by that segment of industry. Sector development may be considered at the request of industry participants or at the initiative of the Certification Management Council. Once established, all Industrial Sector examinations will be developed, maintained and administered following CMC procedures. Current and proposed CMC Industrial Sectors are:

Sector	Description
General Industry (GI)	Intended for personnel working in accordance to multiple industry codes, standards and specifications for general construction needs.
Aviation/Aerospace (AA)	Intended for personnel working in the Aviation or aerospace industry.

Pressure Equipment (PE)	Intended for personnel performing NDT in pressure-related industries such as the power generation, oil and gas, and similar industries that predominantly use the ASME Boiler &Pressure Vessel Code, the ANSI/ASME B31.1 & B31.3 piping codes, API standards or other similar standards.

6.0 Eligibility for Examination

6.1 ACCP Level II candidates shall have met the training requirements shown in Table 1 for the applicable test method(s) and shall submit documentation of the hours claimed.

Table 1 — Initial Training Requirements[1]

NDT Method	Level II (hours)
ET	80
PT	40[2]
MT	40[2]

NDT Method	Level II (hours)
RT	120[2]
UT	120[2]
VT	24[2]

NOTE 1: Training hours may include both practical and theory courses.
NOTE 2: Practical training may not make up more than 50% of the overall level II training curriculum.

Equivalent training: For personnel previously approved/certified under other recognized NDT qualification programs, the adequacy of their previous training to meet the requirements of Table 1 must be documented and acceptance of that documentation will be determined by ASNT.

6.2 ACCP Level III candidates must satisfy one of the following sets of criteria to be eligible to examine:

6.2.1 Have graduated from a minimum four-year* US college or university curriculum with a baccalaureate degree in engineering or science, plus one (1) additional year of experience beyond the level II requirements in NDT in an assignment comparable to that of an NDT Level II in the applicable NDT method(s), or

6.2.2 Have completed with passing grades at least two years of engineering or science study at a university, college, or technical school, plus two (2) additional years of experience beyond the level II requirements in NDT in an assignment at least comparable to that of NDT Level II in the applicable NDT method(s), or

6.2.3 Have four (4) years experience beyond the level II requirements in NDT in an assignment at least comparable to that of an NDT Level II in the applicable NDT method(s).

* *Equivalent baccalaureate degrees from an accredited 3-year program will be accepted for international candidates.*

6.3 For Professional Level III candidates with a currently valid ASNT NDT Level III certificate in the applicable test method(s), the Basic and Method examination is waived.

7.0 **Qualification Examinations**

7.1 ACCP Level II

7.1.1 General Written Examination: This examination shall consist of a minimum of 40 scorable questions that assess the candidate's knowledge of the theory, fundamentals and principles within the applicable test method.

7.1.2 Specific Written Examination: This examination shall require candidates to read a procedure specific to the Industrial Sector and test method for which certification is sought, and to answer a minimum of 30 scorable questions based on that procedure.

7.1.3 Practical Examination: This examination assesses the candidate's ability to perform NDT in each applicable test technique on a minimum of two (2) CMC approved test specimens. When designated by the CMC, multiple areas of interest may be contained in one test specimen. The specimens and areas of interest shall contain actual or artificially induced discontinuities representing those discontinuities found in the product type and Industry Sector for which certification is sought. Candidates must locate, interpret and evaluate discontinuities and shall properly document test results. The practical examination shall also require that the candidate prepare a written work instruction or technique sheet sufficient to permit a third party to recreate or duplicate the examination in question.

7.1.4 Industry Specific Examinations: If an industry has developed examinations that meet their specific needs and that meet or exceed the requirements of the equivalent ACCP examinations, upon approval of the CMC these examinations may be used in lieu of the equivalent ACCP examinations for that Sector. If Industry Specific examinations are used, the certification documentation shall clearly indicate the industry sector and limitations for which certification has been granted.

7.2 ACCP Professional Level III

7.2.1 Basic Examination: This written examination consists of a minimum of 95 scorable questions that assess the candidate's knowledge in the following areas:

7.2.1.1 NDT certification programs in accordance with Recommended Practice No. SNT-TC-1A and ANSI/ASNT CP-189;

7.2.1.2 Materials, fabrication, and product technology; and

7.2.1.3 General knowledge of other common NDT methods.

7.2.2 Method Examination: This written examination consists of a minimum of 72 scorable questions that assess the candidate's knowledge and application of fundamentals, principles, and techniques for that method in which certification is sought.

7.2.3 Procedure Preparation Examination: This essay-type written examination requires candidates to demonstrate the ability to prepare an NDT procedure for the applicable test method for a specified part based on a supplied NDT specification commonly used in the applicable Industry Sector.

7.2.4 Practical Examination: All ACCP Professional Level III candidates shall be required to pass the full ACCP Level II Practical Examination (for all techniques) as detailed in 7.1.3. Candidates holding Limited ACCP Level II certification(s) must take a practical examination on at least one test specimen in each remaining test technique but shall examine on a minimum of two (2) test specimens within the applicable test method.

7.2.5 If an examination is required for both Level II and Level III certification, those examination requirements are waived for Level III candidates that hold a currently valid ACCP Level II certificate in the applicable test method.

7.3 Examination validity: The period of validity for successfully completed ACCP examinations is shown below. If certification in the applicable test method or technique is not completed within these time frames, the examination(s) must be retaken.

Exam Type	Period of Exam Validity
General written examination	5 years
Specific examination	2 years
Instruction Preparation examination	2 years
Practical examination	2 years
Basic examination	5 years
Method examination	2 years
Procedure Preparation examination	2 years

Level III certificate holders need not retake the Basic examination to add another test method as long as they hold a currently valid ASNT NDT or ACCP Level III certificate. Level IIs wishing to add a technique to a current ACCP certification need not retake the General examination for that test method. If all ACCP certifications expire, all of the initial qualification examinations must be retaken to regain certification.

7.4 Job specific examinations: Examinations for specialized NDT techniques or unique product forms above and beyond those detailed in 7.1 and 7.2 are outside the scope of this document and are the responsibility of the employer.

7.5 Limited Certification: Limited certification by technique is not permitted for ACCP Professional Level III personnel. When requested for an industry-developed Sector, limited certification is permitted provided the certification documentation clearly states

the limitations. Level II candidates may choose to certify in individual techniques within a test method by taking practical examinations using only those techniques for which certification is sought and by taking the appropriate Specific examination for the Industry Sector in which certification is sought. Such limitations will be clearly stated on the certification documents for such certification using the technique designations shown below:

Test Method	Technique and Designator			
ET	Alternating Current Field Measurement (ACFM)	Eddy Current (EC)	Remote Field (RF)	
MT	Yoke (Y)	Bench (B)		
PT	Solvent Removable (SR)	Water-Washable (WW)	Post Emulsifiable (PE)	
RT	Radioactive Materials (RAM)	X-ray (X)	Both (B)	
UT	Straight/Angle - Weld (W)	Straight/Angle - Castings/Forgings (CF)		
VT	Direct (D)	Remote (R)		

If approved by the CMC, additional techniques may be added as required.

7.6 Scope of certification: Personnel currently certified under one Industry Sector may certify in another Sector without retaking the Basic Examination, Method Examination, or General Examination, as applicable, but shall complete the Sector-specific examinations for the new Sector.

7.7 Grading

The grading of qualification examinations shall be done by ASNT Technical Services staff in accordance with nationally accepted psychometric principles approved by the CMC.

7.8 Re-examination

7.8.1 Candidates retaking failed examinations within 12 months of the initial examination shall submit a new examination application that shows personal information, changes in experience and training gained since the initial application. Personnel re-examining after 12 months of the most recent attempt shall complete the full application.

7.8.2 Candidates failing examination(s) for behavior in violation of the applicable code of ethics are subject to sanctions up to (but not limited to) invalidation of current examinations, revocation of existing ASNT certifications and loss of the right to sit for future ASNT examinations.

7.9 Vision Requirements

Initial and subsequent annual visual acuity and color differentiation examinations are the responsibility of the employer.

8.0 **Examination Results**

8.1 The ASNT Technical Services shall send examination results in Pass/Fail format to the candidate by surface mail or commercial carrier within 30 business days from the date of the examination. Results may be released to the candidate by fax or e-mail only upon receipt of a written request signed by the candidate. The signed request shall specify the transmittal method and address where the information is to be sent.

8.2 Candidates that successfully pass all required qualification examinations for ACCP certification shall be issued certification documents for the appropriate test method or technique as described in 10.0, Certification.

8.3 Candidates that do not pass all of the required examinations for certification may retake the failed examinations and if successfully completed within the time frames shown in paragraph 7.3, shall be issued certification as noted above.

9.0 **Eligibility for Certification**

To be eligible for ACCP certification, candidates must meet the following requirements:

9.1 must have passed all required examinations for the appropriate test method or technique as shown in paragraphs 7.1 or 7.2; and

9.2 Level II candidates must have met the following experience requirements:

Table 2: Level II Experience Requirements

	ET	MT	PT	RT	UT	VT
Minimum Hours in Method:	800	265	200	800	800	200
Total Hours in NDT[B]	1600	530	400	1600	1600	400

A: Experience shall be based on the actual hours worked in the specific method.

B: While fulfilling total NDT experience requirement, experience may be gained in more than one (1) method, and hours spent performing NDT-related tasks may be counted. Minimum experience hours must be met for each method.

9.3 The experience requirement for Level III candidates is satisfied when the experience requirements shown in paragraph 6.2 are met.

10.0 Certification

10.1 By issuing ACCP certification documents, ASNT certifies that the individual has satisfied the requirements of this document; however, ASNT does not give authority or license to that individual to perform NDT.

10.2 The employer should, through a NDT Level III, review the individual's qualification records for satisfactory completeness and retain copies thereof prior to authorizing the individual to perform NDT. The employer shall be solely responsible for authorizing employees to perform NDT. If the individual is self-employed, then the individual shall assume all employer responsibilities described herein.

10.3 Upon successful completion of all qualification examinations required for the applicable test method or technique, ASNT will issue a parchment-type certificate and a wallet card indicating that the person named has met the ACCP requirements for the test methods or techniques shown. The certificate and wallet card remain the property of ASNT and must be surrendered on demand.

10.3.1 The ACCP certificate shall be 8-1/2" x 11" in size and shall be light blue for ACCP Level II personnel and tan for ACCP Professional Level III personnel. Each certificate shall contain the following as a minimum:

10.3.1.1 the ACCP name with a raised gold leaf ASNT logo;

10.3.1.2 the name of the certificate holder;

10.3.1.3 the level of certification;

10.3.1.4 the test method(s) for which ACCP certification is held;

10.3.1.5 the applicable Industrial Sector(s);

10.3.1.6 the extent of limitation if a certification is limited;

10.3.1.7 the initial certification date;

10.3.1.8 the certification expiration date;

10.3.1.9 a unique ACCP identification number;

10.3.1.10 the signature of the ASNT President and CMC Chairman at the time the certificate was issued; and

10.3.1.11 the raised, embossed ASNT seal.

10.3.2 The ACCP wallet card shall be a plastic driver's license type card and shall contain the following as a minimum:

10.3.2.1 the ACCP name and logo;

10.3.2.2 the name of the certificate holder;

10.3.2.3 a picture of the certificate holder's face;

10.3.2.4 the level of certification;

10.3.2.5 the test method(s) for which ACCP certification is held;

10.3.2.6 the applicable Industrial Sector(s);

10.3.2.7 the extent of limitation if a certification is limited;

10.3.2.8 the initial certification date for each test method or technique;

10.3.2.9 the certification expiration date for each test method or technique;

10.3.2.10 a unique ACCP identification number;

10.3.2.11 the signature of the certificate holder; and

10.3.2.12 the signature of the ASNT Technical Services Manager at the time the wallet card was issued.

10.3.3 In no case shall an individual sign their own certification documents. The CMC Chairman or Technical Services Manager shall have the authority to sign these documents.

11.0 Certification Validity

11.1 ACCP certification shall remain valid for a period not to exceed five years. At the end of the first 5-year period after examination, certificates may be renewed by application as described in paragraph 12. At the end of the tenth year after examination certificates must be renewed by examination as described in paragraph 13. For certifications issued via a 3rd-party agreement, the renewal/recertification of the 3rd-party certification may be accepted as proof of renewal provided the 3rd-party requirements meet or exceed the ACCP requirements and have been approved by the CMC.

11.2 Certifications that are not renewed shall be considered expired and the certificate holder will be required to retake all initial certification examinations to regain ACCP certification.

11.3 New validation periods shall be for a period of five years from the current expiration date unless renewal is tied to other expiration dates based on agreements with other third-party certification bodies. In no case shall a single certification period exceed five (5) years.

11.4 If a significant interruption of continued satisfactory work activity in that period of validity occurs, the applicant shall be required to recertify as detailed in paragraph 12.

"Significant interruption" is defined as:

11.4.1 A time period greater than the sum of an individual's NDT experience at all levels of qualification in the method;

11.4.2 A time period greater than 12 of the last 24 months; or

11.4.3 A time period greater than 36 of the last 60 months.

11.5 Certification shall be ruled invalid if the CMC determines that the certificate holder has violated the applicable code of ethics.

11.6 If ACCP certification is revoked, the ACCP certificate and wallet card must be returned to ASNT.

11.7 Employer authorization (see paragraphs 2.9 and 10.2) shall expire when employment with that company or agency is terminated.

12.0 Renewal by Application

At the 5-year interval after certifying by examination and at 10-year intervals thereafter, certificate holders may renew their certifications by submitting the appropriate ACCP Renewal application and fees to ASNT. Applications may be submitted as early as six (6) months **prior** to the earliest certification expiration date and must be received no later than two (2) months **prior** to the expiration date. The completed application must satisfy the renewal requirements shown in Appendix A for the applicable test method and level of qualification for which renewal by points is sought.

Personnel that do not meet the ACCP requirement for renewal by points, or at the option of the certificate holder, may renew by taking the abbreviated examination (paragraph 13) in place of renewal by points.

ACCP certificates renewed by points shall have new expiration dates set for five years from the current expiration date.

13.0 Renewal by Examination

At the 10-year interval after certifying by examination and at 10-year intervals thereafter, certificate holders are required to renew by abbreviated examination. Renewal by examination requires submittal of a completed renewal by examination application and fees to ASNT and may be submitted not less than (3) months and up to nine (9) months prior to the applicant's current expiration date.

Examinations must be scheduled so that all renewal requirements have been met prior to the applicant's expiration date. The completed application must satisfy the renewal by examination requirements shown in Appendix A for the applicable test method and level of qualification for which recertification is sought.

ACCP certificates renewed by examination within six months of the current examination date shall have new expiration dates set for five years from the current expiration date. If re-examination occurs more than six months prior to the current examination date, the new expiration date shall be 5 years from the examination date.

14.0 Documentation

14.1 The CMC shall maintain and publish at least annually, by suitable means, a list of all certified individuals including the level of certification, Industrial Sectors and NDT methods or techniques for which certification is held.

14.2 A file shall be maintained for each individual certified, for each applicant who has not obtained certification, and for each individual who has had certification revoked, suspended, or terminated containing:

14.2.1 completed application forms;

14.2.2 examination documents including, but not limited to, answer sheets, identification of specimens, and results of examinations;

14.2.3 renewal and recertification documents including evidence of having met all renewal and recertification requirements (as applicable); and

14.2.4 reasons for any withdrawal or suspension of certification and details of any other penalties.

14.3 All individual certification files shall be considered confidential and shall be maintained in a secure location and for a duration in accordance with approved CMC operating procedures.

15.0 Applicant Rights

Appeals, Complaints, and Disputes: An appeals process exists for the resolution of appeals, complaints, and disputes received from candidates, certified persons, their employers and other parties regarding the certification process, qualification criteria, or the performance of certified persons.

Confidentiality: Information gained in the course of the certification process shall not be disclosed to any third party except as required by law.

16.0 Program Change Notification

Changes to the ASNT Central Certification Program (ACCP) are posted on the ASNT Internet website, at www.asnt.org under the "Certification" link. Notification of changes will be published in the ASNT monthly periodical, *Materials Evaluation* magazine.

17.0 Accommodation for Disabilities

ASNT will make appropriate accommodations for persons with documented disabilities. Candidates should contact the ASNT Technical Services Department prior to examination dates to arrange special accommodations.

APPENDIX A

ASNT NDT PROGRAM RENEWAL REQUIREMENTS

A. ASNT NDT/PdM Level III Certification

The period of certificate validity is 60 months from date of issue, ending on the last day of the expiration month shown on the wallet card and certificate. Renewal of ASNT NDT Level III personnel is intended to apply only to individuals who maintain continued active employment in NDT Level III functions and demonstrate efforts to keep abreast of the technology in the Method(s) for which Renewal is sought. Renewal may be by re-examination or by application subject to the following conditions. Each applicant:

1. Must submit the appropriate ASNT Renewal application and fees;
2. Must reaffirm the ASNT Level III Code of Ethics;
3. Shall affirm continued active employment in Level III functions as related to the NDT Method(s) for which renewal is sought as noted below:
   a) Such employment must have covered at least 36 months during the current valid Certification period but not necessarily 36 consecutive months. There shall be no break greater than 12 consecutive months.
   b) At least 12 of the 24 months immediately preceding the expiration of the Certification must have been spent in Level III functions.
   c) If work experience during the certification period did not include all Methods for which Renewal is sought, at least **two** additional points shall be obtained *in each Method* for which there was no work experience.
   d) The effort to keep up to-date, contribute to knowledge or maintain continued growth in the Method(s) for which the individual is certified or to expand knowledge in related technologies must be demonstrated by obtaining a minimum of 25 points during the five (5) year period of certification by engaging in the activities listed in Table 1.

B. ACCP Professional Level III Certification

The period of certificate validity is 60 months from date of issue, ending on the last day of the expiration month shown on the wallet card and certificate. At the first 5-year interval after being certified by examination (or for applicants that came into the ACCP based on holding an approved third-party NDT certification), applicants may renew their certification(s) by meeting all of the requirements listed in paragraphs A(1-3) above. Renewal by examination may be done instead of renewal by points at the request of the applicant.

At the 10-year interval, applicants must renew by examination by meeting all of the requirements listed in paragraphs A1 and A2 above and taking an abbreviated written renewal examination. The renewal examination shall consist of 10 questions on certification programs and 20 questions per test method covering the application of that test method.

Personnel who gained their ACCP Level III certification based on certification(s) issued by an approved 3rd-party NDT certification program may renew their ACCP

certifications by submitting the documentation listed in paragraphs A1 and A2 above, along with a copy of their current 3rd-party NDT certificates for the applicable test methods.

C. ASNT NDT Level II Certification

The period of certificate validity for all ASNT NDT Level II certificates is 60 months from the date of issue, with certification ending on the last day of the expiration month shown on the wallet card and certificate. ASNT NDT Level II personnel may renew in two ways, by points (without re-examination) or by re-examination. Details of these processes are shown below.

1. Recertification by Application

To recertify by application ("Points") a certificate holder:

a. Must submit the appropriate ASNT Renewal application and fees;

b. Must reaffirm the ASNT Level II Code of Ethics;

c. Shall affirm continued active employment in Level II functions as related to the NDT Method(s) for which renewal is sought as noted below:

   i. Such employment must have covered at least 36 months during the current valid Certification period but not necessarily 36 consecutive months. There shall be no break greater than 12 consecutive months.

   ii. At least 12 of the 24 months immediately preceding the expiration of the Certification must have been spent in Level II functions.

d. Documentation of continued NDT involvement during the current five-year period of certification by submitting a minimum of 12 points in one or more of the activities listed in Table 1.

2. Recertification by Examination

Personnel wishing to recertify by examination must fill out a new ASNT NDT Level II examination application in the same manner as was done for initial certification. The new expiration date for personnel that recertify by examination within 6 months of their current expiration date will be 5 years from their current expiration date. Personnel that recertify by examination more than 6 months prior to their current expiration date will receive new expiration dates 5 years from their date of successful re-examination.

D. Conversion of ACCP Level II to ASNT NDT Level II

Personnel that hold currently valid ACCP Level II certificates may convert those certifications to ASNT NDT Level II certifications by submitting an ASNT NDT Level II **renewal** application and meeting the requirements shown in paragraphs C(1)(a-d) above. Once converted, the certificate holder would be required to retake the ACCP Practical and Instruction Preparation to regain ACCP certification in the applicable test method(s).

E. ACCP Level II Certification (For CWI/ACCP Certification, see ¶ F)

The period of certificate validity for all ACCP Level II certificates except those VT certificates issued through the AWS/ACCP agreement is 60 months from date of issue ending on the last day of the expiration month shown on the wallet card and certificate. AWS/ACCP VT certificates, denoted with **VT*** on the wallet card and certificate, expire on the date of the certificate holder's current CWI or SCWI certification.

1. **At the 5-year interval** after initial certification or recertification by examination (and at 10-year intervals thereafter), ACCP Level II certificate holders may renew their certification(s) by meeting the following requirements:
   a. Submit the appropriate ASNT recertification application and fees;
   b. Re-affirm the ASNT Level II Code of Ethics;
   c. Affirm continued active employment in Level II functions as related to the NDT Method(s) for which renewal is sought in the following manner:
      i. Submit a letter from the employer affirming that the applicant has been actively employed in NDT in the applicable test methods with no break greater than 12 consecutive months.

   OR

      ii. Submit letters from two (2) third parties NDT users attesting that the applicant has satisfactorily performed NDT in the applicable test methods within the current certification period; and
      iii. Demonstrate continued NDT involvement during the current five (5) year period of certification by submitting a minimum of 15 points in one or more of the activities listed in Table 1.

2. **At the 10-year interval** after initial certification or recertification by examination (and at 10-year intervals thereafter), ACCP Level II certificate holders must renew by examination by submitting the information detailed in paragraphs 1(a) and 1(b) above and must pass an abbreviated practical renewal examination in place of submitting renewal points. The renewal examination will consist of a hands-on practical examination of at least two ASNT test pieces per test method, with a minimum of one test piece in each applicable test technique.

F. ACCP Level II though the AWS Agreement

At the 3- and 6-year AWS certification intervals, personnel who received their ACCP Level II Visual Testing (VT) certification through the AWS/ASNT agreement (designated on the certificate and wallet card by **VT***) have ACCP expiration dates that match their current AWS CWI or SCWI certificates. Such personnel may renew their ACCP VT certification by submitting the appropriate ASNT recertification application and fees; re-affirming the ASNT Level II Code of Ethics; submitting a copy of their renewed CWI/SCWI certificate or wallet card and a Jaeger J-1 eye examination (or equivalent) that was administered within the past 12 months. Renewal applications can be submitted up to 60 days after the AWS expiration

date. After 60 days applicants must re-apply for ACCP certification using the initial certification application.

At the 9-year AWS certification interval, applicants must submit the appropriate ASNT recertification application and fees; re-affirm the ASNT Level II Code of Ethics and submit a copy of their renewed CWI/SCWI certificate or wallet card.

Additionally, 9-year applicants must submit documentation of having passed the 9-year CWI or SCWI recertification examination or take the ACCP abbreviated Practical examination.

Personnel that do their 9-year AWS renewal based on continuing education (submitting PDHs) or by taking the AWS recertification course *are required to take the ACCP abbreviated Practical examination to renew*. (The ACCP requires *re-examination* at no more than 10-year intervals.)

If the AWS 9-year recertification Practical examination is taken prior to the ninth year of ACCP certification, that date may be considered the ACCP 10-year renewal by examination and the next 3-, 6- and 9-year cycle shall start from the date of that renewal.

G. Third-Party Level II certificate holders

Personnel who gained ACCP Level II certification based on certification(s) issued by an ASNT Approved 3rd-party NDT certification program may renew by submitting the appropriate ASNT recertification application and fees; re-affirming the ASNT Level II Code of Ethics and submitting a copy of their renewed 3rd-Party certificate or wallet card.

H. Renewal by examination

Renewal by examination can be requested at any time subject to the following conditions:

1. At any time prior to their expiration date, ASNT certificate holders may apply to take the following renewal examination(s) applicable to their certifications:
   a. For ASNT NDT Level III certification, the full Method examination(s);
   b. For ASNT NDT Level II, the applicable General and Specific examinations;
   c. For ACCP Level III, the applicable abbreviated written examination(s); and
   d. For ACCP Level II, the applicable abbreviated Practical examinations.
2. If such examination(s) are taken before the expiration date and successfully passed in Methods for which the individual currently holds a valid Certification, the process is considered to be renewal by examination.
3. Failure to successfully renew prior to the current expiration date will require that the applicant recertify as a new examinee.

TABLE 1: ASNT RENEWAL POINTS

The following NDT-related activities may used to accumulate points to be used for renewal of ASNT NDT certifications. All points must be earned within the last 5-year certification period.

	Activity	Point value	Maximum points allowed per certification period
A_1	Teaching NDT courses for which academic credit or IACET accredited CEUs ARE given:	1 point per 2 contact hours	16
A_2	Teaching NDT courses for which academic credit or IACET accredited CEUs are NOT given:	1 point per 2 contact hours	10
	A maximum of 16 points may be claimed in Category A		
B	Additional classroom or computer-based NDT training. (*Documentation must include number of contact hours and verification of successful completion.*)	1 point per 4 contact hours	10
C	Authoring or co-authoring technical NDT presentations at local technical society* or national meetings*. (*To receive credit, the individual must have contributed at least **50** percent of the content.*)	2 points per initial presentation	8
D	Attending technical sessions, seminars or panels at local ASNT Section or at NDT-related national meetings*.	1 point per 3 contact hours	10
E	Preparing and publishing an original NDT-related peer reviewed paper or full article* in a technical society publication*. To receive credit, the individual must have contributed at least 20 percent of the content.	3 points per paper or full article	12
F	Authoring short technical tips in the ASNT TNT Newsletter or other NDT-related technical publication	1 point per published Tip	6
G	Development and technical review of ASNT publications	See Definitions on page 7	15
H	Documented NDT contributions to NDT-related technical society committee projects.	2 points per completed project	12
I	Other non-ASNT third party technical certifications such as CWI, API, NACE, ASQ, etc.	1 pt per cert	5
J	Membership in the American Society for Nondestructive Testing‡	1 point per year	5
K	Serving as ASNT trained Monitor or Assistant Monitor at ASNT examinations	1 point per 1/2-day session	6
L	Performance of external NDT audits*	2 per audit	8
M	Receiving a patent* for an NDT related product	4 per patent	12

* See definitions

INFORMATION CONCERNING THE POINT SYSTEM FOR RENEWAL

1. ASNT Level III Refresher Courses, accredited CEU courses, college courses, corporate training department courses and courses of similar quality leading to examinations do qualify for renewal points, provided they contribute to knowledge and growth at or above the qualification level (Level II or III) in the methods in which the applicant is certified, or are NDT-related (e.g. math, physical science, QC, etc.), or cover advanced NDT material.
2. Time spent taking examinations of any kind do **NOT** qualify for renewal points.
3. Acting as a Session Chairman at a Society meeting, or as a Section Officer, National Officer, Council, or Committee Chairman does **NOT** qualify for points; these are not technical functions. The only exception is for participation in technical society meetings whose primary function was to accomplish a significant technical (not administrative) project. Such projects must meet the requirements for Activity H in Table 1.
4. Test procedures, QC manuals, etc. prepared for employers do not qualify for points; they are considered as part of an applicant's occupational or work experience.
5. To earn points for attendance at technical sessions, documentation of attendance at the actual technical presentations must be submitted. Proving general attendance at the conference is not sufficient. At all ASNT Conferences, forms for documenting attendance are provided at each technical session; have them signed by the session chairperson and submit copies of them with the application for recertification.
6. Reports prepared for employers do not qualify for points unless and until they are given as a technical presentation or published per Activities C or F in Table 1.
7. Passing mathematics or physical science courses in connection with a college degree program qualifies for points, but it is the applicant's responsibility to document the contact hours in order to receive the point credit.
8. Certificates of completion for courses must show either contact hours or **CEUs**. It is up to the applicant to supply suitable documentation showing such hours or **CEUs**. One CEU equals 10 contact hours and is equivalent to 2.5 ASNT recertification points.
9. Providing the name of a person who can verify points is not satisfactory documentation. It is the applicant's responsibility to provide hard copy, i.e., documentation with the attesting person's signature.
10. To count for points, papers must be published in a technical society journal or official society publication. Publications which are not generally available to the public, such as company or governmental meetings or reports, are not acceptable. Similarly, talks given at meetings not open to the public do not earn points.
11. In general, the type of point documentation is the same as that needed to satisfy a strict QA/QC auditor. The ASNT Certification Program records are audited annually and must show strict compliance with the above rules and procedures, so full compliance is required of ***all*** applicants, including proper documentation. In case of doubt about the suitability of documentation or whether points should be awarded, the final decision rests with the Certification Management Council.

DEFINITIONS

Committee Projects: Specific identifiable official activities of the national technical societies such as round-robin or individual studies, preparation of guidelines, appendices, specifications, recommended practices, codes or standards, etc., may qualify. Documentation may include memo or letter reports, drafts of committee output documents, or major written comments on documents. Verbal comments, attendance at meetings, or return ballots without major comments do not qualify. Work on ASNT publications should be accrued under Categories E, F & G.

External NDT Audit: An NDT audit of a facility other than that of the auditor's place of employment such as NDT vendor or supplier audits.

Full Article: A full article is one of 1000 words or more at the time of publication.

Membership: Membership will be calculated based on the number of months a certificate holder has been a member in the current 5-year certification cycle. For each month of membership, 1/12th of a point (0.083 points) may be claimed.

National Meetings: Meetings, conferences, symposia, seminars, panels, etc., organized or sponsored by a national technical society or societies and advertised nationally. Regional conferences may qualify if they meet the above criteria. Trade shows and trade association meetings do not qualify. Closed meetings, i.e., those with attendance or notification restricted to certain groups, do not qualify. Foreign or international meetings qualify if the sponsor(s) are national or international and the attendance is not restricted.

Patents: Patents shall be those issued by the U.S. Patent Office or equivalent non-US governmental agency.

Publication Development and Review: Authors and reviewers may earn points for publication activities as shown below provided the contribution is published.

Publication type	Activity	Points
NDT Handbook	Contribute one full chapter	3
	Contribute part of one chapter	1
	Review one chapter	1
Study Guides, Q&A Books, etc.	Author or revise one full book	3
	Full publication review	2
	Partial publication review	1
	Contribute single chapter	1

Publication type	Activity	Points
Materials Evaluation	Contribute full article (1000+ words)	3
	Contribute short article or Tech Tip	1
	Article review	1
The NDT Technician	Contribute full article (1000+ words)	3
	Contribute Working Smarter Tip	1
	Contribute short article or Tech Tip	1
	Article review	1

Written or e-mail acknowledgement of receipt and publication of such materials by the Publications Department will serve as documentation of completion of an assignment.

Significant Interruption: For the purposes of ASNT recertification, a break greater than 12 consecutive months.

Technical Society: A not-for-profit society representing a segment of industry in an NDT-related field or representing an industry that is an NDT user.

Technical Society Publications: The publications of national technical societies qualify. Foreign or international technical journals also qualify.

ASNT will attempt to notify certificate holders that their certificates are coming due for renewal using the postal and e-mail addresses in the certificate holder's ASNT membership/certification record.

It is the responsibility of each certificate holder to ensure that their contact information is correct.

ASNT shall not be responsible for correspondence not reaching certified personnel. Renewal forms may be requested from the ASNT Technical Services Department or may be downloaded from the Certification pages on the ASNT website at **http://www.asnt.org/certification/certification.htm**.

POINTS DOCUMENTATION

Below are examples of ***typical*** documentation for each of the points categories. Similar documentation that is submitted will be considered on an individual basis.

Item	Typical Documentation
A_1	Training course outlines showing the NDT subject and number of classroom/contact hours and a copy of an IACET CEU certificate with your signature as the instructor. For academic courses, a copy of the course description (from a school Course Catalog, etc) showing the subject, hours, and you as the instructor.
A_2	Training course outlines showing the NDT subject and number of training hours. A copy of a student's training documentation that would be placed in their company personnel certification file is satisfactory as long as the hours, subject and your name as instructor is shown.
B	Evidence of completion such as transcripts, certificates, diplomas, grades, etc. which denote contact hours or CEUs issued, the course subject and your participation.
C	Meeting notices, published programs, or correspondence on company or society letterhead, which identify the meeting, presentation title, presenter/author's name, and date.
D	Registration forms, trip reports, certificates of attendance, correspondence, or other positive evidence of attendance. This must denote activity title, date, location, and content.
E	The first page of a published paper is adequate, provided the title, the author(s) name(s), and the name and date of the publication appear.
F	A copy of the page showing the published technical tip with your name on it as the author or a copy of an e-mail from the editor stating that you did submit a tip that was used.
G	A copy of a letter, fax or e-mail from the appropriate ASNT Editor attesting that you have performed the development work or technical review being claimed. *** NOTE: *You* must request such documentation; it will not be generated automatically. ***
H	Committee meeting minutes or memoranda, correspondence, letter reports, or other evidence that identifies your role in completing committee projects is acceptable.
I	Copies of currently valid NDT-related certifications. Note: If a certification body issues individual certificates for each NDT test method, only one such certificate will be accepted from that cert body for each Level of qualification. Certificates issued by the same cert body but for different *applications* (such as API 653, 510 or 570 certs) would each count as a separate certification.
J	Copies of your ASNT membership cards showing the dates or membership, a copy of the receipt for payment of membership for specific years or written or e-mail confirmation by an ASNT Staff member will be accepted.
K	A copy of the agreement between ASNT and the Monitor (or Assistant Monitor) is acceptable.
L	A letter from a responsible agent of the 3rd party that was audited attesting that the applicant performed an NDT audit is acceptable. (Audit materials are by nature confidential and are not wanted and will NOT be accepted).
M	A copy of a new or renewed patent for an NDT product is acceptable provided it was granted or renewed within the current 5-year certification period.

NBIC Subcommittee R&A Action Block

Subject Change reference standard, "ACCP-189" to "ANSI/ASNT CP-189" and also included reference to the ACCP Program.

File Number **Prop. on Pg.**

Proposal Explanation In NBIC Part 3, Paragraph S6.10 b), "ACCP-189" is referenced, but this standard does not exist. The correct reference standard is "ANSI/ASNT CP-189". This does not appear to be an errata though. It first appeared this way in the 2007 Edition of NBIC Part 3, when Supplement 6 was first printed. Either SNT-TC-1A or CP-189 is used as a guideline for employers to establish their written practice and not used for meeting the examination and demonstration requirements. From the existing language, it appears that the intent was to also include the ACCP Program. This item also includes reference to the ACCP Program and other editorial modifications, which brings this paragraph in line with Paragraph 4.2 b).

Project Manager Nathan Carter

Task Group Negatives **TG Meeting Date**

NBIC Subcommittee R&A Action Block

NBIC Part 3, Paragraph S6.10 b)

Current

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 for Nondestructive Testing Personnel Qualification and Certification*, or ACCP-189, *Standard for Qualification and Certification of Nondestructive Testing Personnel*, may be used to fulfill the examination and demonstration requirements of SNT-TC-1A and the employer's written practice. Provisions for qualification and certification of NDE personnel shall be described in the "TR" Certificate Holder's written quality system.

Proposed

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 for Nondestructive Testing Personnel Qualification and Certification*, or ANSI/ASNT CP-189 ~~*ACCP-189*~~, *Standard for Qualification and Certification of Nondestructive Testing Personnel*, 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 ~~SNT-TC-1A and~~ the employer's written practice. Provisions for training, experience, qualification and certification of NDE personnel shall be described in the "TR" Certificate Holder's written quality system.

Comment [NAC1]: Insert
Comment [NAC2]: Delete
Comment [NAC3]: Insert
Comment [NAC4]: Delete
Comment [NAC5]: Insert