Date Distributed: August 17, 2012

THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS

NATIONAL BOARD INSPECTION CODE COMMITTEE

MINUTES

Meeting of July 19, 2012
Columbus, Ohio

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1. **Call to Order - 8:00 a.m.**

   Chairman Terry Parks called the meeting to order at 8:00 a.m.

2. **Introduction of Members/Visitors**

   All of the members and visitors introduced themselves. Mr. Parks explained the recording software and asked everyone to turn off their cell phones.

3. **Announcements**

   a. Mr. David Douin, National Board Executive Director

   Mr. Douin thanked all of the NBIC members for all of their hard work and then presented a few service rewards:

   - Domenic Canonico has served 10 years on the NBIC Committee.
   - Jim Pillow has served 5 years on the NBIC Committee.
   - Bob Reetz has served 5 years on the NBIC Committee.

   Mr. Douin expressed appreciation to Mr. Parks for serving as Chairman of the NBIC Committee for 5 years. The members and visitors gave Mr. Parks a standing ovation.

   b. Executive Committee Report

   Gary Scribner gave a brief re-cap of the Executive Committee meeting. The following are some of the issues that were discussed:

   - The creation of a Part 4 of the NBIC. It was decided to table this issue and survey the users to see what they would prefer.

   - The cutoff date is October 1 for all information that will be included in the 2013 Edition.

   - The future of the NBIC was discussed and how the Committee plans to move the book forward.

   - A survey of users was done on whether to move the supplements into one book or not and the idea was rejected. He also discussed the SWAT analysis of the Exec committee and that they will meet twice a year other than with the rest of the Committees to devote more time to important issues.

4. **Adoption of the Agenda**

   There was a motion to approve the agenda as modified. The motion was unanimously approved.

5. **Approval of the Minutes of January 2012 Meeting**

   There was a motion to approve the minutes from the last meeting. The motion was unanimously approved.

6. Review of Rosters/Resignations/Nominations/Reappointments (Attachment 1)

a) Changes to rosters

a. Resignations

- Mr. David Parrish has submitted his resignation. He is retiring from his job at FM Global and therefore losing his corporate sponsorship.

- Mr. Paul Welch is retiring from the state of Georgia therefore terminating his membership.

- Mr. Frank Pavlovicz has resigned from the SC on Repairs and Alterations.

- Mr. Stuart Cameron has resigned from the SC on Repairs and Alterations.

- Mr. Terry Parks is resigning as NBIC Committee Chair.

b. Nominations and reappointments for NBIC Committee members and subgroups that serve all four subcommittees.

- Mr. Stan Staniszewski and Mr. Paul Edwards are eligible for reappointment to the NBIC Committee.

  There was a motion to approve the reappointment of Mr. Staniszewski and Mr. Edwards, pending the approval of the Chairman of the Board of Trustees. The motion was unanimously approved.

- Mr. Brian Boseo, NB Certificate Holder, would like to be considered for membership to the SC on Repair and Alteration.

  There was a motion to approve appointing Mr. Boseo to the SC on Repairs and Alterations, pending the approval of the Chairman of the Board of Trustees. The motion was unanimously approved.

- Mr. Chad Bryan Jurisdictional Authority, would like to be considered for membership to the SC on Repairs and Alterations.

  There was a motion to approve appointing Mr. Bryan to the SC on Repairs and Alterations, pending the approval of the Chairman of the Board of Trustees. The motion was unanimously approved.

- Mr. Rick Sturm Jurisdictional Authority would like to be considered for membership to the NBIC Committee and the SC on Installation.

  There was a motion to approve appointing Mr. Strum to the NBIC Committee and the SC on Installation, pending the approval of the Chairman of the Board of Trustees. The motion was unanimously approved.

- Mr. Mark Mooney, Authorized Inspection Agencies, would like to be considered for appointment to the NBIC Committee.

  There was a motion to approve appointing Mr. Mooney to the NBIC Committee

pending the approval of the Chairman of the Board of Trustees. The motion was unanimously approved.

The following committee members were eligible for reappointment to their respective committees:

- There was a motion to approve reappointing Messrs. Brian Moore, Paul Bourgeois, Ray Snyder, Craig Hopkins, Geoff Halley and Michael Richards to the SC on Installation, pending the approval of the Chairman of the Board of Trustees. The motion was unanimously approved.

- There was a motion to approve reappointing Messrs. Domenic Canonico, Don Cook, Stan Staniszewski, John Richardson, Mike Schwartzwalder, Jim Riley, Jim Getter, Mark Horbaczewski, Greg McRae, and Mark Mooney for reappointment to the SC on Inspection, pending the approval of the Chairman of the Board of Trustees.

- There was a motion to reappoint Messrs. George Galanes, Jim Larson, Bryan Schulte, Jim Sekely, Paul Edwards and Mike Webb for reappointment to the SC on Repair and Alteration, pending the approval of the Chairman of the Board of Trustees. The motion was unanimously approved.

- There was a motion to Messrs. Michael Gorman, Dale Keeler, Juan Bustillos, Doug Eisberg, Timothy Fowler Terry Cowley Rick Crawford, David Hodgkinson and Bernard Shelly for reappointment to the SG on FRP pending the approval of the Chairman of the Board of Trustees. The motion was unanimously approved.

- There was a motion to reappoint Mr. Bob Reetz and Mr. Tom Dillon to the SG on Historical Boilers, pending the approval of the Chairman of the Board of Trustees. The motion was unanimously approved.

- There was a motion to reappoint Messrs. Timothy Bonn, Andrew Stupica, Ed Soltow, Merle Minik, Woody Banker and Shawn Malone for reappointment to the SG on Graphite pending the approval of the Chairman of the Board of Trustees. The motion was unanimously approved.

- There was a motion to reappoint Messrs. Frank Hart, Sid Cammeresi, Denis DeMichael, Robert Donalson and Ms. Marianne Brodeur for reappointment to the SC on PRD pending the approval of the Chairman of the Board of Trustees. The motion was unanimously approved.

- There was a motion to reappoint Messrs. Bill Withuin, Steven Butler, David Conrad, Robert Franzen, Stephen Lee, Steve Jackson, Linn Moedinger, George Scerbo, Robert Schueler, Richard Stone, Doyle McCormack, Robert Yuill, David Griner and Matthew Jansen to the SG on Locomotive Boilers pending the approval of the Chairman of the Board of Trustees. The motion was unanimously approved.

7. Report of Subcommittees

a. Subcommittee on Installation (Attachment 2)

Charge: Responsible for developing new rules, revising, interpreting and maintaining existing rules which address administrative and technical requirements for installing pressure retaining items. This subcommittee also directs, supports, reviews and approves any items forwarded by each subgroup functioning under this subcommittee.

Membership: Michael Richards (Chair), Paul Bourgeois, Geoff Halley, Craig Hopkins, Stan Konopacki, Brian Moore, Don Patten, Gary Scribner, Raymond Snyder, Harold Tyndall, Jeanne Bock (Secretary).

Mr. Richards reported on the following:

1) Inquiries

There were no inquiries submitted for this subcommittee.

2) Action Items

NB08-0320 ***Part 1, 4.3,*** **NB08-0321,** ***Part 2, 1.5*****, NB08-322,** ***Part 3, 3.2*** - Add a new paragraph in 4.3 General Requirements to address change of service for a pressure vessel. These requirements should caution installers, inspectors, owners, and jurisdictional authorities of the inherent dangers involved when changing service. A new supplement should be added to address the specific requirements for installation of pressure vessels that are being converted from one service to another. (Attachment 2, pp. 1-6)

- Mr. Wielgoszinski gave a progress report. These items span all three parts of the NBIC. The task group met on Monday and developed a proposal. The proposal indicates a supplement for Part 2 Inspection that each part will make reference to for guidance in change of service for a pressure retaining item. The list of guidelines for change of service include: Factors to consider when making the change, materials, operating environment, design, operating history. These guidelines will drive the user go to their Jurisdiction for approval before usage.

  Mr. Wielgoszinski plans to update the proposal and send it out as a comment letter ballot to the SC and appropriate SGs for comment.

NB08-2101 ***Part 1 Installation SG on Boilers*** **-** CSD-1 does not address solid fuel firing and it would be appropriate for the NBIC to look into it. A task group of G. Halley (Chair), M. Richards, G. Scribner and B. Moore has been assigned. (Attachment 2, pp. 7-14)

- Mr. Richards gave a report on this action item. He presented a handout from Geoff Halley and described the action item. It is broken down into four parts, definitions, functional description, installation requirements and inspection requirements. Mr. Richards made a motion to move the definitions to the glossary after letter balloting them. The motion was unanimously approved.

NB10-0201 ***Part 1 S3*** **-** Expand the section on installation of thermal fluid heaters. This action item is a result of splitting NB09-0601into two parts. A task group of G. Halley and P. Bourgeois has been assigned. (No Attachment)

- A progress report was given.

NB10-1201 ***Part 1 SC Installation-*** Request for a format change to NBIC Part 1 Code Rules. A task group of G. Scribner, S. Konopacki and D. Patten has been assigned. (No Attachment)

- A progress report was given. Mr. Scribner presented a power point to the SC and would like to send this information to the other committees for comment before the next meeting.

NB11-0802 ***Part 1, 1.4.5 SG Boilers*** **-** Boiler Installation Report review. A task group of D. Patten (Chair), G. Scribner, B. Moore and M. Richards has been assigned. (No Attachment)

- A progress report was given. Mr. Patten is taking the lead of the item.

NB11-1901 ***Part 1, SG Fiber Reinforced Plastic-***Installation of High Pressure Composite Pressure Vessels. The FRP Subgroup initiated this proposal to provide guidance for a safe installation of high pressure vessels operating in close proximity to the public. (No Attachment)

- A progress report was given. The SG on FRP is continuing to work on this item.

NB11-2001 ***Part 1, 2.9.4 SG Pressure Vessels and Piping*** **-** Address the safe venting of isolatable economizers where the outlet is below the inlet of other communicable chambers (headers, drums, etc). (Attachment 2, pp. 16-17)

- This item was letter balloted but the ballot was withdrawn before it closed due to the negative comments received. Mr. Patten presented those negative votes to the SC and they decided that there was no need for a wording change and they unanimously approved the reaffirmation of this item. Mr. Richards made a motion to re-ballot the item to the NBIC Committee. The motion was unanimously approved.

NB12-0302 ***Part 1, SG Pressure Vessels and Piping-*** Define installation requirements for PVHO (hyperbaric chambers). (No Attachment)

- A progress report was given. The SC will continue to try to define the requirements for installation of these vessels depending on if these are single or multi chambered devices.

NB12-0304 ***Part 1, SG Pressure Vessels and Piping*** - Installation requirements for carbonated beverage systems. (Attachment 2, pp.18- 23)

- Mr. Scribner reported that there are several stakeholders on the task group to address this item. There are representatives from the Jurisdiction, The McDonald's Corporation, Manufacturers, Distributers, Fire Service, the NB Test Lab and Insurance Agencies. This item was approved at the SC level with one negative vote. There was a motion to letter ballot this item to the MC. The motion was unanimously approved.

NB12-1301 ***Part 1, SG on Boilers*** - Delete the definitions of power boiler and high temperature water boiler from this section. This action item is a result of NB07-1208. (Attachment 2, pp. 24-25)

- There was a motion to move the existing definitions of 2.2 and 3.2 to the glossary. These definitions include power boiler, high temperature water boiler, steam heating boiler, hot water heating boiler and hot water supply boiler. The motion was unanimously approved.

NB12-1401- *Part 1, SG on Boilers* - Reference item NB09-0204. Address the installation of Potable Water Heaters. A task group of G. Scribner, P. Bourgeois, B. Moore, and H. Tyndall was assigned. (No Attachment)

- A progress report was given. The task group will have additional information at the January 2013 meeting.

NB13-0101 – ***Part 1, SG on PVP*** - A system description of the liquid carbonated beverage systems. Mr. Scribner felt that help was needed to better understand how these systems operate. (Attachment 2, pp. 26-29)

- There was a motion to approve letter balloting this item. The motion was unanimously approved.

NB13-0301 *Part 1, SC Installation* - This item is a result of extensive discussions on action item NB12-1301 in the SC on Installation. NB13-0301 was opened to readdress the definition of a power boiler and add a definition of a boiler. (Attachment 2, pp.

There was a motion to letter ballot these definitions to the NBIC Committee. The motion was unanimously approved.

b. **SC on Inspection (Attachment 3)**

Charge: Responsible for developing new rules, revising, interpreting and maintaining existing rules which address administrative and technical requirements for inspection of pressure retaining items. This subcommittee also directs, supports, reviews and approves any items forwarded by each subgroup functioning under this subcommittee.

Membership: Don Cook (Chair), Tim Barker, Domenic Canonico, Mark Horbaczewski, Jim Getter, Greg McRae, Mark Mooney, Venus Newton, David Parrish, Ralph Pate, Bob Reetz , John Richardson, Jim Riley, Jason Safarz, Mike Schwartzwalder, Stan Staniszewski and Bill Smith (Secretary).

Mr. Cook reported on the following:

1) Inquiries

IN12-0201 *Part 2, 5.5.2-5.5.2.3 SC Inspection* - Q: If a National Board Commissioned Inspector has verified the replacement of stamped data or nameplate by an "R" Certificate Holder on Corrugated rolls that are not stationary and subject to operation in multiple Jurisdictions, possibly by multiple owners, is the application of an NB-136 "Replacement of Stamped Data" form required? A: No, if performed by an "R" Certificate Holder and verified by an National Board Commissioned Inspector the responsibility of traceability and nameplate accuracy is on the Certificate Holder similar to nameplate replacement in the NBIC Part 3, 5.5.9.5. (No Attachment)

- A progress report was given. These questions are related to the NB-136 Form. A TG of Mark Mooney, Domenic Canonico, Buddy Dobbins, Timothy Barker and Darin Daley has been assigned. These inquiries are being discussed with the action item NB12-1801 as they are all related and are from the same inquirer.

IN12-0202 *SC on Inspection Part 2, 5.2* – Q: Can an NB-136 "Replacement of Stamped Data Form" which is required to be signed by a National Board Commissioned Inspector, for Corrugated Rolls that are not stationary and subject to operation in multiple

Jurisdictions, possibly by multiple owners, be filed with The National Board and copied ` to the applicable Jurisdiction in lieu of obtaining an approval signature from the Jurisdiction? A: Yes, the approval from one Jurisdiction should not be incumbent on any other Jurisdiction due to transient nature of Corrugated Roll Pressure Equipment. Similarly, if there was no Jurisdiction in the location of installation another Jurisdiction would be compelled to accept National Board filing if the equipment is moved. (No Attachment)

- A progress report was given. These questions are related to the NB-136 Form. A TG of Mark Mooney, Domenic Canonico, Buddy Dobbins, Timothy Barker and Darin Daley has been assigned. These inquiries are being discussed with the action item NB12-1801 as they are all related and are from the same inquirer.

3) Action Items

NB07-0910 ***Part 2 S6 SG Inspection Specific*** **-** Review DOT supplement. A task group of S. Staniszewski (Chair), G. McRae and J. Riley has been assigned. This specific Supplement should be reviewed by the task group for completeness and accuracy. (No Attachment)

- A progress report was given, no action on this item as Mr. Staniszewski was not present. Mr. Cook reported that there have been discussions with the National Board and ASME. DOT is saying that in order for them to adopt the NBIC it must be available to users for free. There is a conflict between giving the information away for free and protecting copyright laws as well as the issue of cost to produce the information. This is more so of an issue for ASME.

NB08-0701 ***Part 2 S7 SG on Inspection Specific*** **-** Add a requirement for change of service from above ground to below ground installation of LPG tanks. We also need requirements for how to inspect these tanks. A task group of G. McRae (Chair), G. Galanes, J. Getter, V. Mullins, J. Reed, D. Cook, J. Richardson and V. Newton has been assigned. (Attachment 3, p. 1)

- There was a motion to send this item out as a letter ballot. The motion was unanimously approved.

NB08-0703 ***Part 2 S7SG on Inspection Specific*****-** Investigate the feasibility of marking or stamping a re-rated name plate on a LPG tank that is being altered from an above ground tank to a below ground tank. A task group of G. McRae (Chair), G. Galanes, J. Getter, M. Huffman, V. Mullins, J. Reed, D. Cook, J. Richardson, and V. Newton has been assigned. (No Attachment)

- There was a motion to close this item with no action taken. This issue is taken care of in action item NB08-0701. The motion was unanimously approved.

N**B10-0601** ***Part 2, SC S6, SG on Fiber Reinforced Plastic*****-** Inspection of high pressure composite vessels. (No Attachment)

- A progress report was given. This item is currently being letter balloted to the SG on FRP.

NB10-1301 ***Part 2 SG Inspection Specific*****-** Address anhydrous ammonia nurse tank inspection. A task group of G. McRae, (Chair), S. Staniszewski, J. Getter and R. Reetz has been assigned. (Attachment 3, pp. 2-3)

- There was a motion to letter ballot this item to the Main Committee. The motion was unanimously approved.

NB11-0201 ***Part 2, S2 SG Historical Boilers-*** Address limits for bulged stayed firebox sheets. A task group of R. Bryce, D. Cook and F. Johnson has been assigned. (No Attachment)

- A progress report was given. The subgroup is still discussing this issue.

NB11-0203 ***Part 2, S2, 13.9.1 SG Historical Boilers -*** Revise text and figure to incorporate the correct percentage of wasting allowed. A task group of M. Wahl and T. Dillon has been assigned. (No Attachment)

- There was no action on this item as it was assigned to the wrong subcommittee. This item needs to be moved to Part 3, Repairs and Alterations.

NB11-0204 ***Parts 2 & 3, S2 SG Historical Boilers-*** Review NDE requirements of stayed areas**.** A TG of M. Wahl (Chair), J. Larson and F. Johnson has been assigned. (No Attachment)

- A progress report was given. Mr. Cook stated that there is.no way to get a picture of stayed areas. You have to do a radiograph of the crack before you can repair it. The task group is continuing to work on this issue.

NB11-0901 ***Part 2 S6, SG on Historical Boilers-*** Add charts and formulas for calculating the MAWP of cylindrical components under external pressure. (No Attachment)

- There was a motion to close this item with no action taken because there is no way to create a chart for this request. The motion was unanimously approved.

NB11-1101 ***Part 2, S2.6.2 b)****,* ***SG on Historical Boilers*** -This section should be revised to provide more guidelines for evaluating local pitting corrosion versus general corrosion. (No Attachment)

- A progress report was given. The SG on HB is still working on this issue.

NB11-1601 ***Part 2, Table S2.10.4.1 SG on Historical Boilers*** -This chart contains errors in formula and should be revised. (Attachment 3, pp. 4-12)

- There was a motion to letter ballot the subcommittee on Inspection and then letter ballot the Main Committee on this item. The motion was unanimously approved.

NB11-1603 ***Part 2, S2.10.2 SG on Historical Boilers-*** Define deteriorated rivet heads. (Attachment 3, pp. 13-21)

- There was a motion to letter ballot the subcommittee on Inspection and then letter ballot the Main Committee on this item. The motion was unanimously approved.

NB11-2101 ***Part 2, SG Inspection Specific-*** Address refurbished tanks. (Attachment 3, pp. 22-24)

- Add a new paragraph to this section to address refurbishing and changing numbers about corrosion. There was a motion to letter ballot this item to the Main Committee. The motion was unanimously approved.

NB12-0604 ***Part 2, Forms NB-6 and NB-7 SG Inspection General*** **-** Change these forms to become current with Jurisdictional requirements. (Attachment 3, 25-27)

- There was a motion to approve the revised forms. The motion was unanimously approved.

NB12-1501 ***Part 2 SG Inspection General*** Review inspection requirements so as to align with installation requirements in Part 1. (No Attachment)

- A progress report was given. The SG is looking at the foreword of the NBIC to be in sync with the other books.

NB12-1801 ***Part 2, 5.5.2-5.5.3, SG Inspection Specific*** - Replacement of stamping during in-service inspection. (No Attachment)

- A progress report was given. The SC is linking this item to the inquiries received from this same group. A task group of Buddy Dobbins, Domenic Canonico, Timothy Barker, Mark Mooney and Daren Dailey has been assigned.

NB12-1901 ***All three parts SC on Inspection*** This action item was opened as a result of NB11-1501 to address the usage of the words "metal" and "material". The task group of Venus Newton (Chair), Brian Moore and Jim Pillow has been assigned to examine their respective parts. (Attachment 3, p. 28)

- Mr. Cook reported with a handout. There was a motion to change “metal” to “material” in the indicated places from Part 2. Parts 1 and 2 were fine and did not need to be addressed. Subcommittee R and A reported later in the meeting that there are a few locations where metal would still be used instead of material. The motion was approved but with two negatives one from Alton Cox and Robert Wielgoszinski. Part 3 will not change and Bob regards this as a disconnect between the two parts.

c. SC on Repairs and Alterations (Attachment 4)

Charge: Responsible for developing new rules, revising, interpreting and maintaining existing rules which address administrative and technical requirements for repairing or altering pressure retaining items. This subcommittee also directs, supports, reviews, and approves any items forwarded by each subgroup functioning under this subcommittee.

Membership: George Galanes (Chair), , Paul Edwards, Wayne Jones, Jim Larson, , Ed Ortman, Jim Pillow, Bryan Schulte, Jim Sekely, Mike Webb and Jim McGimpsey (Secretary).

Mr. Galanes reported on the following:

1) Inquiries

IN11-0903 ***Part 3, 4.4.4 SC Repairs and Alterations-*** Question: If the installation of the new nozzles is considered an alteration(s) (in accordance with NBIC NB23, 2007 Edition, para. 3.4.4) is the R Certificate Holder required to prepare a detailed alteration plan covering the scope of the repair (3.4.4.1) prior to commencement of any work? Answer: Yes. (No Attachment)

- There was a motion to close this inquiry with no action and write letter to the inquirer stating that these inquiries are borderline consulting. The motion was unanimously approved.

IN11-0904 ***Part 3, 4.4.4.1 a) SC Repairs and Alterations*** - Question: Does the R Certificate Holder have to have the detailed alteration plan and R-2 form reviewed and certified by an Engineer meeting the criteria of ASME VIII Div. 2 or 3 prior to commencement of the work?

Answer: Yes (No Attachment)

- There was a motion to close this inquiry with no action and write letter to the inquirer stating that these inquiries are borderline consulting. The motion was unanimously approved.

IN12-0401 ***Part 3, 4.4.2 SC Repairs and Alterations*** Question 1: In Part 3, 4.4.2 a) is it the purpose of the rule to require a liquid pressure test at a pressure less than 150% of the maximum allowable working pressure (MAWP) stamped on the pressure-retaining item, as adjusted for temperature? A1: No.

Question 2: In Part 3, 4.4.2 a) is it allowable to perform a liquid pressure test at a pressure less than 150% of the MAWP stamped on the pressure-retaining item to verify the leak tightness of the alteration? A2: Yes (Attachment 4, pp. 1-2)

- Bryan Schulte presented proposed interpretations and responses. The items were modified to incorporate permission from the Inspector and Jurisdiction There was a motion to approve the questions and answers as modified. The questions and answers were unanimously approved.

2) Action Items

NB10-0103 ***Part 3 Part 3 S2.13.9.2 SG on Historical Boilers-*** Resolve conflict of text and figure. S2.13.9.2. (Attachment 4, pp. 3-5)

- Mr. Reetz reported with a handout of revised wording. There are seven parts to this item. The subgroup is trying to correct the wording and figures as shown in the handout. There was a motion to letter ballot this item. The motion was unanimously approved.

NB10-0110 ***Part 3 S6.19.1 TG on DOT*** Combine and clarify requirements within S6.15 for TR-Forms, S6.18 Preparation of TR-Forms and S6.19 for Reports of Repairs, Alterations and Modifications. (No Attachment)

- A progress report was given. Mr. Galanes reported that Stan had sent him some wording but the SC did not address it and will wait for Stan to discuss the proposed changes.

NB10-1004 ***Part 3 S2 Fig. S213.13.1 SG on Historical Boilers-*** Figure and title are incorrect. Figure should show caulking of seam and rivet heads. The title should reflect caulking of seam and rivet heads also. (Attachment 4, pp. 6-8)

- Mr. Reetz reported with a handout of proposed wording. There was a motion to approve the changes shown in the handout. The motion was unanimously approved.

NB11-0203 ***Part 2, S2, 13.9.1 SG Historical Boilers -*** Revise text and figure to incorporate the correct percentage of wasting allowed. A task group of M. Wahl and T. Dillon has been assigned. (Attachment 4, pp. 9-11)

- There was no action on this item in SC Inspection because it needed to be moved to Part 3, Repairs and Alterations. Mr. Reetz presented a handout with proposed changes. There was a motion to letter ballot this item. The motion was unanimously approved.

NB11-0701 ***Part 3, S3.5.4 SG on Graphite-*** Address graphite tube replacement. (No Attachment)

- A progress report was given. This item will be letter balloted to the SG and will move up the chain

to the Main Committee.

NB11-1001 ***Part 3, 3.3.4.9, SG on R/A Specific-*** Tube plugging for fire tube boilers. (No Attachment)

- A progress report was given. Mr. Pillow reported that this item has turned out to be more complex than what they originally thought.

NB11-1201 ***Part 3, 1.8, SG on R/A General-*** Revise Part 3, 1.8 "NR" Accreditation requirements to include repairs to ASME Section III stamped components. (No Attachment)

- A progress report was given. Mr. Edwards reported that this is an opportunity to enhance the NR program. The TG met on Monday and they are continuing to work toward the goal of printing in the 2015 edition.

NB12-0403 Part 3. SG R/A General - Develop code text to address use of temper bead weld repair for Grade 91 tube material. (Attachment 4, pp. 12 – 56)

- A progress report was given. A task group of George Galanes and EPRI representatives has been formed**.**

NB12-0501 ***Part 3, 3.2.2 c) SG R/A General-*** Hydrostatic testing of pressure parts. (No Attachment)

- A progress report was given. Mr. Wielgoszinski reported that the task group is working on resolving the issues relative to performing pressure test on items that have a code stamp.

NB12-0603 ***Part 3, 1.5.1, 1.7.1, 1.8.1, SG R/A General*** - Removal of administrative requirements from Part 3. (Attachment 4, pp. 57- 114)

- There was a motion to letter ballot this item to the subcommittee of RA and PRD and then move it up to the NBIC Committee. The motion was unanimously approved.

NB12-0801 ***Part 3, SG R/A General*** -Repair and Alteration of Gasketed PHE's in the field. (No Attachment)

- A progress report was given. The task group has formed and a brief presentation was given. There was also a request to change this item to the SG on R/A Specific.

NB12-1101 ***Part 3, 5.13.1 SG R/A General***- Revision of R forms. (Attachment 4, pp.115- 118)

- Mr. Mike Webb reported that the item was revitalized after a publishing error. There was a motion to letter ballot this item. The motion was unanimously approved.

NB12-2001 Part 3, 5.13.4.1 ***SG R/A General*** **-** Revise text in this section to address the inconsistent interpretations of item 12 of the R form. This item will be handled by the same TG handling NB12-1101. (Attachment 4, pp. 119 - 120)

- This action item was created in an effort to promote consistency in completion of data reports. The language that is currently in the NBIC needed to be relaxed. There was a motion to approve letter balloting this issue. The motion was unanimously approved.

NB12-2101 ***Part 3, 4.2 SG R/A General*** – A recommendation to change the reference in this section from 2001 to 2006. (Attachment 4, pp. 121 -126)

- There was a motion to approve making this change. Electronic Search and this only impacts Part 3. Bring 3 in-line with ASME Sections 3, 5 and 8. The motion was unanimously approved.

NB13-0201- ***SG HB*** –Correction errata in this supplement. (Attachment 4, pp. 127- 138)

- There was a motion to letter ballot these changes. The motion was unanimously approved. Correction errata SG on HB letter ballot these 4 items.

d. Subcommittee on PRD (Attachment 5)

Charge: To develop new rules, revise, interpret and maintain existing rules which address administrative and technical requirements for installation, inspection and repairs of pressure relief devices.

Membership: Frank Hart (Chair), Marianne Brodeur, Sid Cammeresi, Alton Cox, Denis DeMichael, Robert Dobbins, Robert Donalson, Thakor Patel, Raymond McCaffrey, Kevin Simmons and Tom Beirne (Secretary).

Mr. Ball reported on the following:

1) Inquiries

IN12-0301 A ***Part 2, 2.5.8, SC on PRD***- Q: The table of suggested inspection and test frequencies in 2.5.8 f) does not include a column for "test frequency". Is the suggested test frequency the same as the suggested inspection frequency? Proposed reply: Yes (Attachment 5, p.1-3)

- Mr. Ball reported with a handout. There was a motion to approve the proposed question and reply. The motion was unanimously approved.

IN12-0301 B ***Part 2, 2.5.8***, ***SC on PRD***- Q: When test records and/or inspection histories are available, can the guidelines in 2.5.8 g) be used to establish inspection and test frequencies, even if a suggested frequency is given in the table in 2.5.8 f)? Proposed reply: Yes (Attachment 5, p. 4)

- Reworded the question and reply. Motion to approve. Motion was unanimously approved.

IN12-0301 C ***Part 2, 2.5.8*** , ***SC on PRD***- Q: For relief devices on a pressure vessel in clean dry gas service, if testing records are available, and a testing frequency is established in accordance with 2.5.8 g) may the interval between relief device tests exceed 5 years? Proposed reply: Yes (Attachment 5, p. 5)

- The SC on PRD discussed this extensively and decided to close this item with no action as this issue was answered in the preceding question. There was a motion to close this item. The motion was unanimously approved.

IN12-0301 D ***Part 2, 2.5.8***, ***SC on PRD***-Q: For relief devices on a pressure vessel in clean dry gas service, if testing records and inspection histories are available, and a testing frequency is established in accordance with 2.5.8 g), may the interval between inspections be different than the interval between tests. For example, in clean dry gas service, would it be acceptable if the relief

devices were inspected every 2 years, but tested every 6 years? Proposed reply: Yes (Attachment 5, p. 6)

- There was a motion to close this item with no action. The inquirer withdrew the inquiry. The motion was unanimously approved.

IN12-0301 E *Part 2, 2.5.8, SC PRD* Q: Once an acceptable relief device test interval has been established per 2.5.8 g), is it acceptable to replace the relief devices with new devices, of the same make and design, at the established test frequency, in lieu of testing the relief devices? For example, in clean dry gas service, would it be acceptable if the relief devices were inspected every 2 years, and replaced every 6 years in lieu of functional testing, with a random sample of replaced devices being bench tested to confirm that the 6-year interval is still acceptable? Proposed Reply: Yes (Attachment 5, p. 7)

- Mr. Ball reported with a handout of a proposed question and reply. There was a motion to approve this question and reply. The motion was approved with one abstention from Mr. Wielgoszinski.

IN13-0101 *Part 3, 1.7 SC PRD* Q: May the VR stamp be applied to pressure relief valves bearing the ASME Certification mark with the V, HV, UV, or NV designator? Reply: Yes. (Attachment 5, p.8)

- There was a motion to approve the SC PRD question and reply. The motion was unanimously approved.

2) Action Items

NB11-0401 *Part 4, SC PRD* - The development of a possible fourth part of the NBIC to cover pressure relief topics. (No Attachment)

- A progress report was given. In the Executive Committee it was discussed that the SC PRD send a survey to NBIC users and stamp holders for their opinion on developing a Part 4.

NB**12-0901 *Part 4 SC on PRD*** - Prepare a guide for repair of tank vents. (No Attachment)

- A progress report was given. Mr. Denis DeMichael reported that shops are eliminating their maintenance programs and are going to VR shops for repair. These devices are not made ready to install so we would like to develop something for guidance of the repair of these vents.

NB12-1701 Part 2, *SC on PRD*- Suggestion to make it mandatory for manufacturers to make it public to all assemblers and VR stamp holders if there is a problem with their valves. (Attachment 5, pp.9-11)

- There was a motion to close this item with no action as this is beyond the scope of the NBIC. A letter will be sent to the inquirer explaining what happened. The motion as unanimously approved.

8. Liaison Activities

a. BOT Activities – Gary Scribner reported for Mr. Jack Given as he was absent that the BOT appreciates all that the members do and that it is a great help to the Jurisdictions.

b. ASME- Mr. Paul Edwards reported on the following ASME developments:
   - ASME is planning to implement a process that the QRR would be available to applicant

certificate holders electronically on CA Connect.

- The QAI are going to be able to provide feedback on the AIA from the team leader during joint reviews. It was recognized that ASME was not getting much feedback about the agencies except on three year reviews. Team leaders will be requested to fill out a checklist questionnaire regarding the activities of the AIA during the joint review.
- A part certificate program for third party accreditation for fabrication of parts and not design.

c. AWS- Jim Sekely- A task group was formed to develop procedures for use by the Navy led by Harvey Castor who is working as a subcontractor for the Navy. The publication of these procedures is being stalled by concerns over who owns the rights to sell them. There are also several Standard Welding Procedures that have been reaffirmed. This means the original documents still good for another 5-10 years.

d API- Jim Riley API 510 code was due for their 5 year renewal. Changes made by the editor that are pretty open. Jurisdictions should look at those if they have boiler boards for API 510. A new practice was being balloted for a recommended practice for corrosion under insulation manual available soon.

e. I.C.C.-Gary Scribner reported in Chuck Withers' absence. - The ICC is requesting input from the National Board and ASME to help develop their code.

f. PCC- Terry Parks – No report at this time.

g. Others- Mr. Scribner discussed the importance of the CO2 tank issue and hopes to have a letter ballot of the requirements to install and inspect these vessels. They plan on allowing the National Board test lab to do some verification testing on some of the valves before they send out a letter ballot

9. New Business

NB12-1602 *NBIC* Procedure -This action item was opened as a result of the negative votes received for the NBIC procedure Rev. 11. (No Attachment))

- Mr. Wielgoszinski is requesting to develop a new paragraph in the NB procedure that clarifies that if there are items that have passed and negative voters have not been responded to the action is still approved as long as there are enough affirmative votes. There was a motion to send this out for letter ballot. The motion was unanimously approved. Recommended changes are presented in the agenda.

  The negative votes and comments from NB12-1601must be addressed to follow ANSI procedures. A new action item, NB13-0401 will be opened to address proposed change to NB-240.

10. Election of NBIC Committee Chairperson.

M**r.** Gary Scribner nominated Mr. Don Cook and Mr. Robert Wielgoszinski nominated Mr. George Galanes.

Each nominee spoke briefly about their experience and why they should be the next Chairman.

Mr. Richard Allison counted the paper ballots and Mr. Don Cook will be the Chairman of the

NBIC Committee pending the approval of the Chairman of the Board of Trustees.

11. Future Meetings

The following meetings have been scheduled:

January 14-18, 2013, Mobile, Alabama
July 15-19, 2013, Columbus, Ohio

12. Adjournment

Mr. Terry Parks made a motion to adjourn the meeting at 2:00. The motion was unanimously approved.

Respectfully Submitted:

Robin Hough
NBIC Committee Secretary

ATTACHMENT 1

Attendance List NBIC Committee

Meeting Date: July 19, 2012

Stanley Staniszewski, Jr. US Dept. of Transportation, Pipelines & Administration Hazardous Materials Safety 1200 New Jersey Ave. S.E. Washington, DC 20590 Ph: 202-366-4545 x 0453 Fax: 202-366-3753 E-mail: stanley.staniszewski@dot.gov	Attended: Yes ☐ No ☒ RMH *Initial*	**Domenic A. Canonico** Canonico & Assoc. ~~35 Old Riding Way~~ Signal Mountain, TN 37377 1423 EAST BROW ROAD Ph: 423-886-1008 Fax: E-mail: canonicod@~~bellsouth.net~~ cpbfi.com	Attended: Yes ☒ No ☐ DAC *Initial*
James T. Pillow Common Arc Corporation 67 Wyndemere Lane Windsor, CT 06095 Ph: 860-688-2531 Fax:860-688-2531 E-mail: JPillow@Commonarc.com	Attended: Yes ☑ No ☐ *Initial*	**Paul D. Edwards** Director, ASME Programs Stone & Webster, Inc. 100 Technology Center Drive Stoughton, MA 02072 Ph: 617-589-5690 Fax: 617-589-1792 E-mail: paul.edwards@shawgrp.com	Attended: Yes ☑ No ☐ *Initial*
Robin Hough NBIC Coordinator The National Board of B&PVI 1055 Crupper Ave. Columbus, OH 43229 Ph; 614-888-8320 Fax: 614-847-1828 E-mail: rhough@nationalboard.org	Attended: Yes ☒ No ☐ RMH *Initial*	**George W. Galanes, PE** Manager, Metallurgy and QA Edison Mission Group/Midwest Generation 235 Remington Blvd. Boilingbrook, IL 60440 Ph: 630-771-7927 Fax: 312-788-5218 E-mail: ggalanes@MWGen.com	Attended: Yes ☒ No ☐ *Initial*
Frank Hart Director Valve Services Furmanite COE Worldwide 6330 Dixie Drive Houston, TX 77087 Ph: 713-844-7623 Fax: 713-844-9245 E-mail: fhart@Furmanite.com	Attended: Yes ☐ No ☒ RMH *Initial*	**Craig Hopkins** Seattle Boiler Works 500 South Myrtle Street Seattle, WA 98108 Ph: 206-762-0737 Fax: 206-762-3516 E-mail: chopkins@seattleboiler.com	Attended: Yes ☐ No ☒ RMH *Initial*
Robert V. Wielgoszinski Hartford Steam Boiler I & I of CT. One State Street Hartford, CT 06103 Ph: 860-722-5064 Fax: 860-722-5705 E-mail: Robert_wielgoszinski@hsbct.com	Attended: Yes ☒ No ☐ RVW *Initial*	**Terry Parks** The National Board 1055 Crupper Avenue Columbus, OH 43229-1183 Ph: 614-888-8320 Fax: 614-847-1828 E-mail: tparks@nationalboard.org	Attended: Yes ☒ No ☐ TMP *Initial*

Attendance List NBIC Committee

Meeting Date: July 19, 2012

Don Cook Principal Safety Engineer Dept. of Industrial Relations Div. of Industrial Safety & Health 1515 Clay Street, Suite 1302 Oakland, CA 94612-1302 Ph: 510-622-3050 Fax: 510-622-3063 E-mail: dcook@dir.ca.gov	Attended: Yes ☑ No ☐ *Initial*	**David Parrish** FM Global 1151 Bos-Prov Turnpike PO Box 9102 Norwood, MA 02062-9102 LAST MEETING! P: 781-255-4734 Been F: 781-762-9375 Fun. E-mail: david.parrish@fmglobal.com	Attended: Yes ☒ No ☐ *Initial*
Larry McManoman Great Lakes Apprenticeship Program 566 W. 95th Street Oak Lawn, IL 60453 Ph: 708.636.6656 Fax: E-mail: Lmac@gLabap.com	Attended: Yes ☐ No ☒ *Initial*	**H. Michael Richards** Southern Company 42 Inverness Center Pkwy. Birmingham, AL 35242 Ph: 205-992-7111 Fax: 205-992-0361 E-mail: hmrichar@southernco.com	Attended: Yes ☒ No ☐ *Initial*
John Richardson Consultant - Dresser, Inc. 980 Richardson Road Colfax, LA 71417 Ph: 318-627-5504 Fax: 318-627-2969 E-mail: jwrichar@aol.com	Attended: Yes ☑ No ☐ *Initial*	**James Sekely** Welding Services, Inc. 716 Vanderbilt Drive Monroeville, PA 15146 Ph: 412-389-5567 Fax: 724-327-7381 E-mail: jsekely@comcast.net	Attended: Yes ☑ No ☐ *Initial*
Raymond Snyder Arise 150 Costa Loop Auburndale, FL 33823 Ph:865-965-4417 Cell: 732-778-6024 Fax: 865-967-0185 E-mail: Raymond.snyder@ariseinc.com	Attended: Yes ☒ No ☐ *Initial*	**Gary Scribner** Missouri Division of Fire Safety P.O. Box 844 Jefferson City, MO 65102 Ph: 573-751-8708 Cell:573-230-3160 Fax: 573-526-5971 E-mail: gary.scribner@dfs.mo.gov	Attended: Yes ☐ No ☑ *Initial*

Attendance List NBIC Committee

Meeting Date: July 19, 2012

Robert Reetz Chief Boiler Inspector North Dakota Insurance Department Boiler Inspection Program 1701 S. 12th Street Bismarck, ND 58504-6644 Ph: 701/328-9607 Fax: 701/328-9610 E-mail: **breetz@nd.gov**	Attended: Yes ☒ No ☐ *Initial*	**Paul Bourgeois** Travelers Insurance ~~11441 Sarasota Lane~~ 6812 5th ST Northport, AL ~~35475~~ 35476 Ph:205-339-6314 Fax: 888-803-1522 E-mail: pcbourge@travelers.com	Attended: Yes ☑ No ☐ *Initial*
Bryan Schulte NRG Maintenance Services 12307 Kurland Drive Houston, TX 77034 Ph: 713-795-1456 Fax: 713-795-1451 E-mail: bryan.schulte@nrgenergy.com	Attended: Yes ☒ No ☐ *Initial*	**Ron Pulliam** Babcock & Wilcox Construction 74 Robinson Ave. BR07 Barberton, OH 44203 Ph; 330-860-2856 Fax: 330-860-2180 Email: RLPulliam@babcock.com Brian Dosed Sitting in for Ron Pulliam	Attended: Yes ☐ No ☐ *Initial*
Mike Webb Xcel Energy 9500 Interstate 76 Henderson, CO 80640 Ph:303-628-2840 Fax: 303-628-2928 E-mail: mike.webb@xcelenergy.com	Attended: Yes ☑ No ☐ Initial	**Jim Riley** ~~Conoco~~ Phillips 66 1380 San Pablo Ave. Rodeo, CA 94572-1354 P: 510-245-5895 F: E-mail: jim.riley@~~conocophillips~~PG6.com	Attended: Yes ☒ No ☐ Initial
Benjamin Anthony Chief B&PV Inspector Department of Labor & Training Division of Occupational Safety 1511 Pontiac Ave., Bldg. 70-2 PO Box 20157 Cranston, RI 02920-0942 Ph: 401-162-8574 Fax: 401-462-8576 Email: banthony@dlt.state.ri.us	Attended: Yes ☑ No ☐ Initial	Name: J. Alton Cox Address: JAC Consulting, Inc. 213 Park View Drive Phone: Belmont, NC 28012 704. 301. 8532 Fax: 704. 820. 8408 E-mail: alton@jaltoncox.com	

Attendance List NBIC Committee

Meeting Date: **July 19, 2012**

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Attendance List NBIC Committee

Meeting Date: **July 19, 2012**

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Attendance List NBIC Committee

Meeting Date: **July 19, 2012**

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Attendance List NBIC Committee

Meeting Date: **July 19, 2012**

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Supplement 9

Requirements for Change of Service

S9.1 Scope:

This Supplement provides requirements and guidelines to be followed when a change of service or service type is made to a pressure retaining item.

Whenever there is a change of service, the local jurisdiction where the pressure retaining item is to be operated shall be notified for acceptance, when applicable. Any specific jurisdictional requirements shall be met.

S9.2 Classification of Service Changes

S9.2.1 Service Contents

A change in service contents is considered to be any modification to the commodity or contents that the pressure retaining item was originally intended to contain when the pressure retaining item was constructed.

For example, a change:

a) From LP gas service to ammonia service.
b) From lethal to non lethal service or vice versa

S9.2.2 Service Type or Change of Usage

A change in service type is considered to be a change of how the pressure retaining item is being used.

For example, a change:

a) From above ground service to underground service for LP gas tanks.
b) From mobile or transport use to stationary use

S9.3 Factors to Consider

Before a change of service is to be made, the owner or user shall consider and evaluate the effects of the new operating conditions or environment on the existing condition and suitability for service of the

pressure retaining item. Various factors will have an impact on the reliability of the pressure retaining item in its new service environment. Changes can be successfully adopted providing there is an understanding of the effect on the pressure retaining item. However, there are some cases where changes are detrimental to the existing pressure retaining item. The owner or user should seek technical guidance of experienced personnel in appropriate areas affected by the change of service (e.g. design, metallurgy, or operations of the pressure retaining item).

The following is a listing of criteria that should be evaluated as appropriate. The criterion is not limited to that listed herein. Other factors may be considered as necessary;

1) Design Consideration:
   a) Thickness of existing vessel material
   b) Vessel or system flow rate or pressure
   c) Weight of vessel with new contents
   d) Existing or additional loads imposed on nozzles and highly stressed areas
   e) Change in pressure or temperature cycling
   f) Compliance to product or industry standards, such as ANSI K61, API 579, or NFPA 58

2) Material Consideration:
   a) Chemical and mechanical properties of existing material or any new material to be added or replaced to assure it has the required strength and toughness to withstand the pressure and temperature effects of the new environment.
   b) Effects of erosion or corrosion
   c) Time dependent effects on service life - creep or fatigue.

3) Environment
   a) Physical condition of the pressure retaining item
   b) Overpressure protection needs
   c) Regulatory environment - Verification of compliance to new or existing jurisdictional rules or regulations.

4) Operational History
   a) A review of current and past operational logs or records should be made to assure that no conditions existed where any further use would render the pressure retaining item hazardous or otherwise unsafe.
   b) Records to be obtained and reviewed would include Data Reports, Repair and Alteration Forms, Inspection reports.

5) Repairs and Alterations Made:

a) A review of any repairs, alterations, reratings, or reconfigurations that have been performed on the pressure retaining item , so as to assure that they will not have a detrimental impact on the intended use.

6) Proposed rework
   a) Any physical work to be performed to restore the material to the existing or intended state or to meet any requirements for the new operating conditions.
   b) Repairs and alterations shall be performed in accordance with NBIC, Part 3.
   c) The effects of heat applied as a result of welding or heat treatment on the material or shaped parts.
   d) The method and extent of any physical or non destructive examination should be considered.
   e) Any physical testing or pressure testing to be performed to determine of verify leak tightness or structural integrity of the pressure retaining item.
   f) The pressure retaining item shall meet the Code requirements for the new environment at the time of change.

7) Documentation
   a) Review existing records that are required to satisfy customer, user, or legal requirements.
   b) Review the need for any marking, stamping, or labeling required for the intended service.

S9.4 Some Examples for Change of Service

The following is a typical list of examples of what constitutes a change in service and some factors to consider. Note: This list is not all inclusive. There may other service changes not mentioned.

Also, the listing of "Factors to Consider" is also not all inclusive. There may be other there are other elements that can influence the safe and reliable operation.

The Owner, the Jurisdiction where the pressure retaining item is to operate in the new environment, and local building Codes, laws, and regulations should be reviewed for additional requirements or prohibitions against a change of service.

Change	Some Factors to Consider
LP gas to ammonia	• PWHT of vessel during construction • Wet-fluorescent magnetic particle testing (WFMT) on all internal surfaces • Internal access of vessel is necessary. May need to install manhole.

Change	Some Factors to Consider
Ammonia to LP gas	• NFPA-58 should be consulted. i.e. restriction on maximum volume • Wet-fluorescent magnetic particle testing (WFMT) on all internal surfaces • Internal access of vessel is necessary. May need to install manhole. • Also see, NBIC Part 2, 2.3.6.4
LP gas service: from above ground to underground	• Requires alterations (additional nozzles). • Corrosion protection • See NFPA 58
LP gas to air receiver	• Assurance of vessel cleanliness. i.e. removal of mercaptan. • Appropriateness and number of inspection and drain openings. • Corrosion allowance
Boiler service: Steam to Hot Water	• May require replacement of smaller steam outlet nozzle with larger nozzle to accommodate condensate carryover
Sulfur dioxide service. Sweet to sour gas service.	• Concern over hydrogen cracking
Lethal service to non-lethal	• Design conditions and suitability for service
DOT railcars or ICC transport tanks to stationary service	• Prohibited by DOT regulations (49 CFR 180) for permanent service. • Temporary stationary service permitted as per NFPA 58 • Inspection for damage mechanisms that may be present from previous service life that is detrimental to the vessel in the new environment.

S9.5 Documentation of Change of Service

Any records, forms, or reports required documenting the change of service event that may be required by contract or the jurisdiction where the pressure retaining item operates shall be completed as specified.

NBIC Part 2

Add new paragraph:

1.6 Change of Service

Supplement 9 provides requirements and guidelines to be followed when a change of service or service type is made to a pressure retaining item.

Whenever there is a change of service, the local jurisdiction where the pressure retaining item is to be operated, shall be notified for acceptance, when applicable. Any specific jurisdictional requirements shall be met.

NBIC Part 1

Add new paragraph:

1.5 Change of Service

See NBIC Part 2, Supplement 9 for requirements and guidelines to be followed when a change of service or service type is made to a pressure retaining item.

Whenever there is a change of service, the local jurisdiction where the pressure retaining item is to be operated, shall be notified for acceptance, when applicable. Any specific jurisdictional requirements shall be met.

NBIC Part 3

Add new paragraph:

1.9 Change of Service

See NBIC Part 2, Supplement 9 for requirements and guidelines to be followed when a change of service or service type is made to a pressure retaining item.

Whenever there is a change of service, the local jurisdiction where the pressure retaining item is to be operated, shall be notified for acceptance, when applicable. Any specific jurisdictional requirements shall be met.

NB08-2101

Part 1, Section 6
Supplement 3

Installation and Control of Solid Fuel (Wood/Biomass) Fired Boilers

(Draft for Review and Comment 6/29/12)

S3.1 – Scope

a) This supplement is intended to provide guidance for the installation and control of boilers which use biomass as a major fuel component. In this context Biomass is intended to mean various types of wood wastes, or wood byproducts.
Many of the requirements of the earlier Sections of Part 1 are common to all boiler installations irrespective of the fuel being fired; therefore this supplement will address the differences that occur when solid fuels, such as Biomass, are being used. Thus the primary thrust of this section will be directed toward the control of the fuel handling and distribution systems.

b) Fuels will vary widely depending upon source, moisture content, particle size and distribution, however once the fuel has been established, good practice dictates that the specification be adhered to as closely as possible in order to minimize handling, combustion and emissions problems.

c) Additionally the emissions control equipment is designed around the initial fuel specification. Any changes in fuel fired will impact on the performance of the various elements of the emissions control system.

d) The typical biomass fired boiler room will comprise not only the boiler with the normal water treatment and feed systems, blow off systems, condensate return systems, steam or hot water systems, but also may include

- Transportation of the fuel from a storage facility to a metering device within the boiler room
- Transportation of the metered fuel to the boiler, for distribution to a combustion system whether it be a grate upon which the combustion takes place, a bubbling fluidized bed, circulating fluidized bed or suspension burner.
- In grate based combustion systems combustion air is typically divided into an underfire air system and an overfire air system, each of which must be closely controlled in order to produce clean, efficient combustion.

- Induced draft fans to overcome the pressure drop of the emissions control equipment
- A fly ash or carbons recycle system, to return unburned carbon to the combustion zone.

S3.2 – Assessment of Installation

a) A general assessment of the complete installation shall be undertaken, in terms of observable results of operating and maintenance practices. Indicators include the general boiler room cleanliness, for example significant quantities of fuel particles (dust) should not be apparent in the boiler room.

b) The combustion air inlet shall be free of any debris or dust particle build up, and where moveable louvered intakes exist, the actuating mechanisms shall be clean and operate freely. Corrective action is required when non-compliance is noted.

c) The flue gas venting system shall be checked for tightness, with no observable signs of leakage. Corrective action is required if leakage is noted.

d) The intakes of the various fans or blowers shall be free of fuel particle build up or signs of other debris. Corrective action in terms of cleaning is required when discrepancies are noted.

e) The fuel metering equipment and the fuel transportation system shall be free from signs of particulate or dust leakage. Corrective action in terms of cleaning and repair work is required as necessary.

f) Electrical equipment and controls shall be properly protected from the ingress of dust, by ensuring that all cover plates are properly installed and all panel doors are intact, operable and closed.

g) Verify that all guards for rotating equipment (shafts, bearings, drives) are correctly installed and fan inlet screens are in place.

h) On the boiler, generally check for signs of potential problems, including;

- Water leaks
- Missing or misaligned pieces or parts
- Condition of support systems
- Provision of “Danger” or “Caution” signs
- Excess vibration
- Excess noise

i) Verify that the Owner/User has established function test, inspection requirements, maintenance and testing of all controls and safety devices in accordance with the manufacturer's recommendations. Verify that these activities are conducted at assigned intervals in accordance with written procedures, non-conformances which impact continued safe operation of the boiler are corrected and the results are properly documented. These activities shall be at a frequency recommended by the manufacturer, or frequency required by the jurisdiction. Where no frequencies are recommended, or prescribed, the activity should be conducted at least annually.

S3.3 – Determination of Allowable Operating Parameters

a) In the case of the combustion side of biomass fired boilers the determination of the allowable operating parameters is most often mandated by the local Air Pollution Control Authority. Thus provided that the defined fuel requirements are adhered to consistently, there is little for the inspector to get involved in.

b) The pressure vessel operating parameters are defined by its design working pressure, rated capacity and safety valve, or relief valve, capacity and thus is no different than boilers fired by more traditional fuels, it terms of inspection requirements.

c) All areas subject to corrosion and erosion shall be closely reviewed. Appropriate repairs shall be undertaken as necessary.

S3.4 – Boiler Installation Requirements

a) Power boilers shall be installed in accordance with the requirements of Section 2 of this Standard. Additionally the requirements of paragraphs S3.5 and S3.6, below should be followed.

b) Steam Heating and Hot Water Heating Boilers shall be installed in accordance with the requirements of Section 3 of this Standard. Additionally the requirements of paragraphs S3.5 and S3.6, below, should be followed.

S3.5 – Fuel System Requirements and Controls

a) Fuel Transport Systems irrespective of type should address certain requirements, including preserving fuel particle size distribution, the prevention of the possibility of fire and the suppression of fires or explosions.
In a single installation various types of fuel transportation systems may co-exist, as follows:

- Conveyor systems
  In these systems fuel is dropped onto a moving belt, bucket elevator, drag link conveyor or a screw or auger mechanism. Speed of the conveyor may be varied to meet fuel demand.
- Lean phase pneumatic systems
  In these systems fuel is dropped into a moving airstream, mixes with the air, and travels through a pipe at a velocity of approximately 5000 ft/min. Air pressures are in the region of 25 inches water column.

b) Solid Fuel Metering Systems may take a variety of forms depending upon the fuel used and the particle size distribution, as follows:

- Variable speed augers
  Variable speed, helically flighted, augers can be located in the bottom of a fuel metering bin. Alternatively they could be a part of a retort type stoker. The auger dimensions, flighting, and speed range are selected on the basis of fuel being burned, its size range, heating value and required boiler turndown range. The metered fuel typically is then dropped into the throat of a venturi, (or in some cases a plain pipe) though which the fuel transport air flows to carry the fuel into the boiler combustion zone, for distribution on a grate, upon which the burning of the fuel takes place.
- Variable speed air-lock valves
  This valve is basically a rotating slotted cylinder, operating within an outer cylinder, suitably sealed to prevent leakage. Rotational speed and slot dimensions can be varied to accommodate changes in fuel flowrate. The fuel passing through the valve, typically, is deposited onto a moving grate type stoker.
- Variable stroke rams
  This is another device that can be located on the bottom of a metering bin, is typically used on smaller units and is essentially a batch feed mechanism. The stroke of the ram is adjusted to set fuel flowrate.

S3.6 – Combustion Requirements

a) Overfire Air/Underfire Air Distribution

When solid fuels are burned on a grate, rather than in fluidized bed units or in suspension, it is normal practice to introduce some of the combustion air under the grate, or bed, and the remainder over the bed. In many cases fuel transport air becomes a part of the over-the-bed combustion air. The proportioning of the overfire to underfire airflow rates is dependent upon several factors, such as fuel particle size, fuel density, burn rate and volatiles. In general the objective is to get as complete a burn on the grate as possible, without creating large quantities of particulate emissions, and then using the overfire air to complete burning of the volatile and small particulate matter, leaving the fuel bed.
Loss of combustion air from either the underfire or overfire source shall cause shutoff of the fuel supply.

The control system shall be capable of maintaining the correct relationship between underfire air and overfire air, over the complete firing range of the boiler, while promoting complete burning with minimum particulate emissions.

b) Programming Controls

Programming controls may be relay based, or on more current units, PLC based. Interactive graphics displays may also be incorporated into the system.

Access to PLC based controls and interactive graphic displays shall be limited to qualified individuals and password protected. PLC functions shall be confined to the normal boiler operating logic, covering startup, interlocks, and normal shutdown sequences.

Safety controls, which cause boiler safety shutdown when activated, shall not be interfered with by the PLC logic.

Consideration should be given to having the PLC logic comply with the requirements of NFPA-85

c) Pre-firing Checks/interlocks

In addition to the Safety Controls defined in Section 3, proof that the various air handling fans or blowers are operating properly is required. This includes:

- Induced draft fans
- Fuel transport fans
- Underfire air and Overfire air fans, and
- Carbon, or flyash, re-injection fans.

In cases where variable speed drives are used on fans, the combustion system manufacturer's instructions shall be followed in terms of the allowable upper and lower limits of the power supply frequency (Hz).

d) Pre-purging

While the need for pre-purging the boiler and its venting system is not as critical in solid fuel fired boilers, as it is in boilers firing the more volatile gaseous or liquid fuels, it is still a requirement. Unless defined otherwise by the manufacturer of the fuel burning equipment, the pre-purge can be achieved by operating the induced draft fan prior to starting the remaining fans in the installation.

Purge air volume shall be set during commissioning by the combustion system manufacturer, or the manufacturer's representative, in accordance with applicable Codes or Standards and shall not be capable of being reset by operating personnel.

e) Ignition Systems

Solid fuel ignition systems, or methods, can vary from the placement of manually ignited, oil soaked rags on the fuel bed, to gas or oil fired pilot burners or lances.

f) Firing Rate Control and Fuel/Air Ratio Control
The control system shall be capable of maintaining the desired air to fuel ratio over the entire firing range of the boiler, while promoting clean, stable combustion.

g) Re-injection Systems
In installations where fly ash is re-injected from a multi-cyclone collector into the combustion zone for carbon re-burn; precautions should be taken to ensure that plugging of the reinjection pipe work does not occur. Consideration should be given to installing cleanouts in the pipe work.

h) Shutdown and Post Purge
Unless the boiler manufacturer's instructions state otherwise, the fuel supply shall be terminated at shutdown, and the overfire air should remain on until the fuel bed is burned out, and the residue cooled.

S3.7 – Boiler Room Cleanliness

a) While boiler room cleanliness is of primary importance in all boiler rooms it is of particular importance in biomass fired boiler rooms. Biomass can contain fine particulate, which if allowed to leak from the transportation system into the surrounding boiler room, will eventually be drawn into fans, resulting in the possibility of combustion air systems becoming plugged.

b) Boiler rooms containing quantities of fine dusts are susceptible to fire or explosion, again emphasizing the need for high standards of cleanliness.

S3.8 – Emission Control Requirements

a) Emission control is dependent upon the fuel being fired and the emission requirements prevailing at the location of the boiler installation. As such they are a part of the initial design and installation process, and apart from ensuring that they are kept in top working condition, so that emission requirements are not violated; there is little that can be done from the inspector's point of view.

b) When Continuous Emissions Monitors (CEM's) are in use, they should be demonstrated to be functioning properly and have a current calibration sticker.

c) Delta-P pressure gauges which measure the pressure drop across the various elements of the emission control system should all be functioning correctly.

d) There should be no sign of erosion caused by entrained particulate matter, in any part of the breaching, ductwork, stack or the individual emission control elements.

e) In systems in which the emissions control system incorporates a baghouse, appropriate fire detection and suppression systems shall be incorporated and functioning properly.

Definitions

The following definitions are to be added to the Glossary:

Biomass – Fuels which result from biological sources requiring a relatively short time for replenishment: Wood and bagasse are typical examples.

Emissions – The discharge of various Federal or State defined air pollutants into the surrounding atmosphere during a given time period.

Emissions Control System – An arrangement of devices, usually in series, used to capture various air pollutants and thereby reduce the amount of these materials, or gases, being admitted to the surrounding atmosphere, below Federal or State defined standards.

Metering Device – A method of controlling the amount of fuel, or air, flowing into the combustion zone.

Grate – The surface on which fuel is supported and burned and through which air is passed for combustion.

Fluidized Bed – A process in which a bed of granulated particles are maintained in a mobile suspension by an upward flow of air or gas.

Fluidized Bed (Bubbling) – A fluidized bed in which the fluidizing velocity is less than the terminal velocity of individual bed particles where part of the fluidizing gas passes through as bubbles.

Fluidized Bed (Circulating) - A fluidized bed in which the fluidizing velocities exceed the terminal velocity of the individual bed particles.

Suspension Burner – A combustion system in which the fuel is in the form of relatively small particles, Their buoyancy is maintained in the transport airstream and the fuel/air mixture flow stream, until combustion is completed.

Underfire Air – A method of introducing air beneath the grate surface/fuel bed.

Overfire Air – Air admitted to the furnace above the grate surface /fuel bed. Used to complete the combustion of fine particles, in suspension. Also aids in reducing NOx formation.

Induced Draft Fan – A fan exhausting hot gases from the heat absorbing equipment.

Flyash – Suspended ash particles carried in the flue gas.

Flyash collector – A device designed to remove flyash in the dry form from the flue gas.

Flyash Recycle – The reintroduction of flyash/unburned carbon from the flyash collector into the combustion zone, in order to complete the combustion of unburned fuel, thereby improving efficiency.

Carbons Recycle – See Flyash Recycle

Fuel Transport Fan – A fan which generates airflow capable of moving fuel particles, in suspension, from a metering device to the combustion zone.

NB08-2101 – Explanation of negative vote

1. The definition of "Biomass" is not consistent with the EPA and DOE definitions as used in various regulations including the Area Source Rules under Boiler MACT.
2. Emissions Control System should delete the last phrase after the comma. Replace "materials, or gases," and replace with "pollutants".
   An arrangement of devices, usually in series, used to capture various air pollutants and thereby reduce the amount of these ~~materials, or gases,~~pollutants being admitted to the surrounding atmosphere~~, below Federal or State defined standards~~.
3. The definition of "Fluidized Bed" is appropriate to a generic fluidized bed reactor. However, in this document the usage is intended to be boilers firing a fuel. To be more in line with NFPA 85 definition, change "Fluidized Bed" as follows:
   A fuel-firing technique~~process~~ in which a bed of noncombustible granulated particles are mixed with a fuel and maintained in a mobile suspension by an upward flow of air ~~or gas~~.
4. The definition of "Fluidized Bed (Bubbling)" is appropriate to a generic bubbling fluidized bed reactor. To be consistent with the definition of "Fluidized Bed", change "Fluidized Bed (Bubbling)" as follows:
   A fluidized bed fuel-firing techique in which the fluidizing air velocity is less than the terminal velocity of individual bed and fuel particles when ~~where part of~~ the fluidizing ~~gas~~ air passes through the bed as bubbles.
5. The definition of "Fluidized Bed (Circulating)" is appropriate to a generic circulating fluidized bed reactor. To be consistent with the definition of "Fluidized Bed" and "Fluidized Bed (Bubbling)", change "Fluidized Bed (Circulating)" as follows:
   A fluidized bed fuel-firing technique in which the fluidizing air velocity exceeds~~velocities exceed~~ the terminal velocity of the individual bed and fuel particles.
6. Correct typo in "Suspension Burner" by deleting the comma after particles and inserting a period.
7. Correct typo in "Overfire Air" by deleting the comma after "fine particles". The incomplete sentence is not appropriate for a definition. Delete "Also aids in reducing NOx formation."

Brian W. Moore, P.E.

NB 11-2001 ***Part 1, 2.9.4 SG Pressure Vessels and Piping*** - Address the safe venting isolatable economizers where the outlet is below the inlet of other communicable chambers (Headers, drums, etc.)

Current Language:

2.9.4 ECONOMIZERS

An economizer that may not be isolated from a boiler does not require a safety relief valve. Economizers that may be isolated from a boiler or other heat transfer device, allowing the economizer to become a fired pressure vessel, shall have a minimum of one safety relief valve. Discharge capacity, rated in lbs/hr (kg/hr), of the safety relief valve or valves shall be calculated from the maximum expected heat absorption rate in Btu/hr (Joules/hr) of the economizer, and will be determined from manufacturer data, divided by 1000. The safety relief valve shall be located as close as possible to the economizer outlet.

Proposed Language:

2.9.4 ECONOMIZERS

An economizer that may not be isolated from a boiler does not require a safety relief valve. Economizers that may be isolated from a boiler or other heat transfer device, allowing the economizer to become a fired pressure vessel, shall have a minimum of one safety relief valve. Discharge capacity, rated in lbs/hr (kg/hr), of the safety relief valve or valves shall be calculated from the maximum expected heat absorption rate in Btu/hr (Joules/hr) of the economizer, and will be determined from manufacturer data, divided by 1000. The safety relief valve shall be installed in a locationed recommended by the manufacturer, when no recommendation exists the location shall be as close as practical possibleto the economizer outlet.

Statement of Need

Victory Energy intends to design isolatable economizers, in accordance with ASME Section I and VIII Div1, and have the PSV located on the uppermost chamber instead of the Outlet connection. ASME requirements for PSVs ensure that the PSV is large enough to vent the energy in the form of steam. The same size PSV venting hot water potentially releases many more times the energy as venting steam. The amount of energy released in a given time is often excessive for vent piping, condensate tanks, and drains to handle. It is preferred to vent the energy as steam, over a longer period of time. Rapid draining of the economizer also allows the economizer to rapidly increase in temperature, causing undue stress. Furthermore, this request should serve to more closely align this part of the code with the ASME codes.

Background Information

An example would be a vertical counterflow economizer where the inlet header is located above the outlet (as in Figure 1) If the designer can specify where the PSV be located then the PSV may be placed such that the release of energy, via steam, happens more slowly through the same size PSV.

Figure 1 illustrates a counter-flow economizer, in a vertical up gas path, having horizontal headers, with the outlet header below the inlet. When this type of eco ıring operation, and the PSV is tripped, steam will begin to collect in the upper "ir ign allows a more controlled venting of isolatable economizers by venting steam instead of hot water. Figure 1 also illustrates moving the safety relief valve from the outlet to the preferred location.

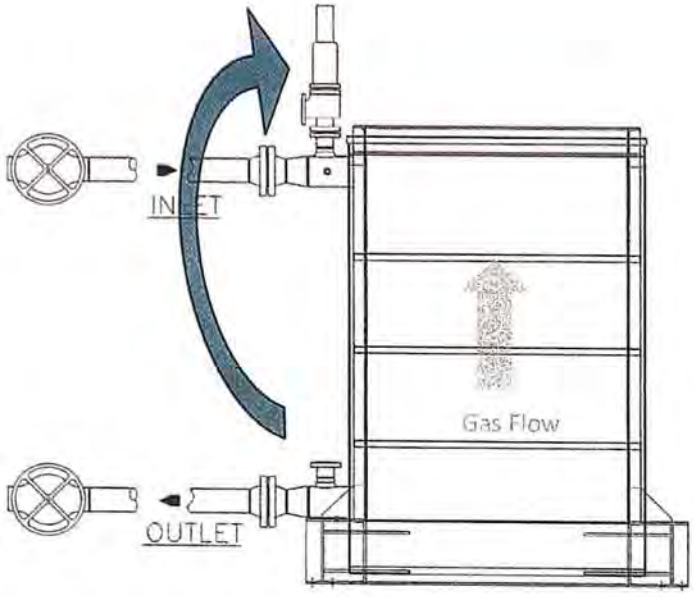


Figure 1

David Olson

QCM

Victory Energy Operations, LLC

918-340-9942

NB12-0304 **NBIC Part 1**

SUPPLEMENT 3
INSTALLATION OF LIQUID CARBON DIOXIDE STORAGE VESSELS

S3.1 SCOPE

This section provides requirements for the installation of Liquid Carbon Dioxide Storage Vessels (LCDSV's), fill boxes, fill lines and pressure relief discharge/vent circuits used for carbonated beverage systems, swimming pool PH control systems and other fill in place systems storing 1,000lbs or less of liquid CO_2.

S3.2 GENERAL REQUIREMENTS

STORAGE TANK LOCATION

LCDSV's should be installed in an unenclosed area whenever possible. LCDSV's that do not meet all criteria for an unenclosed area shall be considered an enclosed area installation.

An unenclosed area:

- Shall be outdoors
- Shall be above grade
- Should not have a roof or overhead cover
- Shall not obstruct more than three sides of the perimeter with supports and walls. At least 25% of the perimeter area as calculated from the maximum height of the storage container shall be open to atmosphere and openings shall be in direct conveyance with ground level.

S3.2 a) General Requirements (enclosed and unenclosed areas)

1) LCDSV's shall not be located within 10 feet of elevators, unprotected platform ledges or other areas where falling would result in dropping distances exceeding half the container height.
2) LCDSV's shall be installed with sufficient clearance for filling, operation, maintenance, inspection and replacement.
3) Orientation of nozzles and attachments shall be such that sufficient clearance between the nozzels, attachments, and the surrounding structures is maintained during the installation, the attachment of associated piping, and operation.
4) LCDSV's shall not be installed on roofs.
5) LCDSV's shall be safely supported. Vessel supports, foundations and settings shall be in accordance with jurisdictional requirements, manufacturer recommendations and/or other industry standards as applicable. The weight of the vessel when full of liquid carbon dioxide shall be considered when designing vessel supports. Design of supports, foundations, and settings shall consider vibration (including seismic and wind loads where necessary), movement (including thermal movement), and loadings. Vessel foundations or floors in multistory buildings must be capable of supporting the full system weight and in accordance with building codes.
6) LCDSV's shall not be installed within 36 in. (914 mm) of electrical panels.

7) LCDSV's installed outdoors in areas in the vicinity of vehicular traffic shall be guarded to prevent accidental impact by vehicles. The guards or bollards shall be installed in accordance with local building codes or to a national recognized standard when no local building code exists.
8) LCDSV's shall be equipped with isolation valves in accordance with paragraph S3.6.

S3.2 b) Unenclosed area LCDSV installations.

If LCDSV's are installed outdoors and exposed to the elements, appropriate additional protection may be provided as necessary based on the general weather conditions and temperatures that the tank may be exposed to. Some possible issues include:

a. Exposure to high solar heating loads will increase the net evaporation rate and will decrease hold times in low CO_2 usage applications. The vessel may be covered or shade provided to help reduce the solar load and increase the time needed to reach the relief valve setting in low use applications.
b. If supply line is not UV resistant then supply line should be protected via conduit or appropriate covering.

S3.2 c) Enclosed area LCDSV Installations

1) Permanent LCDSV installations with remote fill connections.
   a. Shall be equipped with a gas detection system installed in accordance with paragraph S3.4
   b. Shall have signage posted in accordance with paragraph S3.5
   c. Shall be equipped with fill boxes; fill lines and safety relief/vent valve circuits installed in accordance with paragraph S3.6

2) Portable LCDSV installations with no permanent remote fill connection. Warning: LCDSV's shall not be filled indoors or in enclosed areas under any circumstances. Tanks must always be moved to the outside to an unenclosed, free airflow area for filling.
   a. Shall be equipped with a gas detection system installed in accordance with paragraph S3.4
   b. Shall have signage posted in accordance with paragraph S3.5
   c. Shall have safety relieve/vent valve circuit connected at all times except when the tank is being removed for filling. Connects may be fitted with quick disconnect fitting meeting the requirements of paragraph S3.6
   d. Shall be provided with a pathway that provides a smooth rolling surface to the outdoor, unenclosed fill area. There shall not be any stairs or other than minimal inclines in the pathway.

S3.3 FILL BOX LOCATION / SAFETY RELIEF/VENT VALVE CIRCUIT TERMINATION

Fill boxes and/or vent valve terminations shall be installed above grade, outdoors in an unenclosed, free airflow area. The fill connection shall be located so not to impede means of egress or the operation of sidewalk cellar entrance doors, including during the delivery process and shall be:

a) At least three (3) feet from any door or operable windows.
b) At least three (3) feet above grade.
c) Shall not be located within ten (10) feet from side to side at the same level or below, from any air intakes.
d) Shall not be located within ten (10) feet from stair wells that go below grade.

S3.4 GAS DETECTION SYSTEMS

Rooms or areas where carbon dioxide storage vessel(s) are located indoors or in enclosed or below grade outdoor locations shall be provided with a gas detection and alarm system for general area monitoring that is capable of detecting and notifying building occupants of a CO_2 gas release. Alarms will be designed to activate a low level pre-alarm at 1.5% concentration of CO_2 and a full high alarm at 3% concentration of CO_2 (which is the OSHA & ACGIH 15 minute and NIOSH 10 minute Short Term Exposure Limit for CO_2.) These systems are not designed for employee personal exposure monitoring. Gas detection systems shall be installed and tested in accordance with manufactures installation instructions and the following requirements;

a) Activation of the gas detection system shall activate an audible alarm within the room or area in which the carbon dioxide storage vessel is located.
b) Audible alarms shall also be placed at the entrance(s) to the room or area where the carbon dioxide storage vessel and/ or fill box is located to notify anyone who might try to enter the area of a potential problem.

S3.5 SIGNAGE

Warning signs shall be posted at the entrance to the building, room, enclosure, or enclosed area where the container is located. The warning sign shall be at least 8 in (200mm) wide and 6 in (150mm) high. The wording shall be concise and easy to read and the upper portion of the sign must be orange as shown in figure S3.5. The size of the lettering must be as large as possible for the intended viewing distance and in accordance with jurisdictional requirements. When no jurisdictional requirements exist, the minimum letter height shall be in accordance with NEMA American National Standard for Environmental and Facility Safety Signs (ANSI Z535.2). The warning signs shall state the following:

"WARNING – CARBON DIOXIDE GAS. Ventilate the area before entering. A high carbon dioxide (CO_2) gas concentration in this area can cause suffocation."

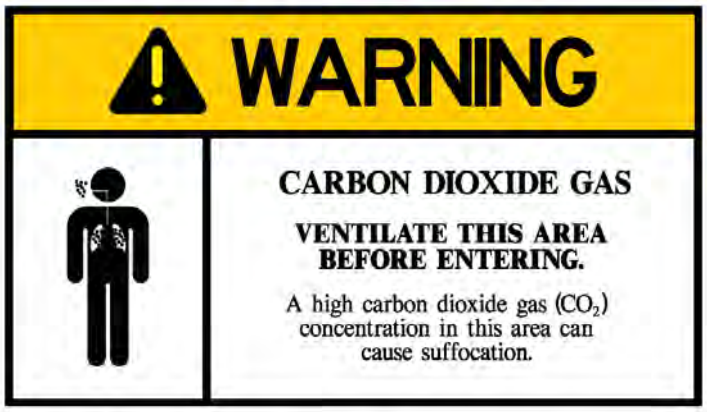


Figure S3.5

a) Additional instruction signage shall be posted outside of the area where the container is located and such signage shall contain at minimum the following information;

   Carbon Dioxide Monitors for general area monitoring (not employee personal exposure monitoring) are provided in this area. These monitors are set to alarm at 15,000ppm (1.5% concentration) for the low level alarm and at 30,000ppm (3% concentration) for high level alarm.

   Low Level Alarm (15,000ppm) – Provide appropriate cross ventilation to the area. Personnel may enter area for short periods of time (not to exceed 15 minutes at a time) in order to identify and repair potential leaks.

   High Level Alarm (30,000ppm) – Personnel should evacuate the area and nobody should enter the affected area without proper self contained breathing apparatus until the area is adequately ventilated and the concentration of CO_2 is reduced below the high alarm limit.

S3.6 VALVES, PIPING, TUBING AND FITTINGS

Materials - Materials selected for valves, piping, tubing, hoses and fittings used in the LCDSV system shall meet following requirements:

a) Components must be compatible for use with CO_2 in the phase, (gas, or liquid) it encounters in the system.
b) Components shall be rated for the operational temperatures and pressures encountered in the applicable circuit of the system.
c) Shall be stainless steel, copper, brass, or plastic/polymer materials rated for CO_2.

d) Only fittings and connections recommended by the manufacturer shall be used for all hoses, tubes, and piping.
e) All valves and fittings used on the LCDSV shall be rated for the maximum allowable working pressure stamped on the tank.
f) All piping, hoses and tubing used in the LCDSV system shall be rated for the working pressure of the applicable circuit in the system and have a burst pressure rating of at least four times the maximum allowable working pressure of the piping, hose or tubing.

Relief Valves – Each LCDSV shall have at least one ASME stamped relief valve at or below the MAWP of the tank. The relief valve shall be suitable for the temperatures and flows experienced during relief valve operation. The minimum relief valve capacity shall be designated by the manufacturer Additional relief valves that do not require ASME stamps may be added per CGA S-1.3 recommendations. Discharge lines from the relief valves shall be sized in accordance with tables S3.6a & S3.6b Note: due to the design of the LCDSV the discharge line may be smaller in diameter than the relief valve outlet size.

Caution: Company's and or individuals filling or refilling LCDSV's shall be responsible for utilizing fill equipment that is acceptable to the manufacture to prevent over pressurization of the vessel.
Question - What is the ANSI number for CGA S-1.3?

Isolation Valves - Each LCDSV shall have an isolation valve installed on the fill line and tank discharge, or gas supply line in accordance with the following requirements:

a) Isolation valves shall be located on the tank or at an accessible point as near to the storage tank as possible.
b) All valves shall be designed or marked to indicate clearly whether it is open or closed.
c) All valves shall be capable of being locked or tagged in the closed position for servicing.
d) Gas Supply and Liquid CO_2 Fill Valves shall be clearly marked for easy identification.

Safety Relief/Vent Lines-Safety relief/vent lines shall be as short and straight as possible with a continuous routing to an unenclosed area outside the building and installed in accordance with the manufacturer's instructions. The vent line shall be a continuous run from PRD to outside vent line discharge fitting, without any splices. These lines shall be free of physical defects such as cracking or kinking and all connections shall be securely fastened to the LCDSV and the fill box. The minimum size and length of the lines shall be in accordance with table S3.6a and S3.6b. Fittings or other connections may result in a localized reduction in diameter have been factored into the lengths given by the tables S3.6a and S3.6b.

Tank Size (Pounds)	Fire Flow Rate Requirements (Pounds per Minute)	Maximum length of 3/8" ID Nominal Metallic Tube Allowed	Maximum length of ½" Metallic Tube Allowed
Less than 500	2.60 maximum	80'	100'
500-750	3.85 maximum	55'	100'
Over 750 to 1000	5.51 maximum	18'	100'

Table S3.6a Minimum LCDSV System Safety Relief/Vent Line Requirements (Metallic)

Tank Size (Pounds)	Fire Flow Rate Requirements (Pounds per Minute)	Maximum length of 3/8 ID plastic/polymer materials Tube Allowed	Maximum length of ½ ID plastic/polymer materials Tube Allowed
Less than 500	2.60 maximum	100'	100'
500-750	3.85 maximum	100'	100'
Over 750 to 1000	5.51 maximum	N/A (See ½" column)	100'

Table S3.6b Minimum LCDSV System Safety Relief/Vent Line Requirements (plastic/polymer)

New Action Item assigned:
NB12-1301

~~NB07 - 1208~~ Part 1 Glossary NBIC Part 1 – Installation

Existing Text	Proposed Text Changes
2.2 DEFINITIONS A power boiler is a closed vessel in which water or other liquid is heated, steam or vapor generated, steam or vapor is superheated, or any combination thereof, under pressure for use external to itself, by the direct application of energy from the combustion of fuels or from electricity or solar energy. The term boiler includes fired units for vaporizing liquids other than water but does not include fired process heaters and systems. The term boiler also shall include the apparatus used to generate heat and all controls and safety devices associated with such apparatus or the closed vessel. a) Power Boiler — a boiler in which steam or other vapor is generated at a pressure in excess of 15 psig (100 kPa) for use external to itself. b) High-Temperature Water Boiler — a boiler in which water is heated and operates at a pressure in excess of 160 psig (1.1 MPa) and/or temperature in excess of 250°F (121°C).	**2.2 DEFINITIONS** ~~A power boiler is a closed vessel in which water or other liquid is heated, steam or vapor generated, steam or vapor is superheated, or any combination thereof, under pressure for use external to itself, by the direct application of energy from the combustion of fuels or from electricity or solar energy. The term boiler includes fired units for vaporizing liquids other than water but does not include fired process heaters and systems. The term boiler also shall include the apparatus used to generate heat and all controls and safety devices associated with such apparatus or the closed vessel.~~ ~~a) Power Boiler — a boiler in which steam or other vapor is generated at a pressure in excess of 15 psig (100 kPa) for use external to itself.~~ ~~b) High-Temperature Water Boiler — a boiler in which water is heated and operates at a pressure in excess of 160 psig (1.1 MPa) and/or temperature in excess of 250°F (121°C).~~ See the Glossary in Section 9.
3.2 DEFINITIONS **3.2.1 STEAM HEATING BOILERS** Steam heating boilers are steam boilers installed to operate at pressures not exceeding 15 psig (100 kPa). **3.2.2 HOT-WATER HEATING AND HOT-WATER SUPPLY BOILERS** Hot-water heating and hot-water supply boilers are hot water boilers installed to operate at pressures not exceeding 160 psig (1100 kPa) and/or temperatures not exceeding 250°F (121°C), at or near the boiler outlet. **3.2.3 POTABLE WATER HEATERS** Water heaters are exempted from NBIC Part 1, Section 3 when none of the following limitations are exceeded: a) Heat input of 200,000 Btu/hr (59 kW); b) Water temperature of 210°F (99°C); and c) Nominal water containing capacity of 120 gal. (454 l), except that they shall be equipped with safety devices in accordance with the requirements of NBIC Part 1, 3.9.4.	**3.2 DEFINITIONS** ~~**3.2.1 STEAM HEATING BOILERS**~~ ~~Steam heating boilers are steam boilers installed to operate at pressures not exceeding 15 psig (100 kPa).~~ ~~**3.2.2 HOT-WATER HEATING AND HOT-WATER SUPPLY BOILERS**~~ ~~Hot-water heating and hot-water supply boilers are hot water boilers installed to operate at pressures not exceeding 160 psig (1100 kPa) and/or temperatures not exceeding 250°F (121°C), at or near the boiler outlet.~~ ~~**3.2.3 POTABLE WATER HEATERS**~~ ~~Water heaters are exempted from NBIC Part 1, Section 3 when none of the following limitations are exceeded:~~ ~~a) Heat input of 200,000 Btu/hr (59 kW);~~ ~~b) Water temperature of 210°F (99°C); and~~ ~~c) Nominal water containing capacity of 120 gal. (454 l), except that they shall be equipped with safety devices in accordance with the requirements of NBIC Part 1, 3.9.4.~~ See the Glossary in Section 9.

Submitted by Brian W Moore January 17, 2012

	9.1 DEFINITIONS **Boiler** — A boiler is a closed vessel in which water or other liquid is heated, steam or vapor generated, steam or vapor is superheated, or any combination thereof, under pressure for use external to itself, by the direct application of energy from the combustion of fuels or from electricity or solar energy. The term boiler also shall include the apparatus used to generate heat and all controls and safety devices associated with such apparatus or the closed vessel. a) Power Boiler — a boiler in which steam or other vapor is generated at a pressure in excess of 15 psig (100 kPa) for use external to itself. The term power boiler includes fired units for vaporizing liquids other than water, but does not include fired process heaters and systems. b) High-Temperature Water Boiler — a power boiler in which water is heated and operates at a pressure in excess of 160 psig (1.1 MPa) and/or temperature in excess of 250°F (121°C). c) Steam Heating Boiler — a boiler installed to generate steam to operate at pressures not exceeding 15 psig (100 kPa). d) Hot-Water Heating Boiler — a Hot-Water Heating Boiler is a boiler installed to generate hot water at pressures not exceeding 160 psig (1100 kPa) and/or temperatures not exceeding 250°F (121°C), at or near the boiler outlet. e) Hot-Water Supply Boiler — A Hot-Water Supply Boiler is a boiler installed to generate hot water at pressures not exceeding 160 psig (1100 kPa) and/or temperatures not exceeding 250°F (121°C), at or near the boiler outlet. **Pressure Vessel** — A pressure vessel is a container other than a boiler or piping used for the containment of pressure.
4.2 DEFINITIONS Pressure vessels are containers other than boilers or piping used for the containment of pressure.	4.2 DEFINITIONS ~~Pressure vessels are containers other than boilers or piping used for the containment of pressure.~~ See the Glossary in Section 9.
RATIONALE: These definitions have remained in the body of the text since reformatting of the NBIC to include Section 9 – Glossary. Moving definitions to the glossary is consistent with the overall approach to have definitions located in one place. Each definition has been slightly rearranged for readability and consistency. If these changes are accepted, then the glossaries in Part 2 and Part 3 will also have to be changed.	

Submitted by Brian W Moore

January 17, 2012

NB13-0101

- **Note: Place the System Description at the beginning of S3**

~~4.6.1~~ System Description

The Liquid Carbon Dioxide Beverage systems include the Liquid Carbon Dioxide Storage Vessel -or LCDSV (tank) and associated sub-system circuits - Liquid CO_2 fill circuit, and Pressure relief / vent line circuit. The LCDSV s are vacuum insulated pressure vessels, constructed of stainless steel, with Super Insulation wrapping between the inner pressure vessel and the outer vacuum jacket. (See Figure ….) These Pressure vessels are typically designed for a Maximum Allowable Working Pressure (MAWP) of either 300 psig or 283 psig. The LCDSV come equipped with a ASME/NB certified "UV" Primary Relief Valve (PRV) set at or below the MAWP of the vessel. Additionally as recommended by CGA S-1.3, (PRESSURE RELIEF DEVICE STANDARDS PART 3 - STATIONARY STORAGE CONTAINERS FOR COMPRESSED GASES) a secondary relief valve may be installed. This secondary relief valve is beyond the scope of ASME Section VIII, Division 1 and is not required to be ASME/NB stamped and certified. This additional PRV is typically rated no higher than 1.5 times the vessel MAWP.

Operating conditions of the system can cause temperatures and pressures to range from 90 psig (-56° F) to 300 psig (+2°F). Below 60 psig in the tank, liquid CO_2 begins changing to solid phase (dry ice). If the tank becomes completely depressurized to 0 psig, temperatures inside the tank could reach -109°F (solid dry ice). When liquid CO_2 turns to solid dry ice in a completely depressurized tank, all CO_2gas flow in the system ceases and the tank becomes non-functional. See the attached CO_2 Phase Diagram figure 4.6.xxx, showing the typical operating range of these systems. Components external to the LCDSV inner tank pressure vessel may encounter temperatures and pressures between 90 psig, (-56°F) and 300 psig (+2°F). Typical operating pressures and temperatures vary in each of the associated sub-system circuits. See Table 4.6.xxx

➢ **Note: Place the Figures at the end of S3**

Figure 4.6.xxx **Carbon Dioxide Phase Diagram**

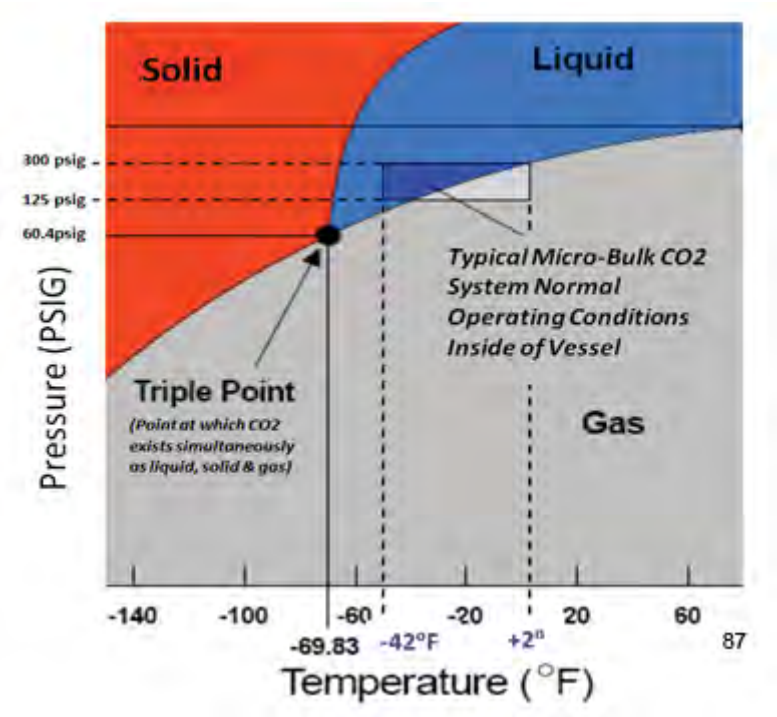
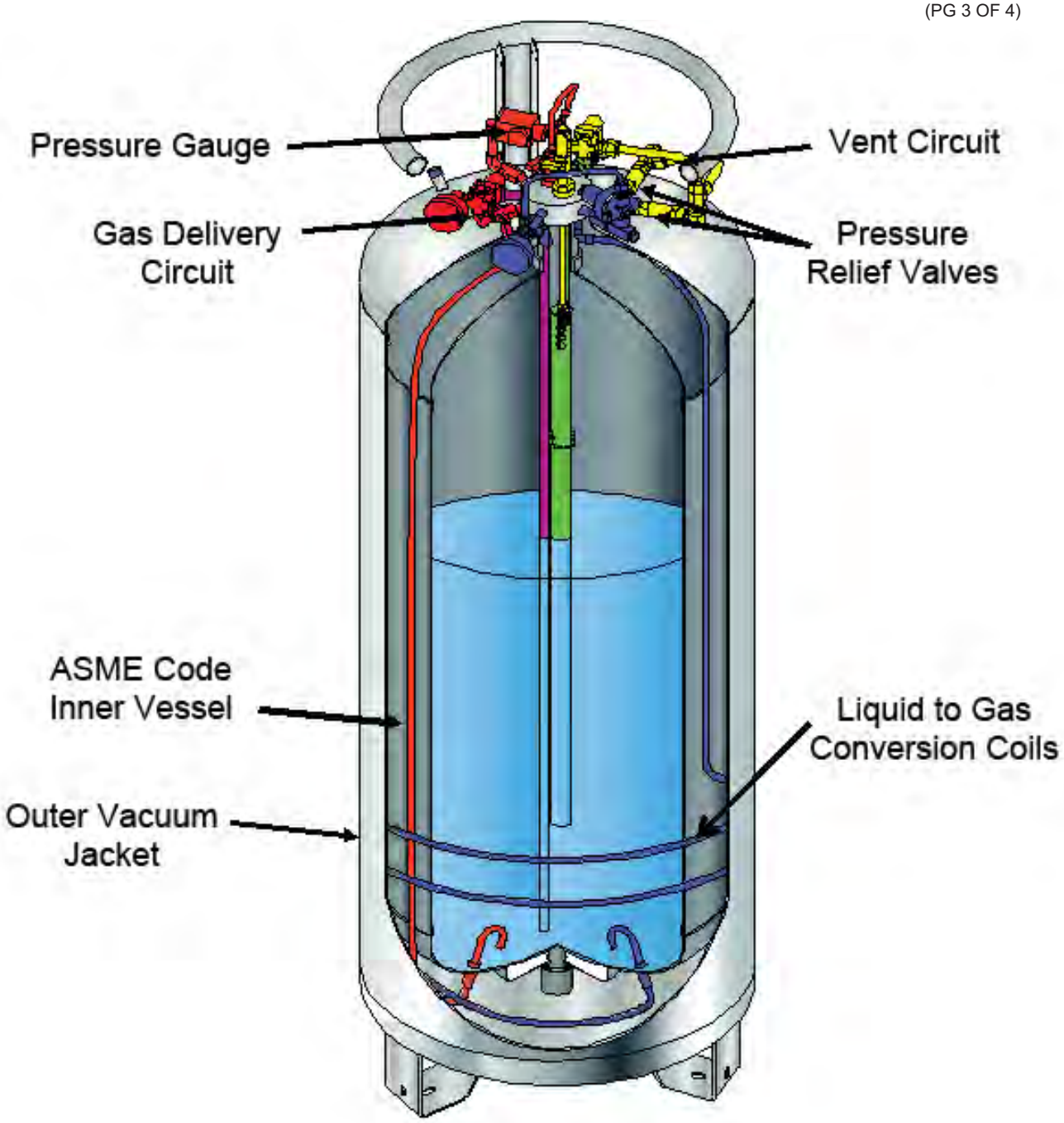


Table 4.6.xxx Typical Operating Pressures & Temperatures of the LCDSV System

System Component	Operating Pressure	Operating Temperature
Storage Vessel (tank internal conditions)	90 - 300 psig	-56°F to +2° F
Liquid CO_2 Fill Line	150 - 300 psig	-34°F to +2° F
Pressure Relief **Gas** Vent Line	0 - 120 psig	ambient to -50° F


Pressure Gauge
Vent Circuit
Gas Delivery Circuit
Pressure Relief Valves
ASME Code Inner Vessel
Liquid to Gas Conversion Coils
Outer Vacuum Jacket

NB13-0101 – Explanation of negative vote

1. The phase diagram included as part of the proposal is not consistent with publically available data. For example, the published triple point is -56.6°C (-69.88°F) at 5.11 atmospheres (60.417 psig) (1 atm = 14.7 psia). Four significant figures of precision requires the change.

   Alternative: If the figure is changed to -70.0°F (three significant figures consistent with 60.4), I would withdrawn my negative.

2. The figure shows an intersection at 125 psig and -42°F with no corresponding explanation in the text.

   Suggested solution: delete the axis labels and intersection lines or provide and explanation in the text.

1. The second paragraph of the System Description confusing as written. I suggest the following revision:
   Operating conditions ~~of~~ in the system, components, and inner pressure vessel can vary between ~~cause temperatures and pressures to range from~~ 90 psig (-56° F) ~~to~~ and 300 psig (+2°F). Below about 60 psig in the tank, liquid CO2 begins changing to solid phase (dry ice). If the tank becomes completely depressurized to 0 psig, temperatures inside the tank could reach -109°F (solid dry ice). When liquid CO2 turns to solid dry ice in a completely depressurized tank, all CO2 gas flow in the system ceases and the tank becomes non-functional. See the attached CO2 Phase Diagram ~~figure~~ Figure ~~4.6.xxx~~S3.2xxx, showing the typical operating range of these systems. ~~Components external to the LCDSV inner tank pressure vessel may encounter temperatures and pressures between 90 psig, (-56°F) and 300 psig (+2°F).~~ Typical operating pressures and temperatures vary in each of the associated sub-system circuits. See Table ~~4.6.xxx~~S3.2xxx.

Brian W. Moore, P.E.

EXPLANATION:
The current definition of "power boiler" in NBIC Part 1 is confusing because the term is defined twice: once in a complete paragraph and once in a subparagraph. The first paragraph is actually a common definition used for "boiler".

The NBIC currently does not have a definition for the term "boiler". It should also be noted that the ASME does not currently define the term "boiler". Although most jurisdictions have their own definition of "boiler" in statute or regulation, it is felt that the NBIC needs to add a definition for completeness.

The intent of this proposal is to merge all elements of the current term "power boiler" into a single definition and to add a new definition for "boiler" for inclusion into Section 9 Glossary for all books of the NBIC.

Proposal

Existing Text	Proposed Text Changes
2.2 DEFINITIONS A power boiler is a closed vessel in which water or other liquid is heated, steam or vapor generated, steam or vapor is superheated, or any combination thereof, under pressure for use external to itself, by the direct application of energy from the combustion of fuels or from electricity or solar energy. The term boiler includes fired units for vaporizing liquids other than water but does not include fired process heaters and systems. The term boiler also shall include the apparatus used to generate heat and all controls and safety devices associated with such apparatus or the closed vessel.	Power Boiler — a boiler in which steam or other vapor is generated at a pressure in excess of 15 psig (100 kPa) for use external to itself. The term power boiler includes fired units for vaporizing liquids other than water, but does not include fired process heaters and systems. (See also High-Temperature Water Boiler).
a) Power Boiler — a boiler in which steam or other vapor is generated at a pressure in excess of 15 psig (100 kPa) for use external to itself.	
b) High-Temperature Water Boiler — a boiler in which water is heated and operates at a pressure in excess of 160 psig (1.1 MPa) and/or temperature in excess of 250°F (121°C).	High-Temperature Water Boiler — a power boiler in which water is heated and operates at a pressure in excess of 160 psig (1.1 MPa) and/or temperature in excess of 250°F (121°C).
Repeated for clarity: A power boiler is a closed vessel in which water or other liquid is heated, steam or vapor generated, steam or vapor is superheated, or any combination thereof, under pressure for use external to itself, by the direct application of energy from the combustion of fuels or from electricity or solar energy. The term boiler includes fired units for vaporizing liquids other than water but does not include fired process heaters and systems. The term boiler also shall include the apparatus used to generate heat and all controls and safety devices associated with such apparatus or the closed vessel.	**Boiler** — A boiler is a closed vessel in which water or other liquid is heated, steam or vapor generated, steam or vapor is superheated, or any combination thereof, under pressure for use external to itself, by the direct application of energy from the combustion of fuels or from electricity or solar energy. The term boiler also shall include the apparatus used to generate heat and all controls and safety devices associated with such apparatus or the closed vessel.

NBO8-0701

S7.9 REQUREMENTS FOR CHANGE OF SERVICE FROM ABOVE GROUND TO UNDERGROUND SERVICE

ASME LPG storage containers, less than 2000 gallons, may be changed from above ground (AG) service to underground (UG) service subject to the following conditions:

1. Containers that have been previously used in anhydrous ammonia service shall not be converted to LPG service. Any blue coloring of the brass valves indicates that the container has been in anhydrous ammonia service.

2. The container shall be blasted down to bare metal so that an inspection can be performed under the guidelines of this Supplement.

3. Verify that there is no internal corrosion due to valves having been removed while the container was out of service.

4. Any unused connections located on the container shall be welded shut using a forged plug or removed and replaced with a flush patch. Any flush patch shall be of the same thickness and type as the original material.

5. All connections on the top of the container, except for the check lock/liquid withdrawal shall be replaced with a multivalve. The multivalve will be attached to a standpipe that will extend the assembly to grade. This assembly will be enclosed by a domed sleeve that reaches the top of the grade.

6. The check lock/liquid withdrawal connection on top of the container shall be located inside the domed sleeve.

7. The bleeder valve tube shall be of the correct length for the container size.

8. The support legs and lifting lugs may remain in place. All attachment welds shall encircle the attachment to prevent crevices that create a potential area of corrosion.

9. There shall be connections for attachment of anodes for cathodic protection.

10. Any welding shall be performed by a qualified ”R“ stamp holder using qualified welding procedures.

11. The repair nameplate shall have the information from the original nameplate. This shall include the manufacturer’s name, container serial number, National Board number, MAWP, year built, and head and shell thicknesses. Additional information shall include an indication of underground service, new maximum percentage of fill, and a National Board “R” stamp. See Part 2- 5.2, Part 3- 5.7 for additional stamping requirements.

12. A coating shall be applied that is suitable for corrosion protection in an underground burial application. Any coating touch up needed at the time of installation shall be compatible with the original coating.

NB10-1301

Task Group on Anhydrous Ammonia Nurse Tank Inspection

Task Group Members: Greg McRae (Trinity), Stan Staniszewski (DOT), Jim Getter (Worthington Cylinders), Bob Reetz (State of North Dakota)

July 18, 2012 Draft

This would be a new section of Part 2. It should be numbered 2.3.6.5 and come directly after 2.3.6.4., the current section on "Liquid Ammonia Vessels". (Present 2.3.6.5 would be renumbered as 2.3.6.6)

2.3.6.5 ANHYDROUS AMMONIA NURSE TANKS

a) Nurse tanks (considered as implements of husbandry) are anhydrous ammonia pressure vessels on farm wagons, not exceeding a capacity of 3,000 water gallons (11,355 liters), used for agricultural application of liquid anhydrous ammonia to farm fields as fertilizer. Nurse tanks come under United States Department of Transportation (DOT) requirements and may also be subject to various local jurisdictional requirements. Nurse tanks shall be inspected closely by the owner or operator at least once per seasonal use. Inspections of nurse tanks include the following items. These items are not meant to be all inclusive.

b) Inspection shall consist of the following:

1) Pressure Vessel - Verify that the pressure vessel is constructed for anhydrous ammonia service and that it is ASME stamped and National Board registered, as required by the jurisdiction. Check that the data plate is legible and not painted over or sand blasted. If the data plate is missing or illegible, welding is prohibited, and the tank shall be tested and operated under the DOT Hazardous Material Regulation (HMR) as required in Title 49 Code of Federal Regulations (CFR) 173.315m or the tank shall be removed from service. Post-construction welding, if any, to the pressure vessel, nozzles or support legs shall be in accordance with NBIC procedures and stamping as required in Part 3. (Also see ANSI K61.1 for the definition of repair.) Cracks, dents, bulges, cuts, gouges and corrosion shall not exceed the acceptance criteria of Section 2.3.6.4 (f).

2) Valves and Fittings - Verify that the pressure relief device is ASME constructed and National Board capacity certified, has correct capacity and set pressure, is date current, and is not leaking, corroded or painted. Check that a rain cap is installed. Ensure that the hydrostatic relief valve is set for 350-400 psi (2415-2760 kPa), is in place in or on the liquid withdrawal valve and that it is in good condition and date current. A liquid level float gage shall be installed and be operable. In addition, a fixed liquid level gage (85% gage) shall be operable and unobstructed by tape or paint. A pressure gage with a clear lens and with a 0-400 psi (0-2760 kPa) dial range shall be installed and be observed to be operable. A liquid withdrawal valve shall be in place and observed to be in good condition. Liquid and vapor fill valves shall be in operable condition and their end fittings protected with valve covers. In addition, check that no galvanized, brass, or cast iron fittings are installed.

3) Nurse Tank Painting, Decals, and Marking – The paint shall be white or aluminum, the painted surface not damaged or faded, and the tank surface not rusted. A nurse tank unique owner identification number shall be observed to be in place. A DOT approved slow-moving vehicle (SMV) emblem or sign shall be installed at the rear. Legible transfer and safety decals shall be in place near the fill valves. "INHALATION HAZARD" markings or decals shall be observed to be in place on each side. On each side and on each end, observe that "DOT 1005" markings or decals and "ANHYDROUS AMMONIA" markings or decals are in place. (Note that these markings or decals are not required on the end of a tank with valves and fittings on that end.) Liquid and vapor valves shall be observed to be color coded or labeled for liquid or vapor. Markings for tests and inspections required due to a missing or illegible data plates shall be in place as required by DOT Hazardous Material Regulations.

4) Safety Specific and Miscellaneous Equipment - Roll-over protection for valves and appurtenances, to include the pressure relief device, shall be observed to be in place. This required protection must include any bottom liquid withdrawal valves. Observe that the transfer hose, if so equipped, is date current and in good condition (not cut to the cords or showing stretch damage, bulging, or kinking). Check that a fitting is in place to secure the transfer hose (if so equipped) during transport and storage. Protective gloves and Z87 rated goggles shall be observed to be in a safety kit on the nurse tank. A safety water container [5 gallon (19 liter) minimum capacity] with adequate withdrawal hose shall be on the nurse tank and be in usable condition.

5) Trailer and Running Gear – Ensure that the hitch and undercarriage are in good repair. Observe that welds are not cracked or the rails bent. The trailer tires shall be in serviceable condition with no cuts to the cords. Two safety chains and hooks shall be in place with one hitch pin and lock pin available. The tank to trailer anchorage shall be satisfactory and any bolting tightened. Spring leaves shall not be cracked or broken on inspection and the ends secured.

Subject: 2010 Edition, Part 2, Supplement 2, S2.10.4.1 – Staybolts

File Number: NB11-1601

Prop. Page: 141

Proposal:

Update the text and reference tables in S2.10.4.1 for two purposes:

- Correct errors in equations (both typographical and mathematical)
- Introduce consideration for, and distinction between, iron and steel staybolts

Current wording:

A08 S2.10.4.1 STAYBOLTS

A09 Table S2.10.4.1 may be used to determine the MAWP for corroded staybolts. The table is based on a stress value of 7,500 psi (51.7 MPa) for staybolts that was the value used in the ASME Section 1, 1971 Edition. The table identifies a calculated MAWP based on measuring the staybolt spacing on the crownsheet and the minimum diameter of the corroded staybolt. See Table S2.10.4.1.

Thickness of Stayed Surface, in.	Staybolt Spacing (Maximum Pitch), in.																				
	3.5	3.625	3.75	3.875	4	4.125	4.25	4.375	4.5	4.625	4.75	4.875	5	5.125	5.25	5.375	5.5	5.625	5.75	5.875	6
0.19	85	80	74	70	65	61	58	55	52	49	46	44	42	40	38	36	35	33	32	30	29
0.2	95	88	82	77	72	68	64	61	57	54	51	49	46	44	42	40	38	37	35	34	32
0.21	104	97	91	85	80	75	71	67	63	60	57	54	51	49	46	44	42	40	39	37	36
0.22	115	107	100	93	88	82	78	73	69	66	62	59	56	53	51	49	46	44	42	41	39
0.23	125	117	109	102	96	90	85	80	76	72	68	65	61	58	56	53	51	48	46	44	43
0.24	136	127	119	111	104	98	92	87	82	78	74	70	67	64	61	58	55	53	50	48	46
0.25	148	138	129	121	113	106	100	95	89	85	80	76	72	69	66	63	60	57	55	52	50
0.26	160	149	139	130	122	115	108	102	97	92	87	82	78	75	71	68	65	62	59	57	54
0.27	172	161	150	141	132	124	117	110	104	99	94	89	85	80	77	73	70	67	64	61	59
0.28	185	173	162	151	142	134	126	119	112	106	101	96	91	87	82	79	75	72	69	66	63
0.29	199	185	173	162	152	143	135	127	120	114	108	103	97	93	88	84	81	77	74	71	68
0.3	213	198	185	174	163	153	144	136	129	122	116	110	104	99	95	90	86	82	79	76	72
0.31	227	212	198	185	174	164	154	146	138	130	123	117	111	106	101	96	92	88	84	81	77
0.32	242	226	211	198	185	174	164	155	147	139	132	125	119	113	108	103	98	94	90	86	82
0.33	258	240	224	210	197	185	175	165	156	148	140	133	126	120	115	109	104	100	95	91	88
0.34	273	255	238	223	209	197	185	175	165	157	148	141	134	128	122	116	111	106	101	97	93
0.35	290	270	252	236	222	209	197	185	175	166	157	149	142	135	129	123	117	112	107	103	99
0.36	307	286	267	250	235	221	208	196	185	176	166	158	150	143	136	130	124	119	114	109	104
0.37	324	302	282	264	248	233	220	207	196	185	176	167	159	151	144	137	131	125	120	115	110
0.38	342	318	298	279	262	246	232	219	207	196	185	176	167	159	152	145	138	132	127	121	116
0.39	360	335	313	294	275	259	244	230	218	206	195	185	176	168	160	153	146	139	133	128	122
0.4	379	353	330	309	290	273	257	242	229	217	206	195	185	177	168	160	153	147	140	134	129
0.41	398	371	346	324	304	286	270	255	241	228	216	205	195	185	177	169	161	154	147	141	135
0.42	417	389	364	340	320	300	283	267	252	239	227	215	204	195	185	177	169	162	155	148	142
0.43	437	408	381	357	335	315	297	280	265	251	237	225	214	204	194	185	177	169	162	155	149
0.44	480	447	418	391	367	345	325	307	290	275	261	247	235	224	213	203	194	186	178	170	163
0.45	502	468	437	409	384	361	340	321	304	287	272	259	246	234	223	213	203	194	186	178	171
0.46	524	489	457	428	402	378	356	336	317	300	285	270	257	245	233	222	212	203	194	186	178
0.47	547	510	477	447	419	394	371	350	331	314	297	282	268	255	243	232	222	212	203	194	186
0.48	571	532	497	466	437	411	387	365	345	327	310	294	280	266	254	242	231	221	212	203	194

TS = Tensile Strength 55 000 psi
t = Thickness of Stayed Surface, in.
S = 13 800 psi

$P = t^2 \cdot S \cdot C / p^2$

For Thicknesses 0.4375 and less, C = 2.1
For Thicknesses larger than 0.4375, C=2.2
MAWP is expressed in psi

Proposed wording:

S2.10.4.1 STAYBOLTS

The maximum allowable working pressure for symmetrically spaced corroded staybolts will be calculated using the formula provided in either of the 2 following paragraphs or the accompanying tables. Equations calculate MAWP based on measuring the staybolt spacing on the stayed surface and the minimum diameter of the corroded staybolt.

a) IRON STAYBOLTS

Staybolts which are of iron or of unknown material shall be calculated using the following formula or Table S2.10.4.1.a. The table is based on a stress value of 7,500 psi (51.7 MPa) for staybolts. Refer to ASME Section 1, 1971 Edition, Table PG-23.3 for allowable loads for all staybolts.

$$P = \frac{\pi\left[\frac{d}{2}\right]^2 S}{p^2}$$, S = 7,500 (51.7 MPa)

b) STEEL STAYBOLTS

Staybolts of known, steel material shall be calculated using the following formula or Table S2.10.4.1.b. The table is based on a stress value of 11,300 psi (78.0 MPa) for staybolts. Refer to ASME Section 1, 1971 Addenda for allowable loads for all staybolts.

$$P = \frac{\pi\left[\frac{d}{2}\right]^2 S}{1.1 \times p^2}$$, S = 11,300 (78.0 MPa)

Staybolt Spacing, in.	Actual Diameter of Corroded Iron Staybolts, in.																						
	0.35	0.375	0.4	0.425	0.45	0.475	0.5	0.525	0.55	0.575	0.6	0.625	0.65	0.675	0.7	0.725	0.75	0.775	0.8	0.825	0.85	0.875	0.9
3.5	**59**	**68**	**77**	**87**	**97**	**108**	**120**	**133**	**145**	**159**	**173**	**188**	**203**	**219**	**236**	**253**	**270**	**289**	**308**	**327**	**347**	**368**	**389**
3.625	**55**	**63**	**72**	**81**	**91**	**101**	**112**	**124**	**136**	**148**	**161**	**175**	**189**	**204**	**220**	**236**	**252**	**269**	**287**	**305**	**324**	**343**	**363**
3.75	**51**	**59**	**67**	**76**	**85**	**95**	**105**	**115**	**127**	**138**	**151**	**164**	**177**	**191**	**205**	**220**	**236**	**252**	**268**	**285**	**303**	**321**	**339**
3.875	**48**	**55**	**63**	**71**	**79**	**89**	**98**	**108**	**119**	**130**	**141**	**153**	**166**	**179**	**192**	**206**	**221**	**236**	**251**	**267**	**283**	**300**	**318**
4	**45**	**52**	**59**	**66**	**75**	**83**	**92**	**101**	**111**	**122**	**133**	**144**	**156**	**168**	**180**	**194**	**207**	**221**	**236**	**251**	**266**	**282**	**298**
4.125	**42**	**49**	**55**	**63**	**70**	**78**	**87**	**95**	**105**	**114**	**125**	**135**	**146**	**158**	**170**	**182**	**195**	**208**	**222**	**236**	**250**	**265**	**280**
4.25	**40**	**46**	**52**	**59**	**66**	**74**	**82**	**90**	**99**	**108**	**117**	**127**	**138**	**149**	**160**	**171**	**183**	**196**	**209**	**222**	**236**	**250**	**264**
4.375	**38**	**43**	**49**	**56**	**62**	**69**	**77**	**85**	**93**	**102**	**111**	**120**	**130**	**140**	**151**	**162**	**173**	**185**	**197**	**209**	**222**	**236**	**249**
4.5	**36**	**41**	**47**	**53**	**59**	**66**	**73**	**80**	**88**	**96**	**105**	**114**	**123**	**133**	**143**	**153**	**164**	**175**	**186**	**198**	**210**	**223**	**236**
4.625	**34**	**39**	**44**	**50**	**56**	**62**	**69**	**76**	**83**	**91**	**99**	**108**	**116**	**125**	**135**	**145**	**155**	**165**	**176**	**187**	**199**	**211**	**223**
4.75	**32**	**37**	**42**	**47**	**53**	**59**	**65**	**72**	**79**	**86**	**94**	**102**	**110**	**119**	**128**	**137**	**147**	**157**	**167**	**178**	**189**	**200**	**211**
4.875	**30**	**35**	**40**	**45**	**50**	**56**	**62**	**68**	**75**	**82**	**89**	**97**	**105**	**113**	**121**	**130**	**139**	**149**	**159**	**169**	**179**	**190**	**201**
5	**29**	**33**	**38**	**43**	**48**	**53**	**59**	**65**	**71**	**78**	**85**	**92**	**100**	**107**	**115**	**124**	**133**	**142**	**151**	**160**	**170**	**180**	**191**
5.125	**27**	**32**	**36**	**41**	**45**	**51**	**56**	**62**	**68**	**74**	**81**	**88**	**95**	**102**	**110**	**118**	**126**	**135**	**144**	**153**	**162**	**172**	**182**
5.25	**26**	**30**	**34**	**39**	**43**	**48**	**53**	**59**	**65**	**71**	**77**	**83**	**90**	**97**	**105**	**112**	**120**	**128**	**137**	**145**	**154**	**164**	**173**
5.375	**25**	**29**	**33**	**37**	**41**	**46**	**51**	**56**	**62**	**67**	**73**	**80**	**86**	**93**	**100**	**107**	**115**	**122**	**130**	**139**	**147**	**156**	**165**
5.5	**24**	**27**	**31**	**35**	**39**	**44**	**49**	**54**	**59**	**64**	**70**	**76**	**82**	**89**	**95**	**102**	**110**	**117**	**125**	**133**	**141**	**149**	**158**
5.625	**23**	**26**	**30**	**34**	**38**	**42**	**47**	**51**	**56**	**62**	**67**	**73**	**79**	**85**	**91**	**98**	**105**	**112**	**119**	**127**	**135**	**143**	**151**
5.75	**22**	**25**	**29**	**32**	**36**	**40**	**45**	**49**	**54**	**59**	**64**	**70**	**75**	**81**	**87**	**94**	**100**	**107**	**114**	**121**	**129**	**136**	**144**
5.875	**21**	**24**	**27**	**31**	**35**	**39**	**43**	**47**	**52**	**56**	**61**	**67**	**72**	**78**	**84**	**90**	**96**	**103**	**109**	**116**	**123**	**131**	**138**
6	**20**	**23**	**26**	**30**	**33**	**37**	**41**	**45**	**49**	**54**	**59**	**64**	**69**	**75**	**80**	**86**	**92**	**98**	**105**	**111**	**118**	**125**	**133**
6.125	**19**	**22**	**25**	**28**	**32**	**35**	**39**	**43**	**47**	**52**	**57**	**61**	**66**	**72**	**77**	**83**	**88**	**94**	**100**	**107**	**113**	**120**	**127**
6.25	**18**	**21**	**24**	**27**	**31**	**34**	**38**	**42**	**46**	**50**	**54**	**59**	**64**	**69**	**74**	**79**	**85**	**91**	**97**	**103**	**109**	**115**	**122**
6.375	**18**	**20**	**23**	**26**	**29**	**33**	**36**	**40**	**44**	**48**	**52**	**57**	**61**	**66**	**71**	**76**	**82**	**87**	**93**	**99**	**105**	**111**	**117**
6.5	**17**	**20**	**22**	**25**	**28**	**31**	**35**	**38**	**42**	**46**	**50**	**54**	**59**	**64**	**68**	**73**	**78**	**84**	**89**	**95**	**101**	**107**	**113**
6.625	**16**	**19**	**21**	**24**	**27**	**30**	**34**	**37**	**41**	**44**	**48**	**52**	**57**	**61**	**66**	**71**	**75**	**81**	**86**	**91**	**97**	**103**	**109**
6.75	**16**	**18**	**21**	**23**	**26**	**29**	**32**	**36**	**39**	**43**	**47**	**51**	**55**	**59**	**63**	**68**	**73**	**78**	**83**	**88**	**93**	**99**	**105**
6.875	**15**	**18**	**20**	**23**	**25**	**28**	**31**	**34**	**38**	**41**	**45**	**49**	**53**	**57**	**61**	**66**	**70**	**75**	**80**	**85**	**90**	**95**	**101**
7	**15**	**17**	**19**	**22**	**24**	**27**	**30**	**33**	**36**	**40**	**43**	**47**	**51**	**55**	**59**	**63**	**68**	**72**	**77**	**82**	**87**	**92**	**97**

***S* = 7,500 psi**

***P* = MAWP psi**

$$P = \frac{\pi \left[\frac{d}{2}\right]^2 S}{p^2}$$

***p* = staybolt spacing, in.**

***d* = Minimum diameter of corroded staybolt, in.**

Table S2.10.4.1.a [US Customary Units]

Maximum Allowable Working Pressure Based on the Load Carrying Capacity of a Single Corroded Iron Staybolt

Staybolt Spacing, mm	Actual Diameter of Corroded Iron Staybolts, mm																								
	10	10.5	11	11.5	12	12.5	13	13.5	14	14.5	15	15.5	16	16.5	17	17.5	18	18.5	19	19.5	20	20.5	21	21.5	22
90	**501**	**553**	**607**	**663**	**722**	**783**	**847**	**914**	**983**	**1054**	**1128**	**1204**	**1283**	**1365**	**1449**	**1535**	**1624**	**1716**	**1810**	**1906**	**2005**	**2107**	**2211**	**2317**	**2426**
92.5	**475**	**523**	**574**	**628**	**683**	**742**	**802**	**865**	**930**	**998**	**1068**	**1140**	**1215**	**1292**	**1371**	**1453**	**1538**	**1624**	**1713**	**1805**	**1898**	**1994**	**2093**	**2194**	**2297**
95	**450**	**496**	**544**	**595**	**648**	**703**	**760**	**820**	**882**	**946**	**1012**	**1081**	**1152**	**1225**	**1300**	**1378**	**1458**	**1540**	**1624**	**1711**	**1800**	**1891**	**1984**	**2080**	**2178**
97.5	**427**	**471**	**517**	**565**	**615**	**667**	**722**	**778**	**837**	**898**	**961**	**1026**	**1093**	**1163**	**1234**	**1308**	**1384**	**1462**	**1542**	**1624**	**1709**	**1795**	**1884**	**1974**	**2067**
100	**406**	**448**	**491**	**537**	**585**	**634**	**686**	**740**	**796**	**854**	**914**	**976**	**1039**	**1105**	**1173**	**1244**	**1316**	**1390**	**1466**	**1544**	**1624**	**1706**	**1791**	**1877**	**1965**
102.5	**386**	**426**	**468**	**511**	**557**	**604**	**653**	**704**	**758**	**813**	**870**	**929**	**989**	**1052**	**1117**	**1184**	**1252**	**1323**	**1395**	**1470**	**1546**	**1624**	**1704**	**1787**	**1871**
105	**368**	**406**	**446**	**487**	**530**	**575**	**622**	**671**	**722**	**774**	**829**	**885**	**943**	**1003**	**1064**	**1128**	**1193**	**1261**	**1330**	**1400**	**1473**	**1548**	**1624**	**1702**	**1783**
107.5	**351**	**387**	**425**	**465**	**506**	**549**	**594**	**640**	**689**	**739**	**791**	**844**	**900**	**957**	**1015**	**1076**	**1138**	**1203**	**1268**	**1336**	**1405**	**1477**	**1550**	**1624**	**1701**
110	**336**	**370**	**406**	**444**	**483**	**524**	**567**	**612**	**658**	**706**	**755**	**806**	**859**	**914**	**970**	**1028**	**1087**	**1149**	**1211**	**1276**	**1342**	**1410**	**1480**	**1551**	**1624**
112.5	**321**	**354**	**388**	**424**	**462**	**501**	**542**	**585**	**629**	**675**	**722**	**771**	**821**	**873**	**927**	**983**	**1039**	**1098**	**1158**	**1220**	**1283**	**1348**	**1415**	**1483**	**1553**
115	**307**	**339**	**372**	**406**	**442**	**480**	**519**	**560**	**602**	**646**	**691**	**738**	**786**	**836**	**887**	**940**	**995**	**1051**	**1108**	**1167**	**1228**	**1290**	**1354**	**1419**	**1486**
117.5	**294**	**324**	**356**	**389**	**424**	**460**	**497**	**536**	**576**	**618**	**662**	**707**	**753**	**801**	**850**	**901**	**953**	**1007**	**1062**	**1118**	**1176**	**1236**	**1297**	**1360**	**1423**
120	**282**	**311**	**341**	**373**	**406**	**441**	**477**	**514**	**553**	**593**	**634**	**677**	**722**	**768**	**815**	**864**	**914**	**965**	**1018**	**1072**	**1128**	**1185**	**1244**	**1303**	**1365**
122.5	**271**	**298**	**327**	**358**	**390**	**423**	**457**	**493**	**530**	**569**	**609**	**650**	**693**	**737**	**782**	**829**	**877**	**926**	**977**	**1029**	**1082**	**1137**	**1193**	**1251**	**1310**
125	**260**	**287**	**314**	**344**	**374**	**406**	**439**	**474**	**509**	**546**	**585**	**624**	**665**	**708**	**751**	**796**	**842**	**889**	**938**	**988**	**1039**	**1092**	**1146**	**1201**	**1258**
127.5	**250**	**275**	**302**	**330**	**360**	**390**	**422**	**455**	**490**	**525**	**562**	**600**	**639**	**680**	**722**	**765**	**809**	**855**	**902**	**950**	**999**	**1050**	**1102**	**1155**	**1209**
130	**240**	**265**	**291**	**318**	**346**	**375**	**406**	**438**	**471**	**505**	**541**	**577**	**615**	**654**	**694**	**736**	**778**	**822**	**867**	**914**	**961**	**1010**	**1060**	**1111**	**1163**
132.5	**231**	**255**	**280**	**306**	**333**	**361**	**391**	**422**	**453**	**486**	**520**	**556**	**592**	**630**	**668**	**708**	**749**	**792**	**835**	**879**	**925**	**972**	**1020**	**1069**	**1119**
135	**223**	**246**	**270**	**295**	**321**	**348**	**377**	**406**	**437**	**468**	**501**	**535**	**570**	**607**	**644**	**682**	**722**	**763**	**804**	**847**	**891**	**936**	**983**	**1030**	**1078**
137.5	**215**	**237**	**260**	**284**	**309**	**336**	**363**	**391**	**421**	**452**	**483**	**516**	**550**	**585**	**621**	**658**	**696**	**735**	**775**	**817**	**859**	**903**	**947**	**993**	**1039**
140	**207**	**228**	**251**	**274**	**298**	**324**	**350**	**378**	**406**	**436**	**466**	**498**	**530**	**564**	**599**	**634**	**671**	**709**	**748**	**788**	**829**	**871**	**914**	**958**	**1003**
142.5	**200**	**220**	**242**	**264**	**288**	**312**	**338**	**364**	**392**	**420**	**450**	**480**	**512**	**544**	**578**	**612**	**648**	**684**	**722**	**760**	**800**	**840**	**882**	**924**	**968**
145	**193**	**213**	**234**	**255**	**278**	**302**	**326**	**352**	**379**	**406**	**435**	**464**	**494**	**526**	**558**	**591**	**626**	**661**	**697**	**734**	**773**	**812**	**852**	**893**	**935**
147.5	**187**	**206**	**226**	**247**	**269**	**292**	**315**	**340**	**366**	**392**	**420**	**448**	**478**	**508**	**539**	**572**	**605**	**639**	**674**	**710**	**747**	**784**	**823**	**863**	**903**
150	**180**	**199**	**218**	**239**	**260**	**282**	**305**	**329**	**354**	**379**	**406**	**434**	**462**	**491**	**522**	**553**	**585**	**618**	**651**	**686**	**722**	**758**	**796**	**834**	**873**
152.5	**175**	**192**	**211**	**231**	**251**	**273**	**295**	**318**	**342**	**367**	**393**	**419**	**447**	**475**	**505**	**535**	**566**	**598**	**630**	**664**	**698**	**734**	**770**	**807**	**845**
155	**169**	**186**	**205**	**224**	**243**	**264**	**286**	**308**	**331**	**355**	**380**	**406**	**433**	**460**	**488**	**518**	**548**	**578**	**610**	**643**	**676**	**710**	**745**	**781**	**818**
157.5	**164**	**180**	**198**	**216**	**236**	**256**	**277**	**298**	**321**	**344**	**368**	**393**	**419**	**446**	**473**	**501**	**530**	**560**	**591**	**622**	**655**	**688**	**722**	**757**	**792**
160	**159**	**175**	**192**	**210**	**228**	**248**	**268**	**289**	**311**	**333**	**357**	**381**	**406**	**432**	**458**	**486**	**514**	**543**	**573**	**603**	**634**	**667**	**699**	**733**	**768**
162.5	**154**	**170**	**186**	**203**	**221**	**240**	**260**	**280**	**301**	**323**	**346**	**369**	**394**	**419**	**444**	**471**	**498**	**526**	**555**	**585**	**615**	**646**	**678**	**711**	**744**
165	**149**	**164**	**180**	**197**	**215**	**233**	**252**	**272**	**292**	**314**	**336**	**358**	**382**	**406**	**431**	**457**	**483**	**510**	**538**	**567**	**597**	**627**	**658**	**689**	**722**
167.5	**145**	**160**	**175**	**191**	**208**	**226**	**245**	**264**	**284**	**304**	**326**	**348**	**371**	**394**	**418**	**443**	**469**	**495**	**522**	**550**	**579**	**608**	**638**	**669**	**700**
170	**141**	**155**	**170**	**186**	**202**	**220**	**237**	**256**	**275**	**295**	**316**	**338**	**360**	**383**	**406**	**430**	**455**	**481**	**507**	**534**	**562**	**590**	**620**	**649**	**680**
172.5	**136**	**150**	**165**	**180**	**197**	**213**	**231**	**249**	**267**	**287**	**307**	**328**	**349**	**372**	**394**	**418**	**442**	**467**	**493**	**519**	**546**	**573**	**602**	**631**	**660**
175	**133**	**146**	**160**	**175**	**191**	**207**	**224**	**242**	**260**	**279**	**298**	**319**	**339**	**361**	**383**	**406**	**430**	**454**	**479**	**504**	**530**	**557**	**585**	**613**	**642**
177.5	**129**	**142**	**156**	**170**	**186**	**201**	**218**	**235**	**253**	**271**	**290**	**310**	**330**	**351**	**372**	**395**	**418**	**441**	**465**	**490**	**516**	**542**	**568**	**596**	**624**
180	**125**	**138**	**152**	**166**	**180**	**196**	**212**	**228**	**246**	**263**	**282**	**301**	**321**	**341**	**362**	**384**	**406**	**429**	**452**	**477**	**501**	**527**	**553**	**579**	**607**

S **= 51,700 kPa**

P **= MAWP kPa**

$$P = \frac{\pi \left[\frac{d}{2}\right]^2 S}{p^2}$$

p **= staybolt spacing, mm**

d **= Minimum diameter of corroded staybolt, mm**

Table S2.10.4.1.a [Metric Units]

Maximum Allowable Working Pressure Based on the Load Carrying Capacity of a Single Corroded Iron Staybolt

Staybolt Spacing, in.	Actual Diameter of Corroded Steel Staybolts, in.																						
	0.35	0.375	0.4	0.425	0.45	0.475	0.5	0.525	0.55	0.575	0.6	0.625	0.65	0.675	0.7	0.725	0.75	0.775	0.8	0.825	0.85	0.875	0.9
3.5	**81**	**93**	**105**	**119**	**133**	**149**	**165**	**182**	**199**	**218**	**237**	**257**	**278**	**300**	**323**	**346**	**370**	**396**	**422**	**448**	**476**	**504**	**533**
3.625	**75**	**86**	**98**	**111**	**124**	**139**	**153**	**169**	**186**	**203**	**221**	**240**	**259**	**280**	**301**	**323**	**345**	**369**	**393**	**418**	**444**	**470**	**497**
3.75	**70**	**81**	**92**	**104**	**116**	**129**	**143**	**158**	**174**	**190**	**207**	**224**	**242**	**261**	**281**	**302**	**323**	**345**	**367**	**390**	**415**	**439**	**465**
3.875	**66**	**76**	**86**	**97**	**109**	**121**	**134**	**148**	**163**	**178**	**193**	**210**	**227**	**245**	**263**	**282**	**302**	**323**	**344**	**366**	**388**	**411**	**435**
4	**62**	**71**	**81**	**91**	**102**	**114**	**126**	**139**	**153**	**167**	**182**	**197**	**213**	**230**	**247**	**265**	**284**	**303**	**323**	**343**	**364**	**386**	**408**
4.125	**58**	**67**	**76**	**86**	**96**	**107**	**119**	**131**	**143**	**157**	**171**	**185**	**200**	**216**	**232**	**249**	**267**	**285**	**303**	**323**	**343**	**363**	**384**
4.25	**55**	**63**	**71**	**81**	**90**	**101**	**112**	**123**	**135**	**148**	**161**	**174**	**189**	**204**	**219**	**235**	**251**	**268**	**286**	**304**	**323**	**342**	**362**
4.375	**52**	**59**	**67**	**76**	**85**	**95**	**105**	**116**	**128**	**139**	**152**	**165**	**178**	**192**	**207**	**222**	**237**	**253**	**270**	**287**	**305**	**323**	**341**
4.5	**49**	**56**	**64**	**72**	**81**	**90**	**100**	**110**	**121**	**132**	**143**	**156**	**168**	**182**	**195**	**209**	**224**	**239**	**255**	**271**	**288**	**305**	**323**
4.625	**46**	**53**	**60**	**68**	**76**	**85**	**94**	**104**	**114**	**125**	**136**	**147**	**159**	**172**	**185**	**198**	**212**	**227**	**241**	**257**	**273**	**289**	**306**
4.75	**44**	**50**	**57**	**65**	**72**	**81**	**89**	**99**	**108**	**118**	**129**	**140**	**151**	**163**	**175**	**188**	**201**	**215**	**229**	**243**	**258**	**274**	**290**
4.875	**42**	**48**	**54**	**61**	**69**	**77**	**85**	**94**	**103**	**112**	**122**	**133**	**143**	**155**	**166**	**178**	**191**	**204**	**217**	**231**	**245**	**260**	**275**
5	**40**	**45**	**52**	**58**	**65**	**73**	**81**	**89**	**98**	**107**	**116**	**126**	**136**	**147**	**158**	**170**	**182**	**194**	**207**	**220**	**233**	**247**	**261**
5.125	**38**	**43**	**49**	**55**	**62**	**69**	**77**	**85**	**93**	**102**	**111**	**120**	**130**	**140**	**151**	**161**	**173**	**184**	**197**	**209**	**222**	**235**	**249**
5.25	**36**	**41**	**47**	**53**	**59**	**66**	**73**	**81**	**89**	**97**	**105**	**114**	**124**	**133**	**143**	**154**	**165**	**176**	**187**	**199**	**211**	**224**	**237**
5.375	**34**	**39**	**45**	**50**	**57**	**63**	**70**	**77**	**84**	**92**	**101**	**109**	**118**	**127**	**137**	**147**	**157**	**168**	**179**	**190**	**202**	**214**	**226**
5.5	**33**	**38**	**43**	**48**	**54**	**60**	**67**	**74**	**81**	**88**	**96**	**104**	**113**	**122**	**131**	**140**	**150**	**160**	**171**	**182**	**193**	**204**	**216**
5.625	**31**	**36**	**41**	**46**	**52**	**58**	**64**	**70**	**77**	**84**	**92**	**100**	**108**	**116**	**125**	**134**	**143**	**153**	**163**	**174**	**184**	**195**	**207**
5.75	**30**	**34**	**39**	**44**	**49**	**55**	**61**	**67**	**74**	**81**	**88**	**95**	**103**	**111**	**120**	**128**	**137**	**147**	**156**	**166**	**176**	**187**	**198**
5.875	**29**	**33**	**37**	**42**	**47**	**53**	**58**	**64**	**71**	**77**	**84**	**91**	**99**	**107**	**115**	**123**	**131**	**140**	**150**	**159**	**169**	**179**	**189**
6	**27**	**32**	**36**	**40**	**45**	**51**	**56**	**62**	**68**	**74**	**81**	**88**	**95**	**102**	**110**	**118**	**126**	**135**	**143**	**153**	**162**	**172**	**182**
6.125	**26**	**30**	**34**	**39**	**44**	**49**	**54**	**59**	**65**	**71**	**77**	**84**	**91**	**98**	**105**	**113**	**121**	**129**	**138**	**146**	**155**	**165**	**174**
6.25	**25**	**29**	**33**	**37**	**42**	**47**	**52**	**57**	**62**	**68**	**74**	**81**	**87**	**94**	**101**	**109**	**116**	**124**	**132**	**141**	**149**	**158**	**167**
6.375	**24**	**28**	**32**	**36**	**40**	**45**	**50**	**55**	**60**	**66**	**71**	**78**	**84**	**90**	**97**	**104**	**112**	**119**	**127**	**135**	**143**	**152**	**161**
6.5	**23**	**27**	**31**	**34**	**39**	**43**	**48**	**53**	**58**	**63**	**69**	**75**	**81**	**87**	**94**	**100**	**107**	**115**	**122**	**130**	**138**	**146**	**155**
6.625	**23**	**26**	**29**	**33**	**37**	**41**	**46**	**51**	**56**	**61**	**66**	**72**	**78**	**84**	**90**	**97**	**103**	**110**	**118**	**125**	**133**	**141**	**149**
6.75	**22**	**25**	**28**	**32**	**36**	**40**	**44**	**49**	**54**	**59**	**64**	**69**	**75**	**81**	**87**	**93**	**100**	**106**	**113**	**121**	**128**	**136**	**143**
6.875	**21**	**24**	**27**	**31**	**35**	**39**	**43**	**47**	**52**	**56**	**61**	**67**	**72**	**78**	**84**	**90**	**96**	**103**	**109**	**116**	**123**	**131**	**138**
7	**20**	**23**	**26**	**30**	**33**	**37**	**41**	**45**	**50**	**54**	**59**	**64**	**70**	**75**	**81**	**87**	**93**	**99**	**105**	**112**	**119**	**126**	**133**

***S* = 11,300 psi**

***P* = MAWP psi**

$$P = \frac{\pi \left[\frac{d}{2}\right]^2 S}{1.1 \times p^2}$$

***p* = staybolt spacing, in.**

***d* = Minimum diameter of corroded staybolt, in.**

Table S2.10.4.1.b [US Customary Units]

Maximum Allowable Working Pressure Based on the Load Carrying Capacity of a Single Corroded Steel Staybolt

Staybolt Spacing, mm	Actual Diameter of Corroded Steel Staybolts, mm																								
	10	10.5	11	11.5	12	12.5	13	13.5	14	14.5	15	15.5	16	16.5	17	17.5	18	18.5	19	19.5	20	20.5	21	21.5	22
90	**688**	**758**	**832**	**909**	**990**	**1074**	**1162**	**1253**	**1348**	**1446**	**1547**	**1652**	**1760**	**1872**	**1987**	**2106**	**2228**	**2353**	**2482**	**2614**	**2750**	**2889**	**3032**	**3178**	**3328**
92.5	**651**	**718**	**788**	**861**	**937**	**1017**	**1100**	**1186**	**1276**	**1368**	**1465**	**1564**	**1666**	**1772**	**1881**	**1993**	**2109**	**2228**	**2350**	**2475**	**2604**	**2735**	**2870**	**3009**	**3150**
95	**617**	**680**	**747**	**816**	**889**	**964**	**1043**	**1125**	**1209**	**1297**	**1388**	**1483**	**1580**	**1680**	**1783**	**1890**	**1999**	**2112**	**2228**	**2346**	**2468**	**2593**	**2721**	**2852**	**2987**
97.5	**586**	**646**	**709**	**775**	**844**	**915**	**990**	**1068**	**1148**	**1232**	**1318**	**1407**	**1500**	**1595**	**1693**	**1794**	**1898**	**2005**	**2115**	**2228**	**2343**	**2462**	**2584**	**2708**	**2835**
100	**557**	**614**	**674**	**737**	**802**	**870**	**941**	**1015**	**1092**	**1171**	**1253**	**1338**	**1426**	**1516**	**1609**	**1706**	**1804**	**1906**	**2010**	**2118**	**2228**	**2340**	**2456**	**2574**	**2695**
102.5	**530**	**584**	**641**	**701**	**763**	**828**	**896**	**966**	**1039**	**1114**	**1193**	**1274**	**1357**	**1443**	**1532**	**1623**	**1717**	**1814**	**1914**	**2016**	**2120**	**2228**	**2338**	**2450**	**2566**
105	**505**	**557**	**611**	**668**	**727**	**789**	**854**	**921**	**990**	**1062**	**1137**	**1214**	**1293**	**1375**	**1460**	**1547**	**1637**	**1729**	**1824**	**1921**	**2021**	**2123**	**2228**	**2335**	**2445**
107.5	**482**	**531**	**583**	**637**	**694**	**753**	**814**	**878**	**945**	**1013**	**1084**	**1158**	**1234**	**1312**	**1393**	**1476**	**1561**	**1649**	**1740**	**1833**	**1928**	**2025**	**2125**	**2228**	**2332**
110	**460**	**507**	**557**	**609**	**663**	**719**	**778**	**839**	**902**	**968**	**1036**	**1106**	**1178**	**1253**	**1330**	**1410**	**1491**	**1575**	**1662**	**1750**	**1841**	**1934**	**2030**	**2128**	**2228**
112.5	**440**	**485**	**532**	**582**	**634**	**688**	**744**	**802**	**862**	**925**	**990**	**1057**	**1126**	**1198**	**1272**	**1348**	**1426**	**1506**	**1589**	**1673**	**1760**	**1849**	**1941**	**2034**	**2130**
115	**421**	**464**	**510**	**557**	**606**	**658**	**712**	**767**	**825**	**885**	**947**	**1012**	**1078**	**1146**	**1217**	**1290**	**1364**	**1441**	**1520**	**1601**	**1684**	**1770**	**1857**	**1947**	**2038**
117.5	**403**	**445**	**488**	**533**	**581**	**630**	**682**	**735**	**791**	**848**	**908**	**969**	**1033**	**1098**	**1166**	**1235**	**1307**	**1381**	**1456**	**1534**	**1614**	**1695**	**1779**	**1865**	**1952**
120	**387**	**426**	**468**	**511**	**557**	**604**	**654**	**705**	**758**	**813**	**870**	**929**	**990**	**1053**	**1118**	**1184**	**1253**	**1324**	**1396**	**1471**	**1547**	**1625**	**1706**	**1788**	**1872**
122.5	**371**	**409**	**449**	**491**	**534**	**580**	**627**	**676**	**727**	**780**	**835**	**892**	**950**	**1010**	**1073**	**1137**	**1202**	**1270**	**1340**	**1411**	**1484**	**1560**	**1637**	**1716**	**1796**
125	**356**	**393**	**431**	**471**	**513**	**557**	**602**	**650**	**699**	**749**	**802**	**856**	**912**	**970**	**1030**	**1092**	**1155**	**1220**	**1287**	**1355**	**1426**	**1498**	**1572**	**1648**	**1725**
127.5	**343**	**378**	**415**	**453**	**493**	**535**	**579**	**624**	**671**	**720**	**771**	**823**	**877**	**933**	**990**	**1049**	**1110**	**1173**	**1237**	**1303**	**1370**	**1440**	**1511**	**1584**	**1658**
130	**330**	**363**	**399**	**436**	**475**	**515**	**557**	**601**	**646**	**693**	**741**	**792**	**844**	**897**	**952**	**1009**	**1068**	**1128**	**1190**	**1253**	**1318**	**1385**	**1453**	**1523**	**1595**
132.5	**317**	**350**	**384**	**420**	**457**	**496**	**536**	**578**	**622**	**667**	**714**	**762**	**812**	**864**	**917**	**971**	**1028**	**1086**	**1145**	**1206**	**1269**	**1333**	**1399**	**1466**	**1535**
135	**306**	**337**	**370**	**404**	**440**	**477**	**516**	**557**	**599**	**642**	**688**	**734**	**782**	**832**	**883**	**936**	**990**	**1046**	**1103**	**1162**	**1222**	**1284**	**1348**	**1413**	**1479**
137.5	**295**	**325**	**356**	**390**	**424**	**460**	**498**	**537**	**577**	**619**	**663**	**708**	**754**	**802**	**851**	**902**	**954**	**1008**	**1063**	**1120**	**1178**	**1238**	**1299**	**1362**	**1426**
140	**284**	**313**	**344**	**376**	**409**	**444**	**480**	**518**	**557**	**597**	**639**	**683**	**727**	**774**	**821**	**870**	**921**	**972**	**1026**	**1080**	**1137**	**1194**	**1253**	**1313**	**1375**
142.5	**274**	**302**	**332**	**363**	**395**	**429**	**463**	**500**	**538**	**577**	**617**	**659**	**702**	**747**	**793**	**840**	**889**	**939**	**990**	**1043**	**1097**	**1153**	**1209**	**1268**	**1327**
145	**265**	**292**	**321**	**350**	**381**	**414**	**448**	**483**	**519**	**557**	**596**	**636**	**678**	**721**	**766**	**811**	**858**	**907**	**956**	**1007**	**1060**	**1113**	**1168**	**1224**	**1282**
147.5	**256**	**282**	**310**	**339**	**369**	**400**	**433**	**467**	**502**	**538**	**576**	**615**	**655**	**697**	**740**	**784**	**829**	**876**	**924**	**973**	**1024**	**1076**	**1129**	**1183**	**1239**
150	**248**	**273**	**299**	**327**	**356**	**387**	**418**	**451**	**485**	**520**	**557**	**595**	**634**	**674**	**715**	**758**	**802**	**847**	**894**	**941**	**990**	**1040**	**1092**	**1144**	**1198**
152.5	**239**	**264**	**290**	**317**	**345**	**374**	**405**	**436**	**469**	**503**	**539**	**575**	**613**	**652**	**692**	**733**	**776**	**820**	**864**	**911**	**958**	**1006**	**1056**	**1107**	**1159**
155	**232**	**256**	**280**	**307**	**334**	**362**	**392**	**422**	**454**	**487**	**522**	**557**	**593**	**631**	**670**	**710**	**751**	**793**	**837**	**881**	**927**	**974**	**1022**	**1072**	**1122**
157.5	**225**	**248**	**272**	**297**	**323**	**351**	**379**	**409**	**440**	**472**	**505**	**539**	**575**	**611**	**649**	**688**	**727**	**768**	**810**	**854**	**898**	**943**	**990**	**1038**	**1087**
160	**218**	**240**	**263**	**288**	**313**	**340**	**368**	**396**	**426**	**457**	**489**	**523**	**557**	**592**	**629**	**666**	**705**	**745**	**785**	**827**	**870**	**914**	**959**	**1006**	**1053**
162.5	**211**	**233**	**255**	**279**	**304**	**330**	**356**	**384**	**413**	**443**	**475**	**507**	**540**	**574**	**610**	**646**	**683**	**722**	**761**	**802**	**844**	**886**	**930**	**975**	**1021**
165	**205**	**226**	**248**	**271**	**295**	**320**	**346**	**373**	**401**	**430**	**460**	**491**	**524**	**557**	**591**	**626**	**663**	**700**	**738**	**778**	**818**	**860**	**902**	**946**	**990**
167.5	**199**	**219**	**240**	**263**	**286**	**310**	**335**	**362**	**389**	**417**	**447**	**477**	**508**	**540**	**574**	**608**	**643**	**679**	**717**	**755**	**794**	**834**	**875**	**918**	**961**
170	**193**	**212**	**233**	**255**	**277**	**301**	**326**	**351**	**378**	**405**	**434**	**463**	**493**	**525**	**557**	**590**	**624**	**660**	**696**	**733**	**771**	**810**	**850**	**891**	**933**
172.5	**187**	**206**	**226**	**248**	**270**	**292**	**316**	**341**	**367**	**394**	**421**	**450**	**479**	**510**	**541**	**573**	**606**	**641**	**676**	**712**	**749**	**787**	**825**	**865**	**906**
175	**182**	**200**	**220**	**240**	**262**	**284**	**307**	**331**	**356**	**382**	**409**	**437**	**466**	**495**	**526**	**557**	**589**	**622**	**656**	**691**	**727**	**764**	**802**	**841**	**880**
177.5	**177**	**195**	**214**	**234**	**255**	**276**	**299**	**322**	**346**	**372**	**398**	**425**	**453**	**481**	**511**	**541**	**573**	**605**	**638**	**672**	**707**	**743**	**780**	**817**	**856**
180	**172**	**190**	**208**	**227**	**248**	**269**	**290**	**313**	**337**	**361**	**387**	**413**	**440**	**468**	**497**	**526**	**557**	**588**	**621**	**654**	**688**	**722**	**758**	**795**	**832**

***S* = 78,000 kPa**

***P* = MAWP kPa**

$$P = \frac{\pi \left[\frac{d}{2}\right]^2 S}{1.1 \times p^2}$$

***p* = staybolt spacing, mm**

***d* = Minimum diameter of corroded staybolt, mm**

Table S2.10.4.1.b [Metric Units]

Maximum Allowable Working Pressure Based on the Load Carrying Capacity of a Single Corroded Steel Staybolt

Explanation:

Since 2007, Table S2.10.4.1 itemizing the maximum allowable load for staybolts (currently on page 141) in NBIC has changed almost yearly. The current equation is written (after typographical corrections) as:

$$P = \frac{\pi d^2 TS}{FS \times 4 \times p^2}$$

Where:

P = Maximum allowable working pressure (psi)
d = minimum diameter of corroded staybolt (inches)
p = maximum staybolt pitch (inches)
TS = tensile strength (7,500psi)
FS = factor of safety (1.1)

This equation has a variety of errors:

- *TS* as it is used here should be corrected to maximum allowable stress (assumed to be taken from Table PG-23.3 from ASME 1971). This value was consistent in all ASME editions prior to ASME 1971 addenda.
    - ASME 1971: 7,500psi (steel)
    - ASME 1971 addenda: 11,300psi (SA-31 steel)
    - ASME 2002: 15,200psi (SA-36 steel)
- *FS* as it is defined here is not a factor of safety, but is intended to be a simple multiplier of 1.1 found in ASME PG-49.1. This multiplier was introduced in the ASME 1971 addenda and exists today. This multiplier did not exist prior to the 1971 addenda.
- The equation mixes two different generations of equations and their coefficients from different eras of ASME (pre- and post- 1971 addenda). This mixture is inconsistent with ASME and should be deemed incorrect.

ASME Equation

ASME 1971 (pre-addenda) PFT-27.1, PG-49.1 define the following equation:

$$P = \frac{\pi\left[\frac{d}{2}\right]^2 S}{p^2 - \pi\left[\frac{d}{2}\right]^2}$$, S = 7,500

Where:

P = Maximum allowable working pressure
d = diameter at bottom of thread (PG-49.2)
S = maximum allowable stress (Table PG-23.3) (7,500 psi)
p = maximum staybolt pitch (inches) (PFT-27.1 states “full pitch dimensions” which we simplify to maximum staybolt dimensions)

ASME 1971 (post-addenda) defines the following equation:

$$P = \frac{\pi\left[\frac{d}{2}\right]^2 S}{1.1 \times \left(p^2 - \pi\left[\frac{d}{2}\right]^2\right)}$$, S = 11,300

given the same definitions as above, but S = 11,300 instead of 7,500.

ASME 1971 Addenda granted a net *increase* of allowable staybolt pressure of ~35%. No change in material specification for steel staybolts was made, but allowance for iron staybolt material was dropped. Logic would dictate that the lower allowable load was only applicable to iron staybolts.

The assumed steel staybolt material (SA-31) is assumed to have a tensile strength (TS) of 50,000-60,000.

ASME 1914:

SPECIFICATIONS FOR STAYBOLT STEEL

REQUIREMENTS FOR ROLLED BARS

63 Steel for staybolts shall conform to the requirements for Boiler Rivet Steel specified in Pars. 40 to 62, except that the tensile properties shall be as follows:

Tensile strength, lb. per sq. in.	50,000–60,000
Yield point, min., lb. per sq. in.	0.5 tens. str.
Elongation in 8 in., min., per cent	1,500,000 / Tens. str.

Also with the exception that the permissible variations in gage shall be as follows:

Permissible Variations in Gage. The bars shall be truly round within 0.01 in. and shall not vary more than 0.005 in. above, or more than 0.01 in. below the specified size.

Cdn Interprov. Rules, 1931:

SPECIFICATIONS FOR STAYBOLT STEEL

Solid or Hollow Staybolts

72. Steel for solid or hollow bars for staybolts shall conform to the requirements for boiler rivet steel, except as follows:

Tension Tests—The bars shall conform to the following requirements as to tensile properties:

Tensile strength, maximum, pounds per square inch	60,000
Yield point minimum pounds per square inch	26,000
Elongation in 8 inches minimum per cent	1,500,000 / Tensile strength

Variation in Gauge—Solid or hollow bars for staybolts, not exceeding 1¼ inch in diameter, which are to be threaded as rolled, shall be truly round within 0.01 inch and shall not vary more than 0.005 inches under or more than 0.01 inches over.

All other bars for staybolts shall conform to the specified tolerances for steel bars.

Given these rules, our factors of safety for steel staybolts are are:

- ASME 1914 - 1971 pre-addenda = $\frac{50{,}000}{7{,}500} = FS = 6.67{:}1$
- ASME 1971 post-addenda = $\frac{50{,}000}{\left(\frac{11{,}300}{1.1}\right)} = FS = 4.87{:}\,1$
- Current NBIC = $\frac{50{,}000}{\left(\frac{7{,}500}{1.1}\right)} = FS = 7.33{:}\,1$
- Canadian Historic Code = $\frac{50{,}000}{8{,}000} = FS = 6.25{:}1$

Recommendations:

- Drop removal of staybolt area from sheet area because sheet thicknesses and staybolt diameters will vary due to corrosion
    - Pre-addenda equation becomes

$$P = \frac{\pi\left[\frac{d}{2}\right]^2 S}{p^2}, \text{ S = 7,500}$$

    - Post-addenda equation becomes

$$P = \frac{\pi\left[\frac{d}{2}\right]^2 S}{1.1 \times p^2}, \text{ S=11,300}$$

- Apply pre-addenda equations to iron staybolts or staybolts of unknown material. This rule satisfies historic loading limits for this material (6:1 safety factor or better). Reference to PG-23.3 is necessary for correct stress values for through-stays and diagonal stays.

- Apply post-addenda equations to staybolts which are known to be of steel material. This rule is consistent with ASME's choice to apply a higher loading factor for steel material. It also remains at least a ~5:1 safety factor.

Subject: 2010 Edition, Part 2, Supplement 2, S2.10.2 – Define Deteriorated Rivet Heads

File Number: NB11-1603

Prop. Page: 133

Proposal: Update text in S2.10.2 to include guidelines for decayed rivets.

Current Wording:

S2.10.2 RIVETS

When the diameter of the rivet holes in the longitudinal joints of a boiler is not known, the diameter of rivets, after driving, may be ascertained from the Table S2.10.2.

Proposed Wording:

S2.10.2 Rivets and Rivet Heads

When the diameter of the rivet holes in the longitudinal joint of a boiler is not known, the diameter of the rivets, after driving, may be ascertained from Table S2.10.2.

TABLE S2.10.2
Sizes for Rivets Based on Plate Thickness

Thickness of Place, inches (mm)	Diameter of Rivet after Driving, inches (mm)
1/4 (6)	11/16 (17)
9/32 (7)	11/16 (17)
5/16 (8)	3/4 (19)
11/32 (9)	3/4 (19)
3/8 (10)	13/16 (21)
13/32 (10)	13/16 (21)
7/16 (11)	15/16 (24)
15/32 (12)	15/16 (24)
1/2 (13)	15/16 (24)
9/16 (14)	1-1/16 (27)
5/8 (16)	1-1/16 (27)

Rivet Head Types

Finished rivet heads are shown in NBIC Part 3, Figure S2.13.13.4.

Note that a riveted seam may have more than one type of rivet to, for example, provide necessary clearance during operation, or for provision for equipment assembly and maintenance.

S2.10.2.1 Inspection of Corroded Rivets

A riveted seam or joint is very redundant by design. Therefore, the following guidelines apply when generalized corrosion is present and consistent on a group of adjacent rivets (typically 4 or more), and not to individual rivets. The inspector must consider the frequency and consistency of corroded rivet heads, and condition, location, and type of riveted joint (and how it may fail) in determining allowable corrosion.

a. Visually identify all connections containing rivets which show signs of significant corrosion.

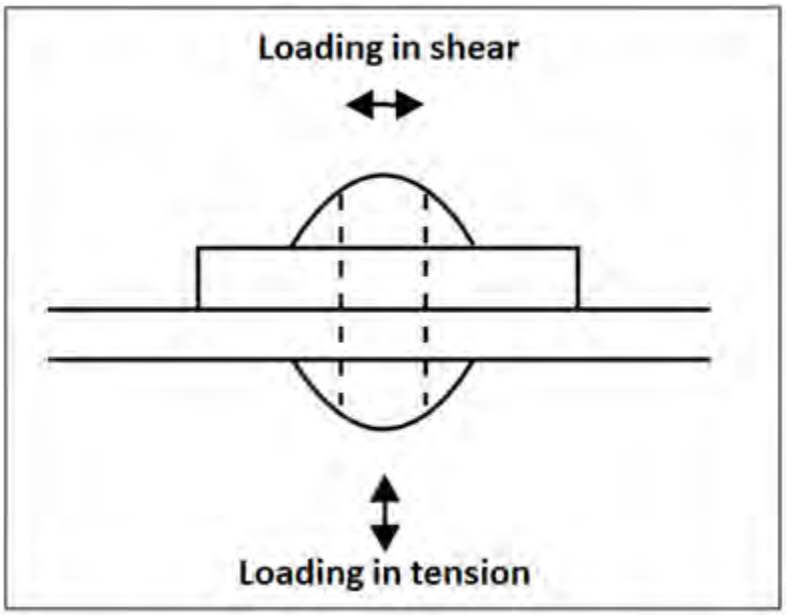
b. Categorize each connection as the type which loads the rivets in one of three possible modes (pure shear, pure tension, or combined shear and tension). Refer to Figure S2.10.2.

c. A leak around a rivet head may be indicative of a rivet which is loose, broken, or otherwise failing to provide adequate clamping force and will require further inspection.
    i. A rivet shall be deemed loose if it can be felt to move after being struck on the side of the head in a direction approximately perpendicular to its shank with a 40oz. engineer's hammer.
    ii. NBIC Part 3, S2.13.13 defines procedures to address a leak around a rivet head.

d. Allowable corrosion:
    i. For rivets in pure shear load, the amount of measured head deterioration shall not exceed 80% of its total head volume. Where rivets have countersunk heads, the head diameter must be equal or greater than 65% of the original head diameter. Severe head corrosion will require further evaluation of the condition and thickness of the plate at the joint.
    ii. For rivets in pure tension, the amount of measured head deterioration shall not exceed 35% of its total head volume. Where rivets have countersunk heads, the head diameter must be equal or greater than 85% of original head diameter. Application of this value shall take into consideration the consistency and frequency of adjacent rivets showing excessive corrosion.

iii. For connections subjected to combined shear and tension loads, the amount of measured head deterioration shall not exceed 60% of its total head volume. Where rivets have countersunk heads, the head diameter must be equal or greater than 75% of original head diameter. Application of this value shall take into consideration the consistency and frequency of adjacent rivets showing excessive corrosion.

Figure S2.10.2



The condition of the plate surrounding the rivets including general wastage, pitting, and the condition of the caulking edge, must be considered.

Explanation

Supplement 1 (Locomotives) has a guideline for deteriorated rivet head acceptance/ rejection [5]. Supplement 2 (Historical Boilers) does not have such a guideline. This report itemizes concerns and errors in Supplement 1 guidelines, and proposes a new Supplement 2 guideline.

Supplement 1 Errors & Omissions

1.) No guidelines for rivets in shear.
2.) S1.4.2.1.L wording is unclear / self-contradictory. The first sentence discusses wastage, and the 2nd sentence discusses remaining height at shank diameter, both using 0.25D.

Discussion

[1, 9] state "U.S. Navy rules require the repair or replacement of rivets when head thickness has been reduced by 25% for 40.8lb [1-inch thick] plate and smaller and by 20% in plate over this weight."

[8] is heavily referenced, and states that current practice is to replace all rivets in connections subject to tensile or tensile-shear loading that have heads corroded to the point of losing 50% or more of their projection beyond the shank. An original copy of this publication could not be sourced, but this wording is consistent among all papers referencing this work.

[2] performs FEA on a 7/8" button head rivet, and recommends that the measured amount of head deterioration shall not exceed 35% of its total head volume.

Caveats:

- [2] assumes A502 grade rivets, other reports do not appear to specify the grade of rivet. Historical boilers are using A-31 grade rivets.
- All referenced work assumes no change to the load of the rivets. NBIC is unique where the standard will degrade MAWP based on boiler condition, thus changing the load imposed on the rivet. However, FEA in [2] shows a rather sharp increase in stress when deterioration surpasses 35%. This increase is far greater than the reduction due to change in MAWP. The paper reports that measurements have shown rivet clamping force approaches yield load of the rivet.
- Where mentioned, only button head rivet designs are discussed in reference materials.

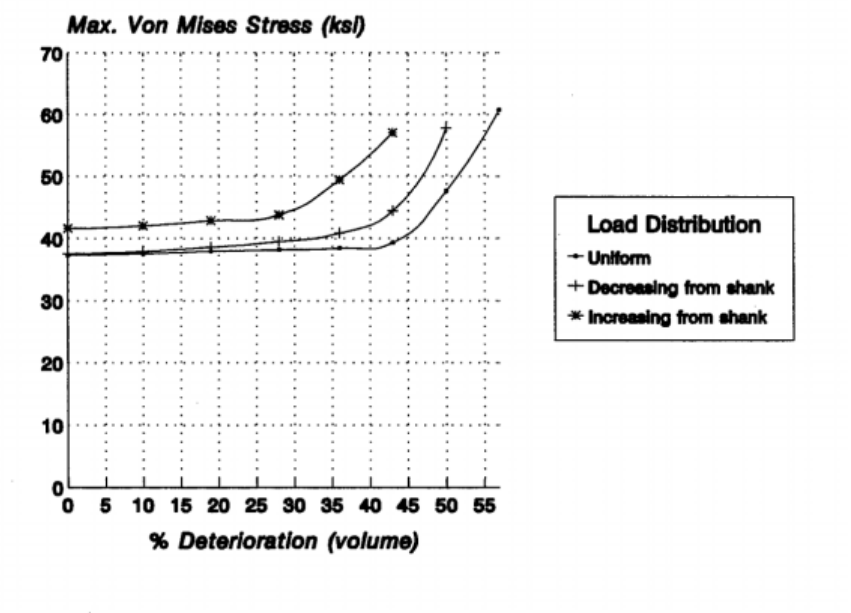


Figure 12 - Max. Stress Vs. Loss of Head Volume (Uniform Model)

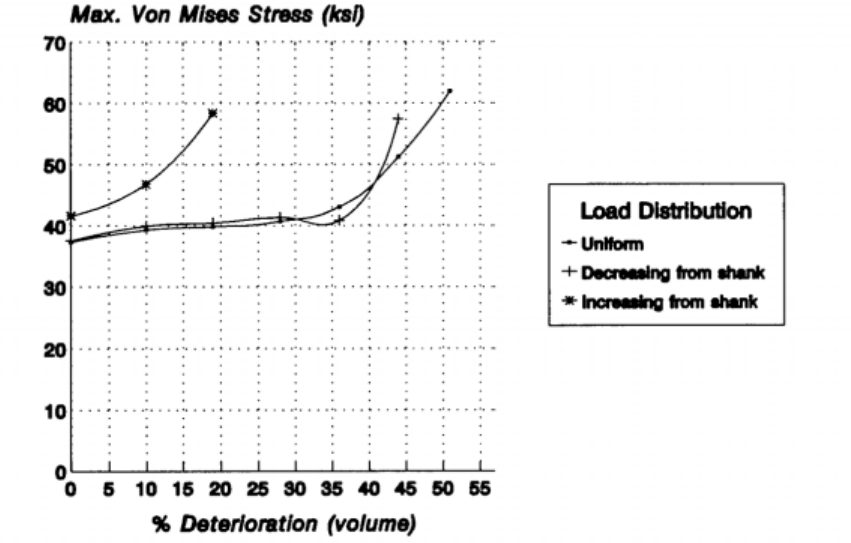
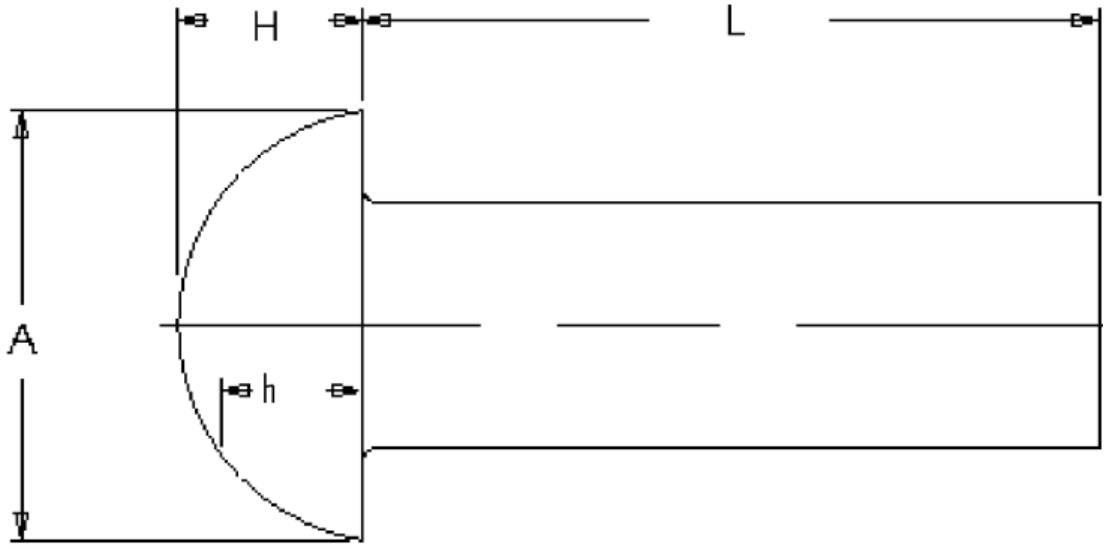


Figure 13 - Max. Stress Vs. Loss of Head Volume (Non-Uniform Model)

New Button Head Rivet Dimensions

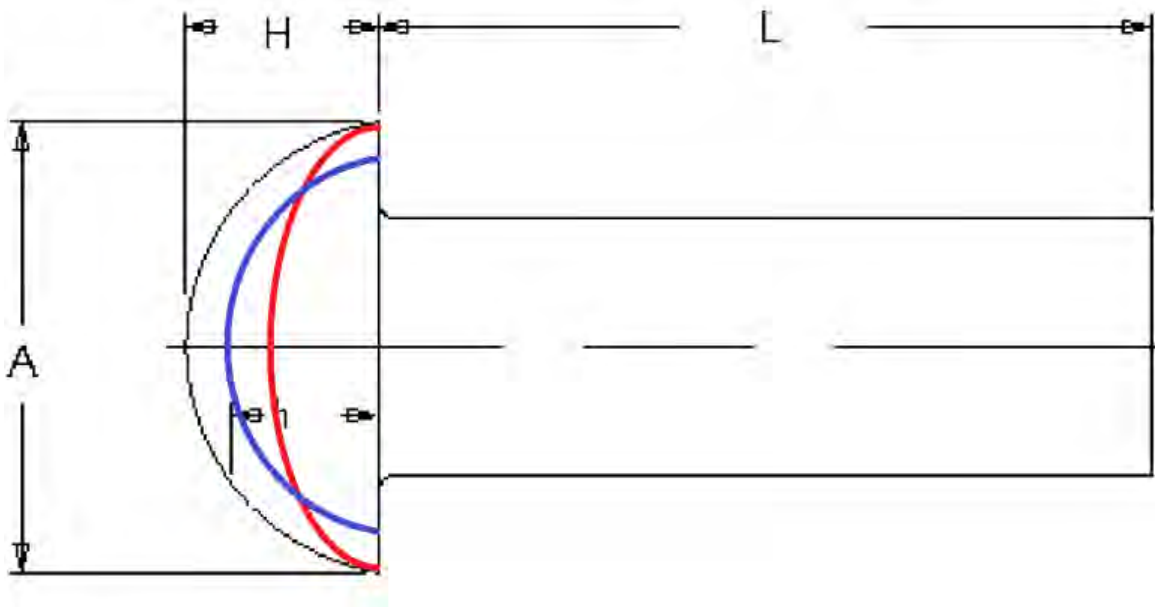
Values are taken from [6]. Calculated values below are based on equations from [7].



Shank Diameter	A Head Diameter	H Head Height	h Height at Shank Circumference (new)	Head Volume
0.500	0.875	0.375	0.298	0.140
0.625	1.094	0.469	0.372	0.274
0.750	1.312	0.562	0.446	0.473
0.875	1.531	0.656	0.521	0.752
1.000	1.750	0.750	0.595	1.123
1.125	1.969	0.844	0.670	1.600
1.250	2.188	0.938	0.745	2.200
1.375	2.406	1.031	0.818	2.918
1.500	2.625	1.125	0.893	3.790
1.625	2.844	1.219	0.968	4.820
1.750	3.062	1.312	1.041	6.013

Deteriorated Button Head Rivet Dimensions

We will consider two types of generalized deterioration. All red values will represent even deterioration at the crown of the head, where the base of the rivet head remains intact. All blue values represent equal deterioration around the rivet head.



NBIC S1.4.2.1: minimum h = 0.25 * shank diameter

Assuming even deterioration at the rivet head crown, but no deterioration at the edge of the rivet head (red line), **60%** of rivet head material is removed before the rivet must be replaced.

Assuming even deterioration (blue line) throughout the rivet head, **52.5%** of material is removed before the rivet must be replaced.

US Navy [1, 9]: minimum H = 0.75 * original H

Assuming even deterioration at the rivet head crown, but no deterioration at the edge of the rivet head (red line), **31.5%** of rivet head material is removed before the rivet must be replaced.

Assuming even deterioration throughout the rivet head, **55%** of material is removed before the rivet must be replaced.

[8] is calculated in the same manner, except **H = 0.5 * original H**. Assuming even deterioration at the rivet head crown, but no deterioration at the edge of the rivet head (red line), **57.5%** of rivet head material is removed before the rivet must be replaced. However, assuming even deterioration throughout the rivet head, deterioration enters the rivet shank so these values are not considered. Given this result, [8] will not be further considered until a copy is attained to determine how to interpret its guidelines.

US Army [2]: minimum head volume = 0.65 * original head volume

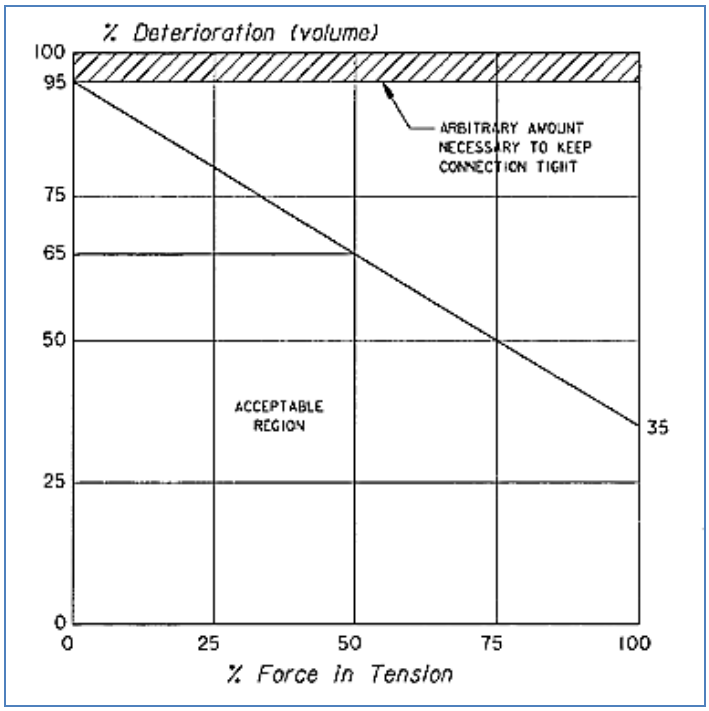
Assuming even deterioration at the rivet head crown, but no deterioration at the edge of the rivet head (red line), to obtain 35% removal of head volume, 'h' must only reduce by **20%** of its original height. Using NBIC S1.4.2.1 metrics, 'h' must be **40%** or greater than shank diameter.

Assuming even deterioration throughout the rivet head, to obtain **35%** removal of head volume, 'h' must only reduce by **17.5%** of its original height. Using NBIC S1.4.2.1 metrics, 'h' must be **46%** or greater than shank diameter.

Discussion

The FEA results [2] assumed even corrosion around the entire rivet head. These conclusions (35% volume removal) are similar to the rule-of-thumb U.S. Navy guidelines [1, 9] (31.5%) when corrosion is maximum at the crown of the rivet head. Given this consistency, this draft targets a maximum 35% volume removal threshold for rivets in pure tension.

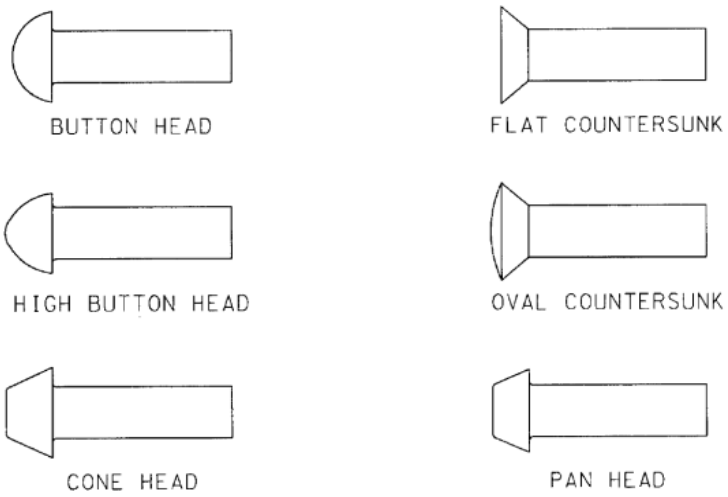
[2] also suggested that for rivets in pure shear, rivets do not need to be replaced as long as the corrosion has not extended into the shank and that the rivet is not loose. Furthermore, the ratio of total head volume removed may linearly scale from 35% (for 100% tension) to 95% (for 100% shear). Refer to below figure from [2].



However, in practicality, one must expect the plate to deteriorate with the rivet head. For example, when a flat countersunk rivet head is 20% of its original volume, the adjoining plate is 33% of its original thickness. So, in practice, it is reasonable to expect a repair that replaces both plate and rivets when severe rivet head decay is present.

Regardless of the type of corrosion, NBIC S1.4.2.1 allows more corrosion than all other approaches for rivets in pure tension. Research and references to peer reviewed documents for NBIC S1.4.2.1 is unknown so cannot be considered. However, due to the difficulties in determining the ratio of shear/tension load on a specific rivet, this draft

adopts the rule to apply equal 50/50% shear/tension. Given the above text, allowable head corrosion for rivets in combined shear/tension is 60%; consistent with NBIC S1.4.2.1.



We assume equal allowable wastage regardless of rivet head type because all known construction codes assume equal allowable loading regardless of rivet head type.

References

[1] "Atlantic Area Best Practices: Rivet Inspection Guidance", U.S. Department of Transportation, United States Coast Guard, 2000.
[2] "Rivet Replacement Analysis", Erich Edward Reichle, U.S. Army Corps of Engineers, 1999.
[3] "Inspection, Evaluation, and Repair of Hydraulic Steel Structures", U.S. Army Corps of Engineers, 2001.
[4] "Guidelines for Assessing Condition of Riveted Spillway Gates", REMR Technical Note CS-ES-1.12, 1994
[5] NBIC Supplement 1, Part 2, 2010.
[6] ASME B18.1.2: American National Standard Large Rivets
[7] http://en.wikipedia.org/wiki/Spherical_cap
[8] "Rivet Replacement Criteria", Fazio, A.E., and R.N. Fazio, Second Bridge Engineering Conference. Washington, D.D. Transportation Research Board. Vol 1, TRR-950
[9] "Procedures For Hull Inspection and Repair on Vessels Built of Riveted Construction", U.S. Department of Transportation, United States Coast Guard, 2001.

SUPPLEMENT 7

INSPECTION OF CONTAINERS IN LIQUEFIED PETROLEUM GAS (LPG) SERVICE

S7.1 SCOPE

Containers designed for storing LPG can be stationary or can be mounted on skids. LPG is generally considered to be non-corrosive to the interior of the container. NBIC Part 2, Supplement 7 is provided for guidance of a general nature for the owner, user, commercial refurbisher or jurisdictional authority. There may be occasions where more detailed procedures will be required such as changing from one service to another (e.g., anhydrous ammonia to LPG; aboveground to underground; or containers that are commercially refurbished).

The application of this Supplement to underground containers will only be necessary when evidence of structural damage to the container has been observed, leakage has been determined, or the container has been dug up, and is to be reinstalled. Special consideration will be given to containers that are commercially refurbished (see NBIC Part 2, Supplement 7.10).

S7.2 PRE-INSPECTION ACTIVITIES

A review of the known history of the container shall be performed. This shall include a review of information, such as:

1. Operating conditions;
2. Historical contents of the container;
3. Results of any previous inspection;
4. Current jurisdictional inspection certificate, if required;
5. ASME Code symbol stamping or mark of code of construction, if required; and
6. National Board and/or jurisdictional registration number, if required.

The container shall be sufficiently cleaned to allow for visual inspection. Except for commercially refurbished containers see S7.9

S7.3 INSERVICE INSPECTION FOR CONTAINERS IN LP GAS SERVICE

The type of inspection given to containers shall take into consideration the condition of the container and the environment in which it operates. The inspection may be external or internal, and use a variety of nondestructive examination methods. Where there is no reason to suspect an unsafe condition or where there are no inspection openings, internal inspections need not be performed. When service conditions change from one service to another, such as ammonia to LPG, an internal inspection may be required. The external inspection may be performed when the container is pressurized or depressurized, but shall provide the necessary information that the essential sections of the container are of a condition to operate.

S7.4 EXTERNAL INSPECTION

All parts of the container shall be inspected for corrosion, distortion, cracking, or other conditions as described in this Section. In addition, the following shall be reviewed, where applicable:

a.) Insulation or Coating

If the insulation or coating is in good condition and there is no reason to suspect an unsafe condition behind. it, then it is not necessary to remove the insulation or coating in order to inspect the container, except for commercially refurbished containers see S7.9 However, it may be advisable to remove a small

portion of the insulation or coating in order to determine its condition and the condition of the container surface.

S7.8.2 DENTS

b.) Welds

The maximum mean dent diameter on welds (i.e., part of the deformation includes a weld) shall not exceed 10% of the shell diameter. The maximum depth shall not exceed 5% of the mean dent diameter.

S7.8.4 CUTS OR GOUGES

When a cut or a gouge exceeds 25% of the required thickness of the container, the container shall be removed from service until it is repaired by a qualified repair organization or permanently removed from service.

S7.8.5 CORROSION

a) Line and Crevice Corrosion

For line and crevice corrosion, the depth of the corrosion shall not exceed 25% of the required thickness.

b) Isolated Pitting

Isolated pits may be disregarded provided that:

1) Their depth is not more than 25% of the required thickness of the container wall;

2) The total area of the pits does not exceed 7 sq. in. (4500 sq. mm) within any 8 in. (200 mm) diameter circle; and

3) The sum of their dimensions along any straight line within this circle does not exceed 2 in. (50 mm).

c) General Corrosion

For a corroded area of considerable size, the thickness along the most critical plane of such area may be averaged over a length not exceeding 10 in. (250 mm). The thickness at the thinnest point shall not be less than 75% of the required wall thickness, and the average shall not be less than 90% of the required wall thickness. When general corrosion is identified that exceeds the limits set forth in this paragraph, the container shall be removed from service until it is repaired by a qualified “R” Stamp holder or permanently removed from service unless an acceptable fitness for service evaluation is performed in accordance with Part 2- 4.4 .

(New Section)

S7.9 ASME LPG Containers Less Than 2000 Gallons Being Refurbished By a Commercial Source.

Commercially refurbished containers are used containers that are temporarily taken out of service for repair and or renewal and sent to a company which specializes in this type of work. Because the history of some of these containers is unknown, special attention shall be given to inspection and repair before returning any of these containers back to service. ASME LPG containers less than 2000 gallons may be refurbished subject to the following conditions:

1) A complete external inspection shall be completed under the guidelines of this Supplement.
   a) If any defects are found, the defect shall be repaired under NBIC Part 3, Repairs and Alterations by qualified personnel or permanently removed from service

2) Containers that have been previously used in anhydrous ammonia service shall not be converted to LPG service. Any blue coloring of the brass valves indicates that the container has been in anhydrous ammonia service.

3) The container shall be blasted down to bare metal so that an inspection can be performed under the guidelines of this Supplement.

4) Verify that there is no internal corrosion due to valves having been removed while the container was out of service.

NB 12-0604

5.3.4 BOILER OR PRESSURE VESSEL DATA REPORT FORM (NB-5)

FORM NB-5 BOILER OR PRESSURE VESSEL DATA REPORT
FIRST INTERNAL INSPECTION

Standard Form for Jurisdictions Operating Under the ASME Code

Complete When Not Registered National Board

1	DATE INSPECTED MO | DAY | YEAR	CERT EXP DATE MO | YEAR	CERTIFICATE POSTED ☐Yes ☐No	OWNER NO.	JURISDICTION NUMBER	NAT'L BD NO. ☐ OTHER NO. ☐
2	OWNER				NATURE OF BUSINESS	KIND OF INSPECTION ☐Un ☐Ex / CERTIFICATE INSPECTION ☐Yes ☐No
	OWNER'S STREET ADDRESS NUMBER				OWNER'S CITY	STATE / ZIP
3	USER'S NAME - OBJECT LOCATION				SPECIFIC LOCATION IN PLANT	OBJECT LOCATION - COUNTY
	USER'S STREET ADDRESS NUMBER				USER'S CITY	STATE / ZIP
4	CERTIFICATE COMPANY NAME				CERTIFICATE COMPANY CONTACT NAME	EMAIL
	CERTIFICATE COMPANY ADDRESS				CERTIFICATE COMPANY CITY	STATE / ZIP
5	TYPE ☐FT ☐WT ☐CI ☐AIR TANK ☐WATER TANK Other			YEAR BUILT	MANUFACTURER	YEAR INST ☐New ☐Second Hand
6	USE ☐Power ☐Process ☐Steam Htg ☐HWH ☐HWS ☐Storage ☐Heat Exchange ☐Other				FUEL (BOILER)	METHOD OF FIRING (BOILER) / PRESSURE GAGE TESTED ☐Yes ☐No
7	PRESSURE This Inspection ____ Prev. Inspection ____		SAFETY-RELIEF VALVES Set at		EXPLAIN IF PRESSURE CHANGED	
8	IS CONDITION OF OBJECT SUCH THAT A CERTIFICATE MAY BE ISSUED? ☐Yes ☐No (If no, explain fully on back of form - listing code violation)				PRESSURE TEST ☐Yes ____ psi Date ____ ☐No	
9	SHELL No.	DIAMETER ☐ID ____ in. ☐OD	OVERALL LENGTH ____ ft ____ in.	THICKNESS ____ in.	TOTAL HTG SURFACE (BOILER) ____ Sq Ft	MATERIAL ASME Spec Nos
10	ALLOWABLE STRESS ____ psi	BUTT STRAP Thks ____ in.	☐Single ☐Double	HEADERS - WT BOILERS Thickness ____ in.	TYPE ☐Box ☐Sinuous ☐Wtr Wall ☐Other	
11	TYPE LONGITUDINAL SEAM ☐Lap ☐Butt ☐Welded ☐Brazed ☐Riveted		RIVETED Dia Hole ____ in.		PITCH ____ in. X ____ in. X ____ in.	SEAM EFF ____ %
12	HEAD THICKNESS ____ in.	HEAD TYPE ☐Flued ☐Flat ☐Plus ☐Minus	☐Fixed ☐Movable ☐Quick Opening	RADIUS DISH ____ in.	ELLIP RATIO	BOLTING No. ____ Dia. ____ in. Material ____
13	TUBE SHEET THICKNESS ____ in.	TUBES No. ____ Dia ____ in.	Length ____ ft ____ in.		PITCH (WT BLRS) ____ in. X ____ in.	LIGAMENT EFF ____ %
14	FIRE TUBE BOILERS	DISTANCE UPPER TUBES TO SHELL Front ____ in. Rear ____ in.		STAYED AREA FRONT HEAD { Above Tubes ____ Below Tubes ____	REAR HEAD { Above Tubes ____ Below Tubes ____	
	STAYS ABOVE TUBES Front No. ____ Rear No. ____	TYPE ☐Head to Head ☐Diagonal ☐Welded ☐Weldless			AREA OF STAYS Front ____ Rear ____	
	STAYS BELOW TUBES Front No. ____ Rear No. ____	TYPE ☐Head to Head ☐Diagonal ☐Welded ☐Weldless			AREA OF STAYS Front ____ Rear ____	
15	FURNACE - TYPE Adamson (No. Sect ____) ☐Corrugated ☐Plain ☐Other			THICKNESS ____ in.	TOTAL LENGTH ____ ft ____ in.	TYPE LONG. SEAM ☐Welded ☐Riveted ☐Seamless
16	STAYBOLTS - TYPE Threaded ____ Welded ____ Hollow ____ Drilled (Size Hole ____ in.)			DIAMETER ____ in.	PITCH ____ in. X ____ in.	NET AREA ____ sq. in.
17	SAFETY-RELIEF VALVES No. ____ Size ____	TOTAL CAPACITY ____ Clm ____ Lb/Hr ____ Btu/Hr		OUTLETS No. ____ Size ____	PROPERLY DRAINED ☐Yes ☐No (If no, explain on back of form)	
18	STOP VALVES ☐Yes ☐No	ON STEAM LINE ☐Yes ☐No	ON RETURN LINES ☐Yes ☐No	OTHER CONNECTIONS ☐Yes ☐No	STEAM LINES PROPERLY DRAINED ☐Yes ☐No (If no, explain on back of form)	
19	FEED PIPE Size ____ in.	FEED APPLIANCES No. ____	TYPE DRIVE ☐Steam ☐Motor	CHECK VALVES	FEED LINE ☐Yes ☐No	RETURN LINE ☐Yes ☐No
20	WATER GAGE GLASS No. ____	TRY COCKS No. ____	BLOWOFF PIPE Size ____ No. Location ____		INSPECTION OPENINGS COMPLY WITH CODE ☐Yes ☐No (If no, explain on back of form)	
21	CAST-IRON BOILERS Length ____ in. Width ____ in. Height ____ in.		SECTIONS No. ____		DOES WELDING ON STEAM, FEED BLOWOFF AND OTHER PIPING COMPLY WITH CODE? ☐Yes ☐No (If no, explain on back of form)	
22	SHOW ALL CODE STAMPING ON BACK OF FORM. Give details (use sketch) for special objects NOT covered above - such as Double wall vessels etc.				DOES ALL MATERIAL OTHER THAN AS INDICATED ABOVE COMPLY WITH CODE? ☐Yes ☐No (If no, explain on back of form)	
23	NAME AND TITLE OF PERSON TO WHOM REQUIREMENTS WERE EXPLAINED:					
24	I HEREBY CERTIFY THIS IS A TRUE REPORT OF MY INSPECTION Signature of Inspector	IDENT NO.	EMPLOYED BY		IDENT NO.	

NB12-0604

FORM NB-6 BOILER-FIRED PRESSURE VESSEL
REPORT OF INSPECTION
Standard Form for Jurisdictions Operating Under the ASME Code

1	DATE INSPECTED MO | DAY | YEAR	CERT EXP DATE MO | YEAR	CERTIFICATE POSTED ☐ Yes ☐ No	OWNER NO. JURISDICTION NUMBER		NAT'L BD NO. ☐ OTHER NO. ☐
2	OWNER			NATURE OF BUSINESS	KIND OF INSPECTION ☐ Int ☐ Ext	CERTIFICATE INSPECTION ☐ Yes ☐ No
	OWNER'S STREET ADDRESS NUMBER			OWNER'S CITY	STATE	ZIP
3	USER'S NAME – OBJECT LOCATION			SPECIFIC LOCATION IN PLANT	OBJECT LOCATION - COUNTY	
	USER'S STREET ADDRESS NUMBER			OWNER'S CITY	STATE	ZIP
4	CERTIFICATE COMPANY NAME			CERTIFICATE COMPANY CONTACT NAME	EMAIL	
	CERTIFICATE COMPANY ADDRESS			CERTIFICATE COMPANY CITY	STATE	ZIP
5	TYPE ☐ FT ☐ WT ☐ CI ☐ Other _____		YEAR BUILT	MANUFACTURER		
6	USE ☐ Power ☐ Process ☐ Steam Htg ☐ HWH ☐ HWS ☐ Other _____			FUEL	METHOD OF FIRING	PRESSURE GAGE TESTED ☐ Yes ☐ No
7	PRESSURE ALLOWED MAWP _____ This Inspection _____ Prev. Inspection _____			SAFETY-RELIEF VALVES Set at _____ Total Capacity _____		HEATING SURFACE OR BTU (Input/Output)
8	IS CONDITION OF OBJECT SUCH THAT A CERTIFICATE MAY BE ISSUED? ☐ Yes ☐ No (If no, explain fully under conditions)				HYDRO TEST ☐ Yes _____ psi Date _____ ☐ No	
9	CONDITIONS: With respect to the internal surface, describe and state location of any scale, oil or other deposits. Give location and extent of any corrosion and state whether active or inactive. State location and extent of any erosion, grooving, bulging, warping, cracking or similar condition. Report on any defective rivits, bowed, loose or broken stays. State condition of all tubes, tube ends, coils, nipples, etc. Describe any adverse conditions with respect to pressure gage, water column, gage glass, gage cocks, safety valves, etc. Report condition of setting, linings, baffles, supports, etc. Describe any major changes or repairs made since last inspection.					
10	REQUIREMENTS: (List Code Violations)					
11	NAME AND TITLE OF PERSON TO WHOM REQUIREMENTS WERE EXPLAINED:					
	I HEREBY CERTIFY THIS IS A TRUE REPORT OF MY INSPECTION					
	SIGNATURE OF INSPECTOR		IDENT NO.	EMPLOYED BY		IDENT NO.

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

NB-6 Rev. 4

NB12-0604

3 of 3

FORM NB-7 PRESSURE VESSELS
REPORT OF INSPECTION
Standard Form for Jurisdictions Operating Under the ASME Code

1	DATE INSPECTED MO | DAY | YEAR	CERT EXP DATE MO | YEAR	CERTIFICATE POSTED ☐ Yes ☐ No	OWNER NO.	JURISDICTION NUMBER	NAT'L BD NO. ☐ OTHER NO. ☐		
2	OWNER				NATURE OF BUSINESS	KIND OF INSPECTION ☐ Int ☐ Ext	CERTIFICATE INSPECTION ☐ Yes ☐ No	
	OWNER'S STREET ADDRESS				OWNER'S CITY	STATE	ZIP	
3	USER'S NAME - OBJECT LOCATION				SPECIFIC LOCATION IN PLANT	OBJECT LOCATION - COUNTY		
	USER'S STREET ADDRESS				USER'S CITY	STATE	ZIP	
4	CERTIFICATE COMPANY NAME				CERTIFICATE COMPANY CONTACT NAME	EMAIL		
	CERTIFICATE COMPANY ADDRESS				CERTIFICATE COMPANY CITY	STATE	ZIP	
5	TYPE ☐ AIR TANK ☐ WATER TANK ☐ OTHER			YEAR BUILT	MANUFACTURER			
6	USE ☐ STORAGE ☐ PROCESS ☐ HEAT EXCHANGE ☐ OTHER				SIZE	PRESSURE GAGE TESTED ☐ Yes ☐ No		
7	PRESSURE ALLOWED THIS INSPECTION _____ PREVIOUS INSPECTION _____				SAFETY RELIEF VALVES SET AT _____ TOTAL CAPACITY _____	EXPLAIN IF PRESSURE CHANGED		
8	IS CONDITION OF OBJECT SUCH THAT A CERTIFICATE MAY BE ISSUED? ☐ YES ☐ NO (IF NO EXPLAIN FULLY UNDER CONDITIONS)					HYDRO TEST ☐ YES _____ PSI DATE _____ ☐ NO		
9	CONDITIONS: With respect to the internal surface, describe and state location of any scale, oil or other deposits. Give location and extent of any corrosion and state whether active or inactive. State location and extent of any erosion, grooving, bulging, warping, cracking or similar condition. Report on any defective rivets, bowed, loose or broken stays. State condition of all tubes, tube ends, coils, nipples, etc. Describe any adverse conditions with respect to pressure gage, water column, gage glass, gage cocks, safety valves, etc. Report condition of setting, linings, baffles, supports, etc. Describe any major changes or repairs made since last inspection.							
10	REQUIREMENTS: (LIST CODE VIOLATIONS)							
11	NAME AND TITLE OF PERSON TO WHOM REQUIREMENTS WERE EXPLAINED:							
	I HEREBY CERTIFY THIS IS A TRUE REPORT OF MY INSPECTION _____ SIGNATURE OF INSPECTOR			IDENT NO.	EMPLOYED BY	IDENT NO.		

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

NB-7 Rev. 2

NB12-1901

Original Comment:
Please replace the word "metal" in the first sentence with the word "Material" as metal is not the only material used in the construction of a pressure retaining item. Also we need to indicate that the metal/material temperature being talked about are the minimum and/or maximum values.

4.3.1.1 ALL PRESSURE TESTING

Careful design of test procedure can limit potential damage. For testing of pressure retaining items, parameters that should be considered are the test media, test pressure, materials of construction and ~~metal~~ material temperature and temperature of test media. Some carbon steel and low alloy steel materials that were manufactured prior to 1970 may not have sufficient notch toughness to prevent brittle fracture during pressure testing conducted at, or even above, the generally acceptable temperature of 60°F (16 deg C).

For thick-walled pressure-retaining items, it is recommended to seek technical guidance in establishing notch toughness characteristics of steel plate prior to pressure testing so that the metal temperature may be warmed above 60 deg F (16 deg C) to avoid brittle fracture.

The organization making any pressure test shall determine pressure-retaining item material has adequate notch toughness at the minimum temperature of the material and test media during pressure test.

4.3.1.2 LIQUID PRESSURE TESTING

Paragraph 7

~~Metal~~ Material temperature shall not be more than 120°F (49°C) unless the owner-user specifies the requirement for a higher test temperature. If the owner-user specifies a test temperature higher than 120°F (49°C), then precautions shall be taken to afford the Inspector close examination without risk of injury.

ATTACHMENT 4

Proposed Interpretation

Inquiry:	IN12-0401
Source:	Tony Hardin
Subject:	Part 3, 4.4.2. a) Liquid Pressure Test
Edition:	2011
Question:	(1) In Part 3, 4.4.2 a), is it the purpose of the rule to require a liquid pressure test at 150% of the maximum allowable working pressure (MAWP) stamped on the pressure retaining item, adjusted for temperature ?
Reply:	No
Committee's Question:	(1) In Part 3, 4.4.2 a) is a liquid pressure test not exceeding 150% of MAWP stamped on the pressure retaining item required for an alteration?
Committee's Reply:	No. In accordance with Part 3, 4.4.2 a) 2), liquid pressure testing of connecting welds not exceeding 150% of MAWP may be tested or examined in accordance with rules for repairs.
Rationale:	Part 3, 4.4.2 a) 2) references either testing or examination methods used in repairs for connecting welds, in lieu of liquid pressure testing at 150% of MAWP.
SC Vote	
NBIC Vote	

Inquiry:	IN12-0401
Source:	Tony Hardin
Subject:	Part 3, 4.4.2. a) Liquid Pressure Test
Edition:	2011
Question:	(2) In Article 3, 4.4.2. a) is it allowable to perform a liquid pressure test at less than 150% of the MAWP stamped on the pressure retaining item to verify the leak tightness of the alteration?
Reply:	Yes.
Committee's Question:	(2) In Part 3, 4.4.2. a) 2) may a liquid pressure test of connecting welds for a pressure retaining item be performed below 150% of the MAWP for an alteration?
Committee's Reply:	Yes, with acceptance of Inspector and when required the Jurisdiction. See NBIC Part 3, 4.4.
Rationale:	Part 3, 4.4.2. a) 2) provides an alternative to a code required pressure test by liquid pressure testing of connecting welds to be performed at less than 150% of MAWP.
SC Vote	
NBIC Vote	

Subject: 2007 Edition, Part 3, Supplement 2, S2.13.9.2 – Welded Repair of Cracks in Unstayed Area

File Number: NB10-0103

Prop. Page: 156 & 157

Proposal: Update figure S2.13.9.2 to show crack in non-riveted area, update text to fix a typo, move “See figure S.2.13.9.2” and change girth to circumferential.

Explanation This area currently is confusing and can be updated and corrected to fix these issues. There are six issues to address.

1. Remove “See figure S.2.13.9.2” from a).
2. Correct Typo in b) should say Cracks in unstayed not Cracks in stayed
3. Change 8” requirement to insure that the repair is at least 2” from last row of rivets and that preheat is used. Text should be changed to “within 2in. (50mm) from the center line of the outer most row of rivets. Minimum 175 degree preheat shall be used.”
4. Add a reference to figure S2.13.9.2-a in c).
5. Add a reference to figure S2.13.9.2 –b in d).
6. Change girth to circumferential in d)
7. Use new figure S.2.13.9.2-a and S.13.9.2-b

Update text and diagram can be found on page 3

Item # 2

Change to UNSTAYED

Item # 1

Remove text from here

Item # 3

Change text for 8" rule and preheat

Item # 4

Add Reference to Figure

Item # 5

Add Reference to Figure

Item # 6

Change girth to Circumferential

S2.13.9.2 WELDED REPAIR OF CRACKS IN UNSTAYED AREAS

a) Prior to repairing cracks, the plate shall be NDE examined for other defects. All affected sections shall be repaired. ~~(See NBIC Part 3, Figure S2.13.9.2).~~

b) Cracks in ~~stayed~~ areas may be repaired by welding. Before cracks are repaired, however, the inner surface of the plate should be examined for possible excessive corrosion or grooving.

c) Cracks in unstayed areas may be repaired by welding, providing the cracks do not extend between rivet holes in a longitudinal seam or parallel to a longitudinal seam within ~~8 in. (200 mm)~~. The completed repair must be radiographed and stress relieved. Alternative methods in lieu of Postweld Heat Treatment identified in NBIC Part 3, 2.5.3 may be used. (See Figure S2.13.9.2.-a)

d) Cracks radiating from a common point (star cracking) shall not be repaired; installation of a flush patch is required. Cracks radiating from a rivet hole in a girth seam may be repaired if the plate is not seriously damaged. (See Figure S2.13.9.2-b)

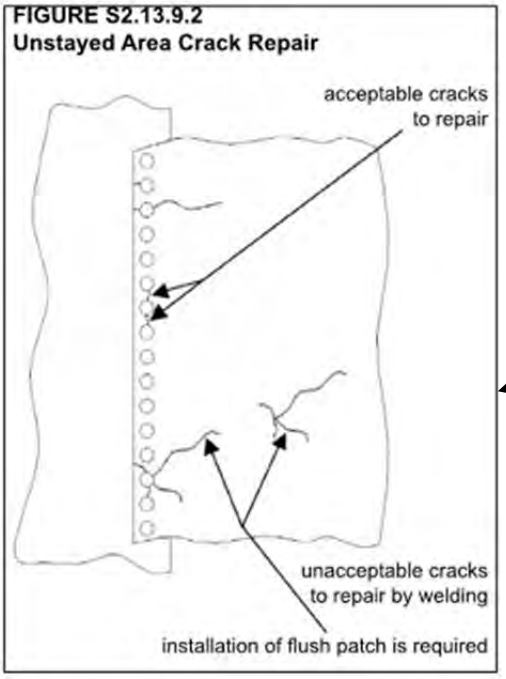
e) Prior to welding, the rivets into which cracks extend and the rivets on each side of them shall be removed.

f) In riveted joints, tack bolts should be placed in alternating holes to hold the plate laps firmly.

g) Rivets holes should be reamed after welding.

h) Welding shall not cover rivet heads.

FIGURE S2.13.9.2
Unstayed Area Crack Repair



Item # 7 Replace this with the Figure S2.13.9.2-a and Figure S2.13.9.2-b on page 3

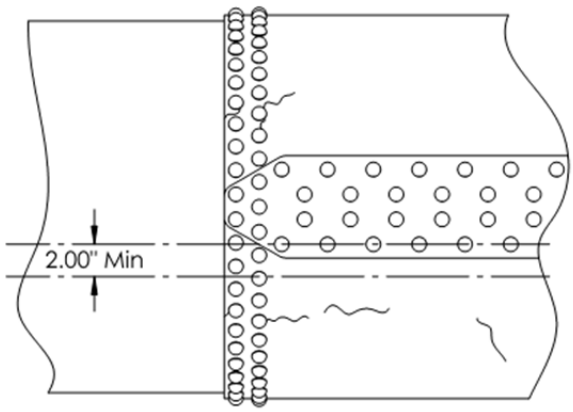
[2]

Updated text and Diagram

S.2.13.9.2 WELDED REPAIR OF CRACKS IN UNSTAYED AREAS

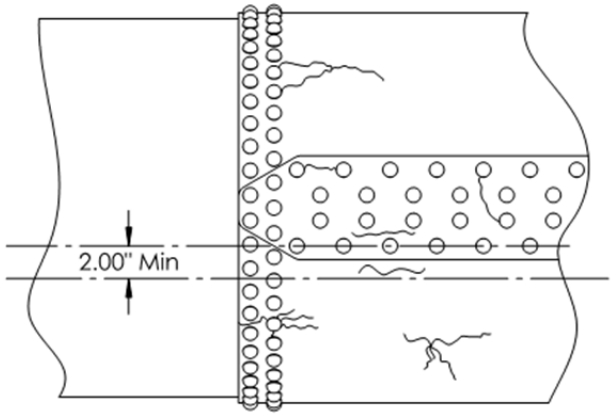
a) Prior to repairing cracks, the plate shall be NDE examined for other defects. All affected sections shall be repaired.
b) Cracks in unstayed areas may be repaired by welding. Before cracks are repaired, however, the inner surface of the plate should be examined for possible excessive corrosion or grooving.
c) Cracks in unstayed areas may be repaired by welding, providing the cracks do not extend between rivet holes in a longitudinal seam or parallel to a longitudinal seam within 2in. (50mm) from the center line of the outer most row of rivets. Minimum 175^0 F. (65^0 C.) preheat shall be used. The complete repair must be radiographed and stress relieved. Alternative methods in lieu of Postweld Heat Treatment identified in NBIC Part 3, 2.5.3 may be used. (See NBIC Part 3, Figure S.2.13.9.2-a)
d) Cracks radiating from a common point (star cracking) shall not be repaired; installation of a flush patch is required. Cracks radiating from a rivet hole in a circumferential seam may be repaired if the plate is not seriously damaged. (See NBIC Part 3, Figure S.2.13.9.2-b)
e) Prior to welding, the rivets into which cracks intend and the rivets on each side of them shall be removed.
f) In riveted joints, tack bolts should be placed in alternating holes to hold plate laps firmly.
g) Rivets holes should be reamed after welding.
h) Welding shall not cover rivet heads.

Figure S2.13.9.2-a
Unstayed Area Crack Repair



Cracks Acceptable to
Repair by Welding

Figure S2.13.9.2-b
Unstayed Area Crack Repair



Cracks Unacceptable
to Repair by Welding

Subject: 2007 Edition, Part 3, Supplement 2, S2.13.13.1 – Caulking Rivet Seams and Rivet Heads

File Number: NB10-1004

Prop. Page: 166 & 167

Proposal: Update figure S2.13.13.1 with proper title and update figure to show caulking rivet seams.

Explanation:

1. Update a) to say caulking tool instead of impact tool.
2. Current title calls out Rivet heads; however, figure shows caulking rivet seam. Figure title should be caulking rivet seams and show caulking rivet seams.

Update Text & figure can be found on page 3

[4]

S2.13.13.1 CAULKING RIVETED SEAMS AND RIVET HEADS (SEE NBIC PART 3, FIGURE S2.13.13.1)

a) Caulking refers to the sealing of plate seams and rivet heads by driving the edge of one surface onto the other by use of an ~~impact tool~~.

b) The plate edges should be beveled to an angle not sharper than 70 degrees to the plane of the plate and as near thereto as practicable.

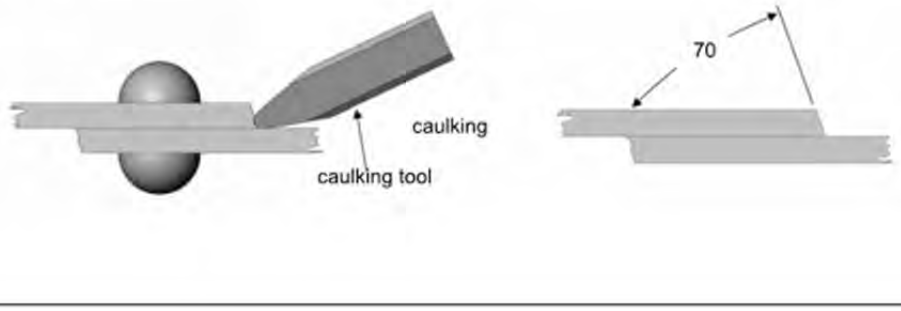
c) Caulking shall be done with a tool of such form that there is no danger of scoring or damaging the plate underneath the caulking edge, or splitting the caulked sheet.

d) Riveted seams and rivet heads may be re-caulked after repairs to tighten joint.

Item #1

Change to caulking tool

FIGURE S2.13.13.1
Rivet Heads



Item #2

Replace this figure with the one update one on page 3

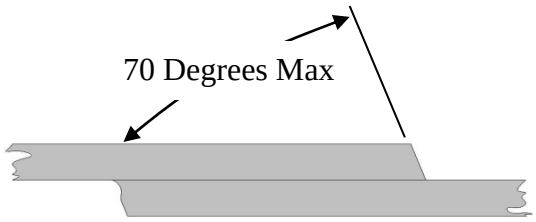
[5]

S.2.13.13.1 Caulking Riveted Seams and Rivet Heads

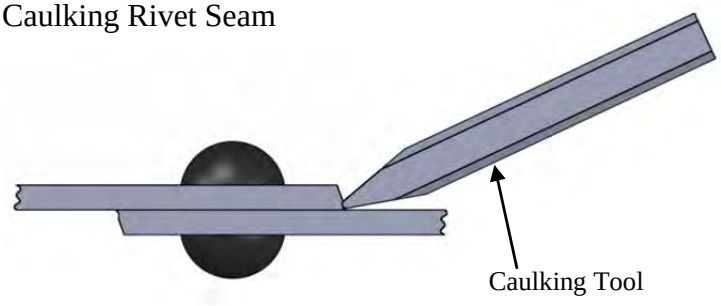
a) Caulking refers to the sealing of plate seams and rivet heads by driving the edge of one surface onto the other by use of a caulking tool.

S2.13.13.1
Caulking Rivet Seams

Plate Edge Bevel



Caulking Rivet Seam



[6]

Subject: 2007 Edition, Part 3, Supplement 2, S2.13.9.1 – Weld Buildup of Wastage and Grooving in Unstayed Areas

File Number: NB11-0203

Prop. Page: 155 & 156

Proposal: Clarify the 60% minimum required thickness.

Explanation: An area of 3 square inches has been added to allow for the buildup of pits and grooving in smaller area's where the thickness is less than the 60% of minimum required.

1. Add "in an area exceeding 3 sq. in. (1,950 sq. mm)." to a)
2. Add "and have an area exceeding 3 sq. in. (1,950 sq. mm)" to b)
3. Update figure S2.13.9.

Update text and diagram can be found on page 3

Item #1
Add the text below:

in an area exceeding 3 sq. in. (1,950 sq. mm).

S2.13.9.1 WELD BUILDUP OF WASTAGE AND GROOVING IN UNSTAYED AREAS

a) Weld buildup shall not be used if the affected section of plate has wasted below 60% of the minimum required thickness per NBIC Part 2, Supplement 2. (See NBIC Part 3, Figure S2.13.9.1).

b) Wasted sections that have wasted below 60% of the minimum required thickness shall be repaired by installing a flush patch using full penetration welds.

Item #2
Add the text below:

and have an area exceeding 3 sq. in. (1,950 sq. mm).

c) Weld buildup of wasted areas shall not exceed 100 sq. in. (65,000 sq. mm).

d) Weld buildup is to replace material that has been lost due to wastage and grooving, and is not to replace thickness on the opposite side of the sheet. Weld buildup must be applied to the side of the sheet that is wasted or grooved.

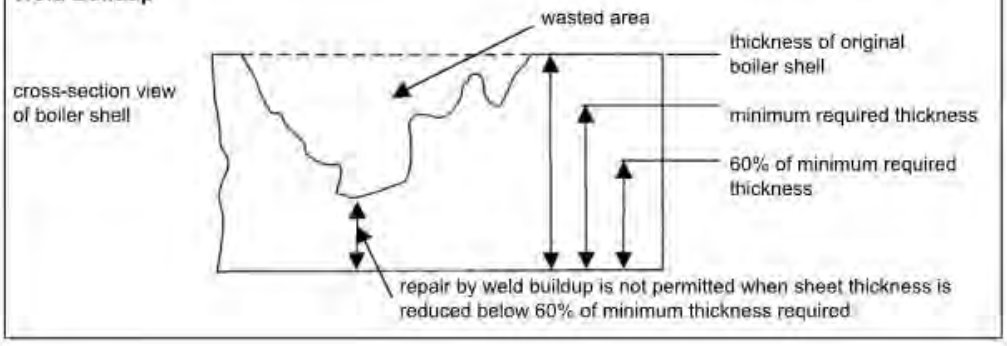
e) Prior to welding, the rivets in the wasted area should be removed.

f) Rivets holes should be reamed after welding.

g) Welding shall not cover rivet heads.

Item # 3 Replace this with the Figure S2.13.9.1 on page 3

FIGURE S2.13.9.1
Weld Buildup



S2.13.9.1 – Weld Buildup of Wastage and Grooving in Unstayed Areas

a) Weld buildup shall not be used if the affected section of plate has wasted below 60% of the minimum required thickness per Part 2, Supplement 2 in an area exceeding 3 sq. in. (1,950 sq. mm). (See NBIC Part 3, Figure S2.13.9.1)

b) Wasted sections that have wasted below 60% of the minimum required thickness and have an area exceeding 3 sq. in. (1,950 sq. mm), shall be repaired by installing a flush patch using full penetration welds.

c) Weld buildup of wasted areas shall not exceed 100 sq. in. (65,000 sq. mm).

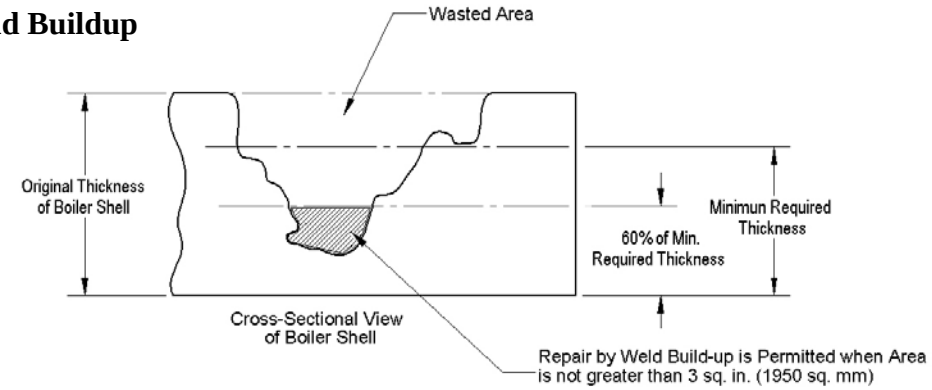
d) Weld buildup is to replace material that has been lost due to wastage and grooving, and is not to replace thickness on the opposite side of the sheet. Weld buildup must be applied to the side of eth sheet that is wasted or grooved.

e) Prior to welding, the rivets in the wasted area should be removed.

f) Rivets holes should be reamed after welding.

g) Welding shall not cover rivet heads.

Figure S2.13.9.1
Weld Buildup



NBIC Subcommittee R&A Action Block

Subject Alternative Repair Option for CSEF Steel, Grade 91

File Number NB12-0403 **Prop. on Pg.**

Proposal Develop code text to address use of temper bead weld repair for Grade 91 tube material

Explanation

EPRI has been working on temper bead weld repair initiatives for Grade 91 tubing since development of a new Ni-base filler metal. This project will provide test results on weld procedure qualification and elevated temperature testing of weld coupons.

Project Manager Galanes/EPRI

Task Group **TG Meeting Date**

Negatives

NBIC Subcommittee R&A Action Block

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Project Manager Galanes/EPRI

Task Group **TG Meeting Date**

Negatives

Temper Bead Repair of T91 Using EPRI P87 Filler Metal

J. A. Siefert, J. P. Shingledecker
Electric Power Research Institute
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Charlotte, NC, 28262
jsiefert@epri.com

Temper bead Repair of T91 Using EPRI P87 Filler Metal

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Abstract

Tube failures in grade 91 (9Cr-1Mo-V steel) occur in fossil-fired power plants and heat recovery steam generators. Due to the hardenability of grade 91, post-weld heat-treatment (PWHT) after welding is required. In this work, thin section Grade 91 was welded utilizing a nickel-based filler metal, EPRI P87, the gas tungsten arc welding (GTAW) process, and various temper bead techniques. The goal of this study was to establish whether it may be possible to forgo PWHT after welding of grade 91 and still provide satisfactory material performance in cases where shortening the repair duration is advantageous. For example if a sudden outage occurs and it is critical for a plant to get back online as quickly as possible, it may be difficult to organize all of the necessary requirements of the material (such as PWHT). Limited studies and industry experience have suggested that a temper bead repair may be possible. For this research, weldments were analyzed using hardness and metallography to screen the two different approaches to the temper bead technique, and to ultimately determine if there is promise in continuing to pursue such a radical repair technique for Grade 91.

Introduction

Temper bead procedures have been utilized since the 1960s. The advantages of these methods lies in the avoidance of a potentially complicated and costly post weld heat treatment (PWHT) and the potential increase in life over a comparable PWHT condition. Success of a temper bead technique lies in the application of a carefully controlled procedure with a compatible material. Through the 1980s and 1990s, EPRI and others demonstrated a wide range of temper bead techniques across a wide range of materials, including nuclear pressure vessel steels and low alloy power generations steels [1,2].

The use of newly developed creep strength enhanced ferritic (CSEF) steels has increased greatly over the last two decades. Such increase has displaced some of the use of low alloy Chromium-Molybdenum (CrMo) steels like Grades 11, 12 and 22. Because temper bead procedures have been successfully applied to these low alloy steels, inquiries have arisen regarding the applicability of a temper bead procedure to the more complicated CSEF family of materials - especially Grade 91. Because Grade 91 components have been employed since the early 1990s, there is sufficient interest in rapid nonconventional (radical) welding procedures for replacement and repair, even if such welding procedures were only regarded as temporary. Additionally, because Grade 91 requires PWHT regardless of thickness, it is often difficult to coordinate both the welding and the PWHT procedure in situations where access is difficult and/or in situations where an unplanned outage was the result of a Grade 91 material failure.

The set of experiments detailed in this paper focus on the development of two different welding techniques for tubing applications. The majority of unplanned outages can be attributed to tube failures. Furthermore, access to a failed tube can be extremely limited, preventing the use of a half-bead technique or buttering the ends of the tubing prior to welding the fill passes. Because of this, two temper bead procedures were selected that would ideally temper the HAZ through the thickness of the weldment. The automated gas tungsten arc welding (GTAW) process was selected for use; if successful, the documented techniques and parameters may be extrapolated to manual processes like GTAW or SMAW. The two temper bead approaches are described below [3,4]:

1. **Consistent Layer.** The consistent layer technique requires that each subsequent weld layer penetrate the underlying layer to develop overlapping temperature profiles while preventing additional transformation of the underlying HAZ. This procedure utilizes controlled heat energy dissipation to develop a tempered martensitic microstructure in the first few millimeters of the HAZ [3]. It can be applied with the SMAW or GTAW process and uses identical heat inputs and/or electrode diameters for each layer.
2. **Controlled Deposition.** In this temper bead process, the heat input is increased in each layer by 30-80%. Because this temper bead technique is normally implemented with the SMAW process, the increase in heat input is typically achieved by increased the electrode diameter one sequential size (i.e. 3/32” to 1/8” to 5/32”, 2.5mm to 3.2mm to 4.0mm). In each layer, the adjacent weld pass overlaps the previously deposited bead by 50%.

The filler metal selected for this demonstration was the nickel-base filler material EPRI P87; its development is detailed elsewhere [6]. Because this filler metal matches Grade 91 in Cr, C and carbide formers, the development of detrimental Type I carbides in service is severely retarded. Additionally, nickel-base filler metals have the added advantage of good toughness and low susceptibility to hydrogen-induced cracking during welding. EPRI P87 has several unique

attributes over conventional nickel-base (i.e. ERNiFe-2 or ERNiCr-3) and ferritic filler materials (i.e. –B91 or –B23) that may increase the success of a temper bead procedure in repair and replacement scenarios for Grade 91:

1. Excellent thermal stability with respect to carbide formation, Figure 1;
2. Excellent stability with respect to hardness, Figure 2;
3. Excellent creep ductility, Figure 3;
4. Thermal expansion comparable to Grade 91, Figure 4.

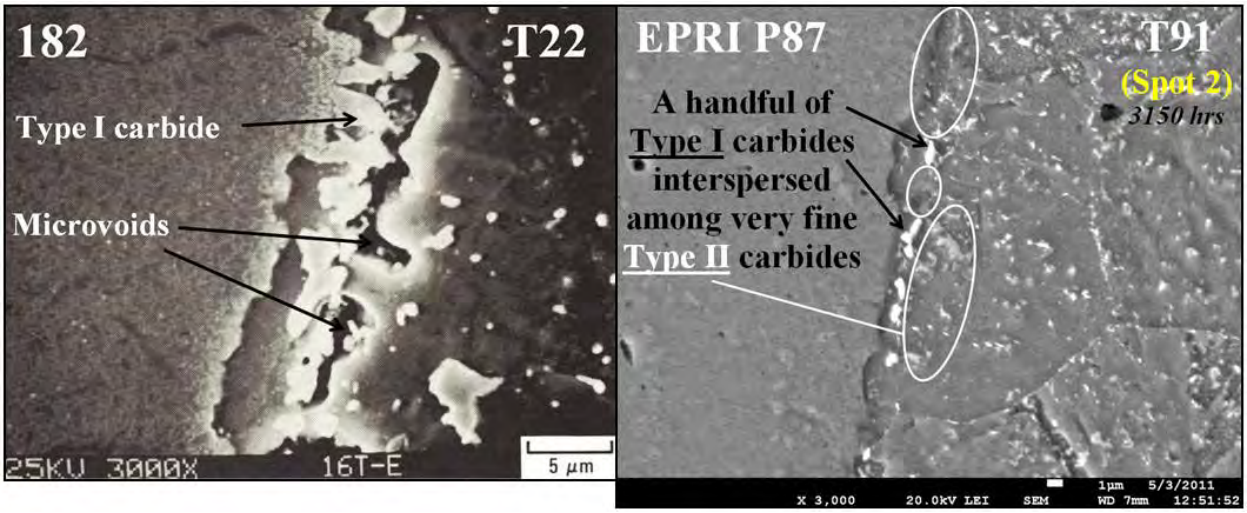

Figure 1
IN182 and EPRI P87 Thermal Stability Comparison
IN182 was exposed for 77,000hrs between 1100-1155F, LMP = 21560-22320 (as determined by oxide scale measurements) [5]. EPRI P87 was exposed for 3,150hrs at 1200F, LMP = 21665 [6].
Note: Figures were sized to match the micron bars for comparison.

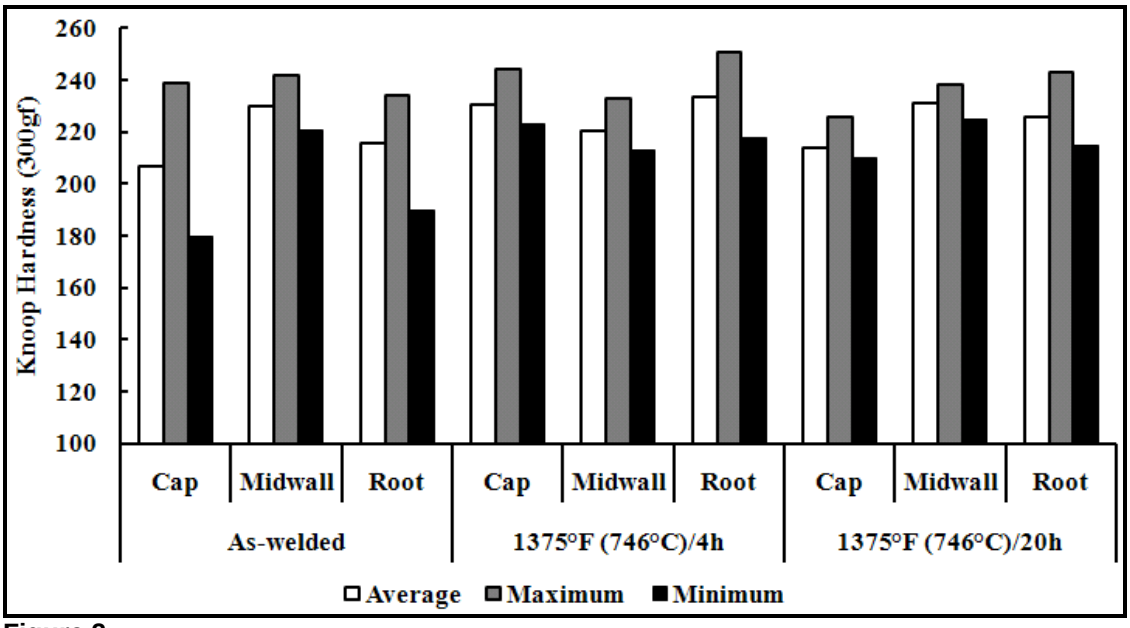

Figure 2
EPRI P87 Weld Metal Hardness Comparison [6]

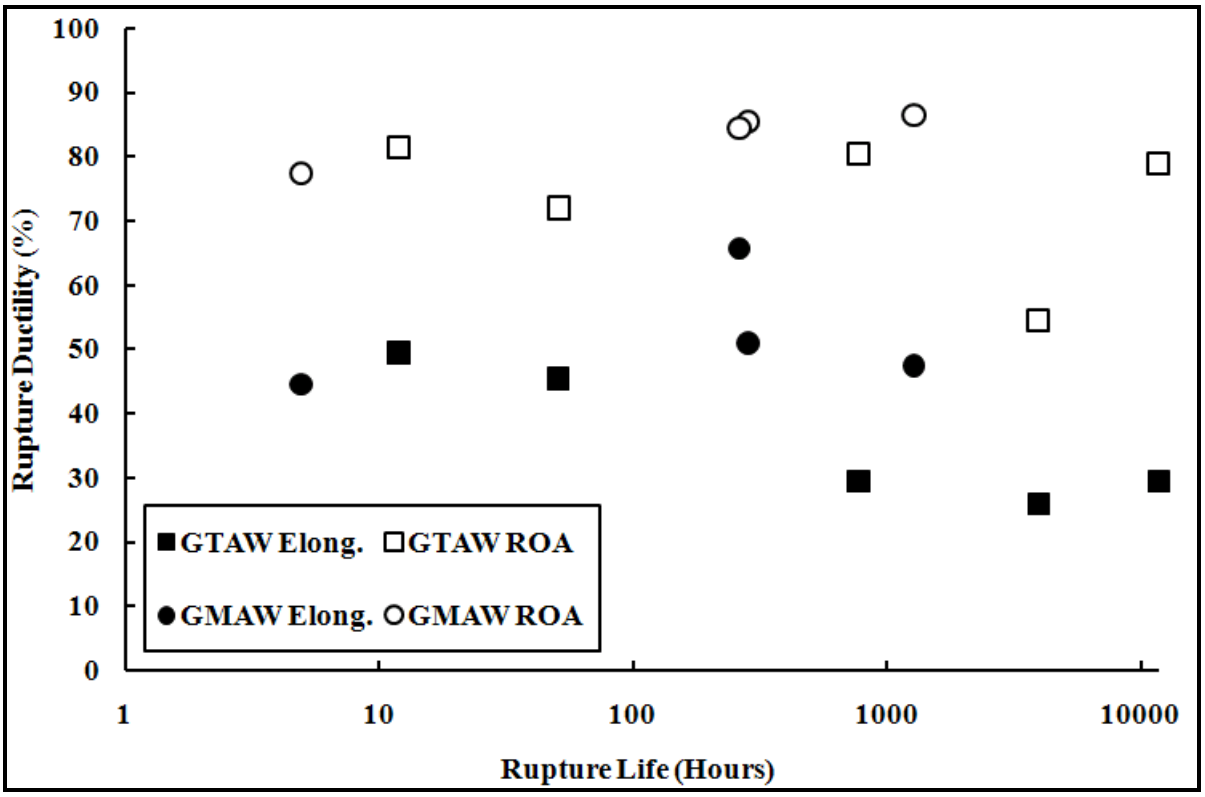

Figure 3
Creep Ductility, GTAW and GMAW All Weld Metal Creep Tests [6]

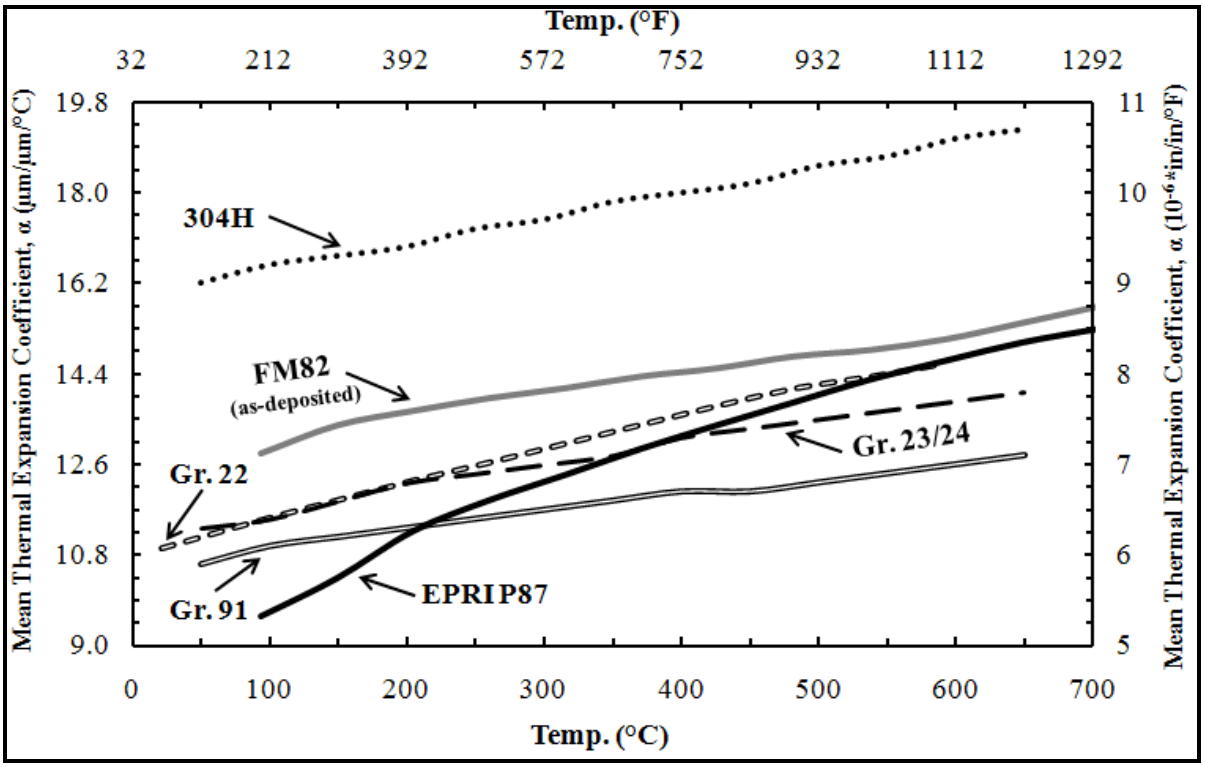

Figure 4
Mean Thermal Expansion Coefficient Comparison [6]

A low preheat (200°F, 93°C) and interpass (250°F, 121°C) was utilized to ensure complete transformation of the deposited weld metal prior to performing the next fill pass. If too high a preheat and interpass were utilized in welding Grade 91, incomplete transformation to martensite on cooling would ensure that fresh martensite would be present in the as-welded microstructure following the completion of the weld. The fresh martensite would not only increase hardness, but reduce toughness and potentially increase susceptibility to cracking phenomena like stress corrosion cracking. M_F temperatures for Grade 91 are given in Figure 5. The $M_{F,OSU}$ band represents a compilation of Grade 91 base material data at a range of cooling rates [7].

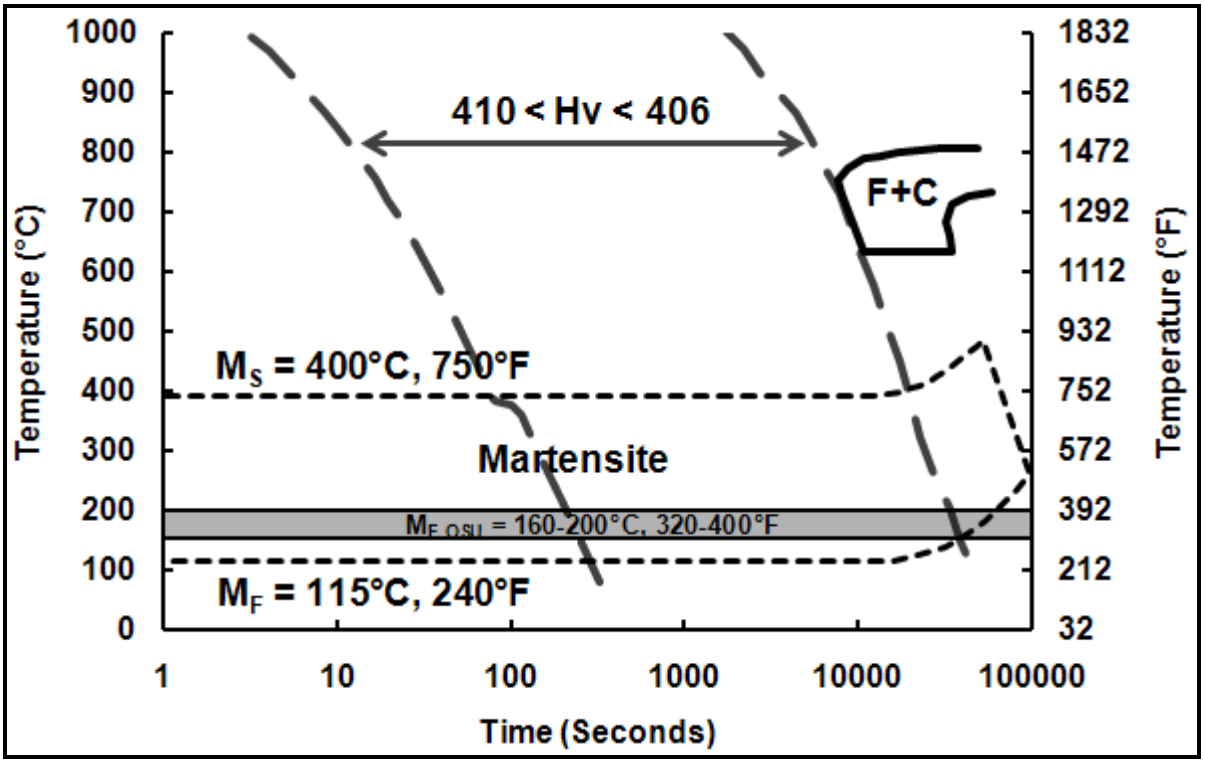

Figure 5
CCT Curve for Grade 91 Adapted from [7,8]

Because the two previously mentioned temper bead techniques were applied in this paper to *T91* material, it was critical to ensure as few weld passes and as simple a welding procedure as possible. Additionally, the development of a temper bead technique for tube to tube butt welds necessitates the consideration of the application. Tube to tube butt welds can be oriented in virtually any position and difficult to access; these two facts complicate the success of *any* welding procedure, let alone a temper bead technique. Because of this, it was decided that grinding (as in half-bead) and buttering of either side of the tube to tube butt weld (as typically done in thick-section temper bead procedures) prior to performing fill passes would be avoided. This paper details the welding development of the consistent layer and controlled deposition temper bead techniques on thin plate material representative of T91 material. Analysis was completed utilizing light microscopy and extensive hardness mapping for screening the success of the two procedures.

Experimental Procedure

Two weldments were made in Grade 91 plate using 0.035” diameter EPRI P87 filler metal. The chemical composition for the base material and filler metal are given in Table 1; these compositions are as reported from the material certifications. The semi-automated gas tungsten arc welding (GTAW) process was used to complete two weldments; one labeled “consistent layer” and the other “controlled deposition.” The shielding gas was 100% Argon. Each weldment was machined to identical dimensions, Figure 6. The mismatch in the groove geometry in Figure 6 was intentional for two purposes:

1. To determine the importance of the bevel on the through-thickness tempering behavior of the HAZ;
2. To determine more accurate impact results in future mechanical testing. The 0° bevel should, theoretically, force crack propagation through the HAZ and not into the weld metal or base material.

Table 1
Chemical Composition of Grade 91 Base Material and EPRI P87 Filler Metal

Element	Grade 91		EPRI P87	
	EPRI Spec. [9]	***Plate R1976***	***Spec. [6]***	***WO35419***
C	0.08-0.12	0.080	0.09-0.14	0.11
Mn	0.30-0.60	0.46	1.2-1.8	1.55
P	0.020 max	0.009	0.01	0.008
S	0.010 max	0.004	0.01	0.003
Cu	0.25 max	0.06		
Si	0.20-0.50	0.35	0.05-0.25	0.16
Ni	0.20 max	0.09	54 max	Bal.
Cr	8.00-9.50	8.59	8.5-9.5	8.52
Mo	0.85-1.05	0.89	1.8-2.2	2.02
V	0.18-0.25	0.207		
Ti	0.010 max	0.002		
Al	0.020 max	0.009		
Zr	0.010 max	0.001		
Cb	0.06-0.10	0.078	0.90-1.40	1.09
N	0.035-0.070	0.0476		
Others	As: 0.012 max Sn: 0.010 max Sb: 0.003 max	NS	Fe: 38-42	Fe: 38.8
N/Al Ratio	4.0 min.	5.3		
C+N	>0.12	0.1276		

The welding parameters for each weldment are given in Tables 2 and 3. A 200°F (93°C) preheat and 250°F (121°C) maximum interpass was instituted; actual starting temperature of the weldment prior to each subsequent pass is shown in Tables 2 and 3. The fundamental layout of each weldment is shown in Figures 8 and 10. During welding, the fill layers were staggered along the length of the weld by ~1” (25.4mm) to allow for individual characterization of each

layer, Figure 7. A completed weldment is shown in Figure 7, detailing the sections of the weldment utilized for destructive testing and metallographic analysis.

Metallographic samples were taken from each fill pass as shown in Figures 9 and 11. Analysis included detailed light microscopy and hardness mapping. An automated hardness mapping system, utilizing a Vickers hardness indenter, 200g load with a spatial distance of 0.15mm was utilized in the creation of the hardness maps. Mapping was done on as-polished samples and every indent was visually verified for accuracy.

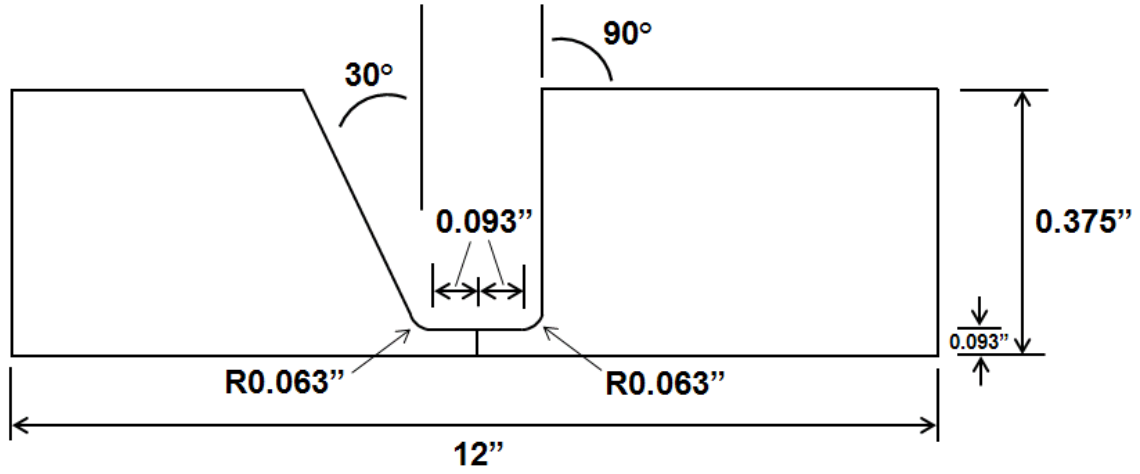

Figure 6
Weldment Dimensions

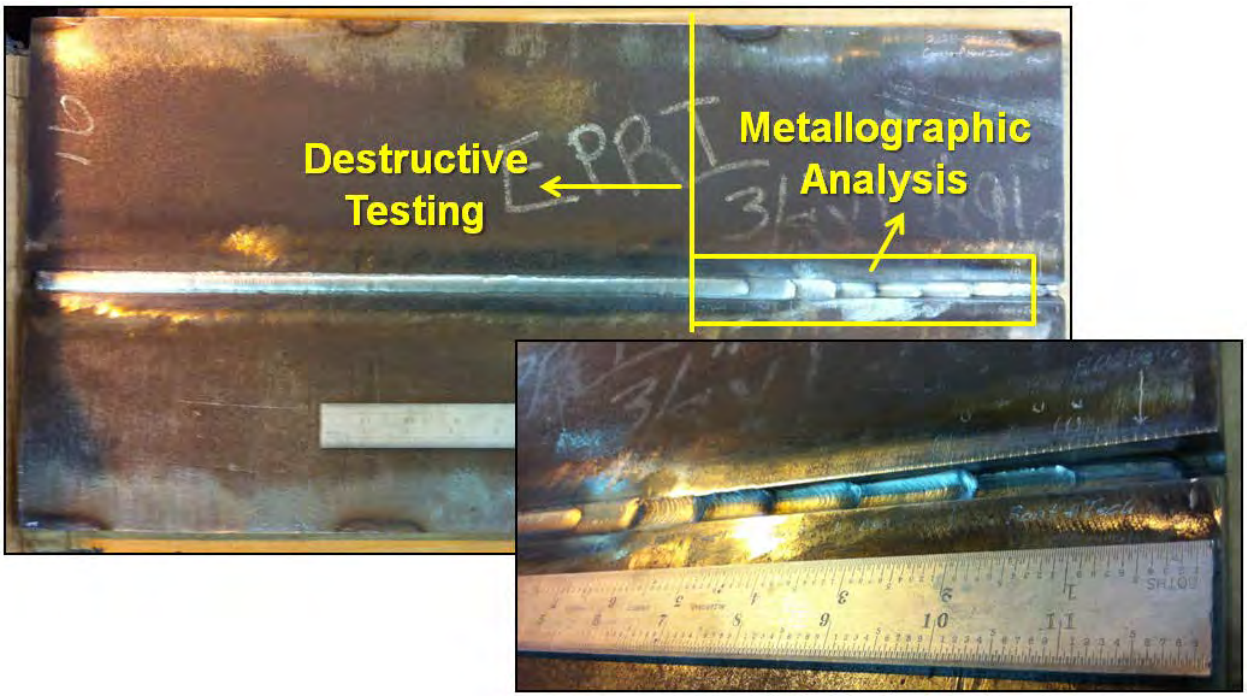

Figure 7
Example of Welded Plate and Sectioning

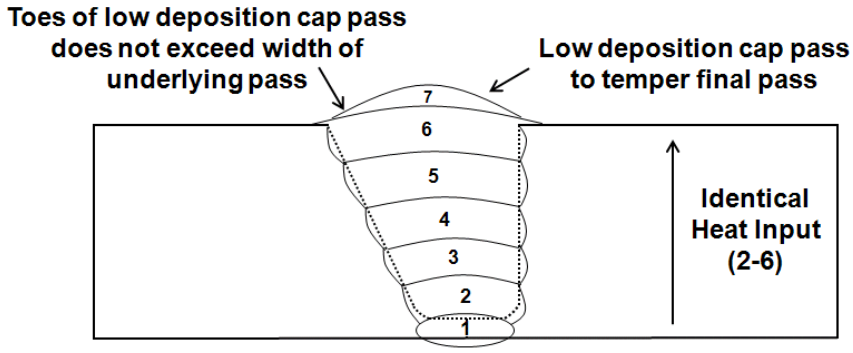

Figure 8
Consistent Layer Weldment Fill Layout

Table 2
Consistent Layer Weldment Parameters

	Current (A)	Voltage (V)	TS[1] (ipm, mm/s)	HI[2] (kJ/in, % inc.)	Start Temp.[4] (°F, °C)
Root	175			28.5, +0%	216, 102
Fill 1					220, 202
Fill 2					216, 198
Fill 3	190	9.5	3.5, 88.9	30.9, +8.4%	218, 200
Fill 4					207, 189
Fill 5					202, 184
Low Dep. Wash Pass	140			22.8, -26.2%	232, 214

[1]TS = Travel Speed

[2]HI = Heat Input; HI (kJ/in) = Voltage*Amperage*60/TS

[3]% inc. = Percentage increase in heat input over previous weld pass

[4]Start Temp. = Starting temperature of weldment prior to deposition of indicated weld pass

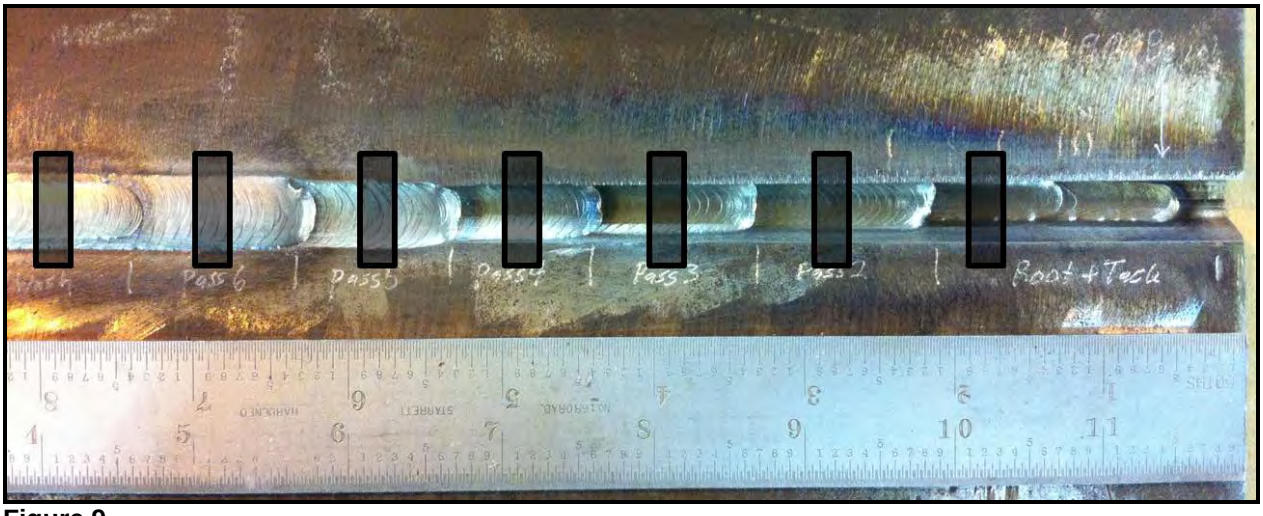

Figure 9
Consistent Layer Metallographic Sample Locations

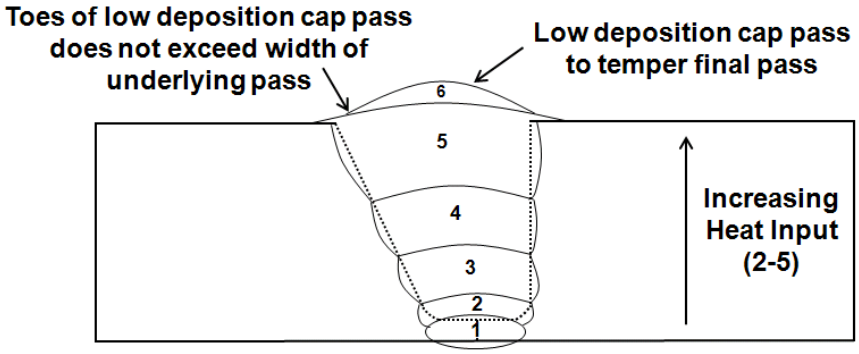

Figure 10
Controlled Deposition Weldment Fill Layout

Table 3
Controlled Deposition Weldment Parameters

Weld Pass	Current (A)	Voltage (V)	TS[1] (ipm, mm/s)	HI[2] (kJ/in, % inc.[3])	Start Temp.[4] (°F, °C)
Root	170	9.5	3.5, 88.9	27.7, +0%	220, 104
Fill 1	190			30.9, +11.5%	213, 195
Fill 2	200			32.6, +5.5%	214, 196
Fill 3	210			34.2, +4.9%	206, 188
Fill 4	220			35.8, +4.7%	219, 201
Low Dep. Wash Pass	140			22.8, -36.3%	229, 211

[1]TS = Travel Speed

[2]HI = Heat Input; HI = V*I*60/TS

[3]% inc. = Percentage increase in heat input over previous weld pass

[4]Start Temp. = Starting temperature of weldment prior to deposition of indicated weld pass

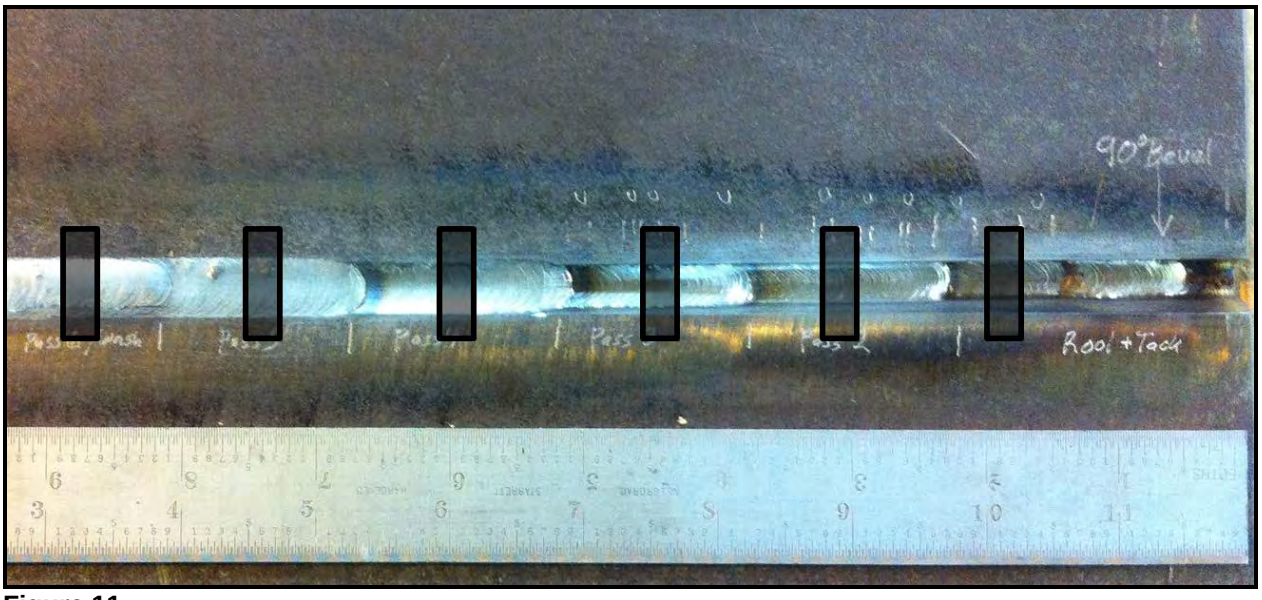

Figure 11
Controlled Deposition Metallographic Sample Locations

Results

Macro images for each weld pass in the consistent layer and controlled deposition weldments are shown in Figures 12 and 13, respectively. For each weldment, the width of the HAZ is similar with no major improvement in size or width in the 0° bevel side of the weldment. For the controlled layer technique, the wash pass provided necessary reinforcement to complete the weldment. In the case of the consistent layer technique, the wash pass was not needed to provide sufficient reinforcement. In either case, the wash pass could be ground away in the field should it be deemed excessive.

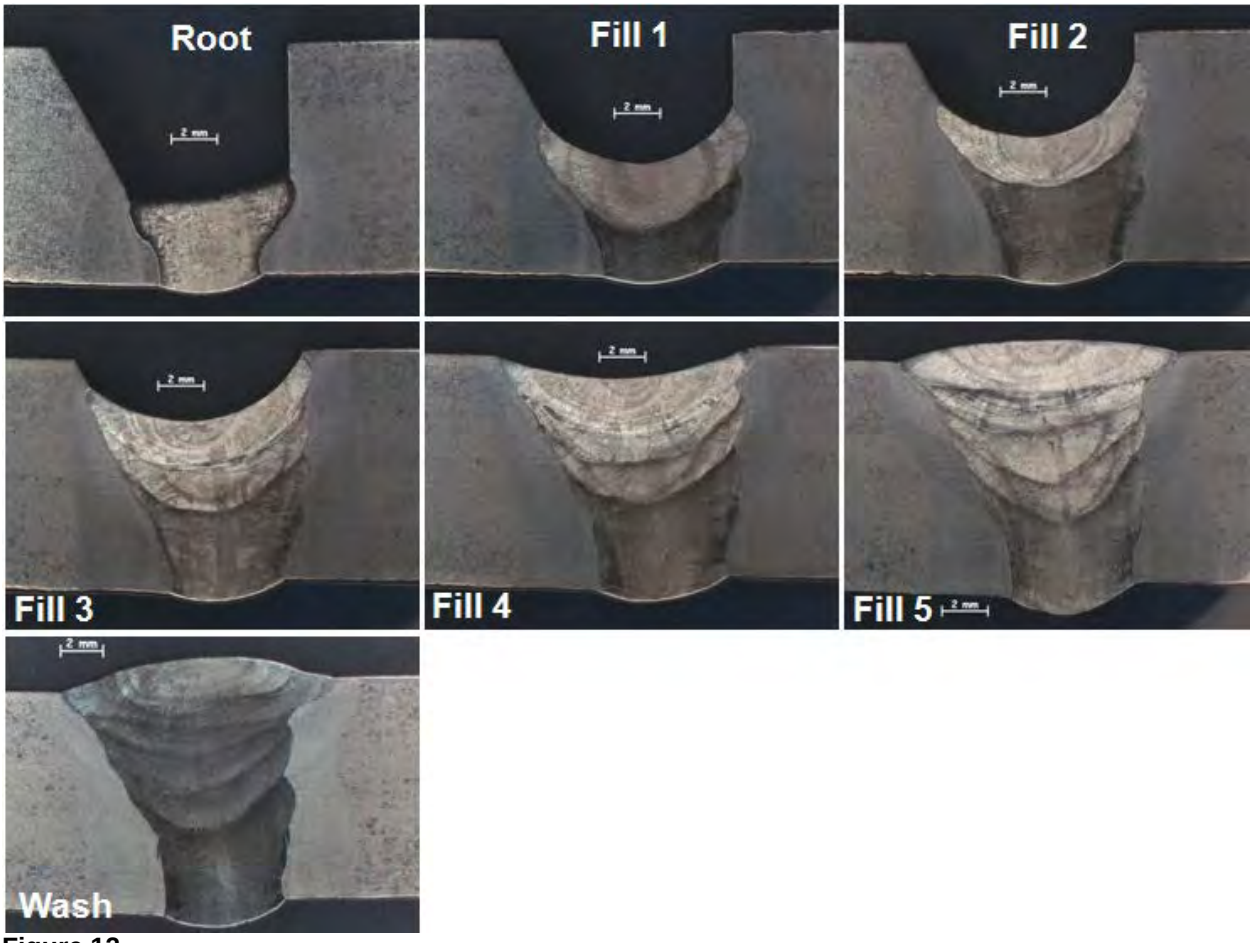

Figure 12
Consistent Layer Weld Passes

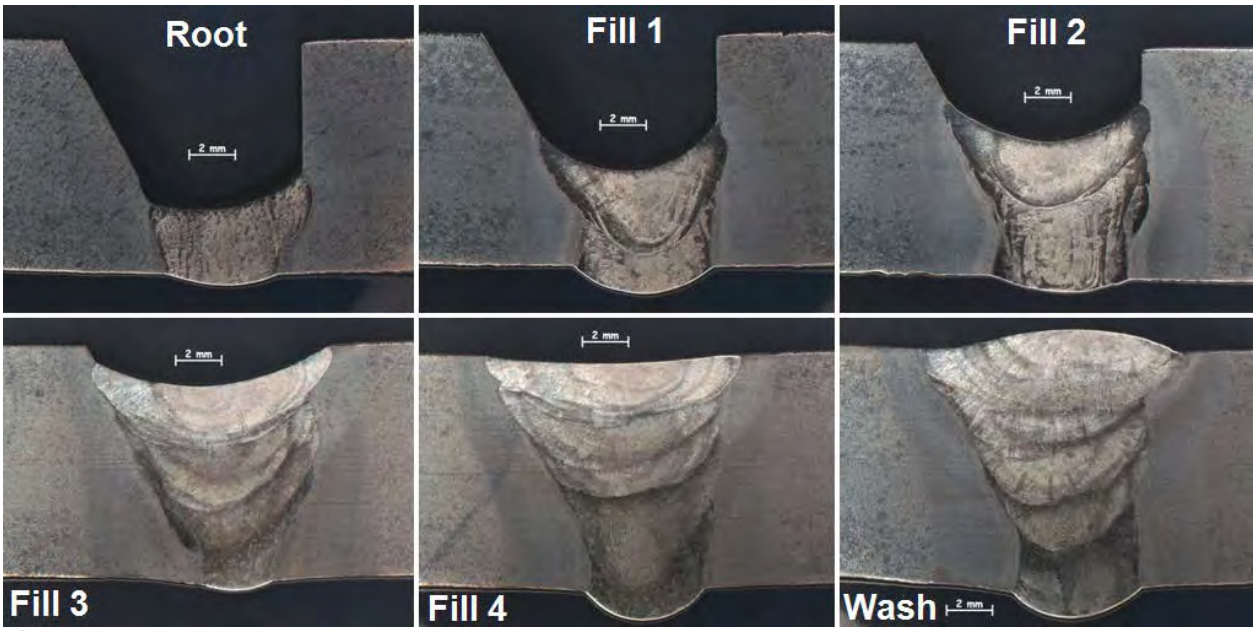

Figure 13
Controlled Deposition Weld Layers

The hardness data for each of the weldments was post-processed and plotted using a contour map. In Figures 14 and 15, each color represents a range of 50HV and the scales are identical for both maps:

- 150-200HV 0.2 ➔ Blue
- 200-250HV 0.2 ➔ Light Blue
- 250-300HV 0.2 ➔ Green
- 300-350HV 0.2 ➔ Yellow
- 350-400HV 0.2 ➔ Orange + Hashes
- 400-450HV 0.2 ➔ Red + Cross Hashes
- > 450HV 0.2 ➔ Black

To compare the overall tempering of the weldments more methodically, all of the data points in each hardness map below 225HV 0.2 were deleted for statistical analysis. This was done to eliminate all of the base metal hardness data and most (if not all) of the weld metal data. Using this comparison, the effectiveness of tempering in the HAZ was compared. The deletion of these data resulted in a sample size of 1102 indents for the consistent layer weldment and 1267 indents for the controlled deposition weldment. The histograms for each of these data sets are shown in Figure 16. The percentage of indents above a stated hardness value is shown in Table 4.

The hardness data for the consistent layer technique was plotted onto a macro image of the tested area, Figure 17. The hardness data plotted in Figure 17 was limited to the highest measured data points, those above 325HV.

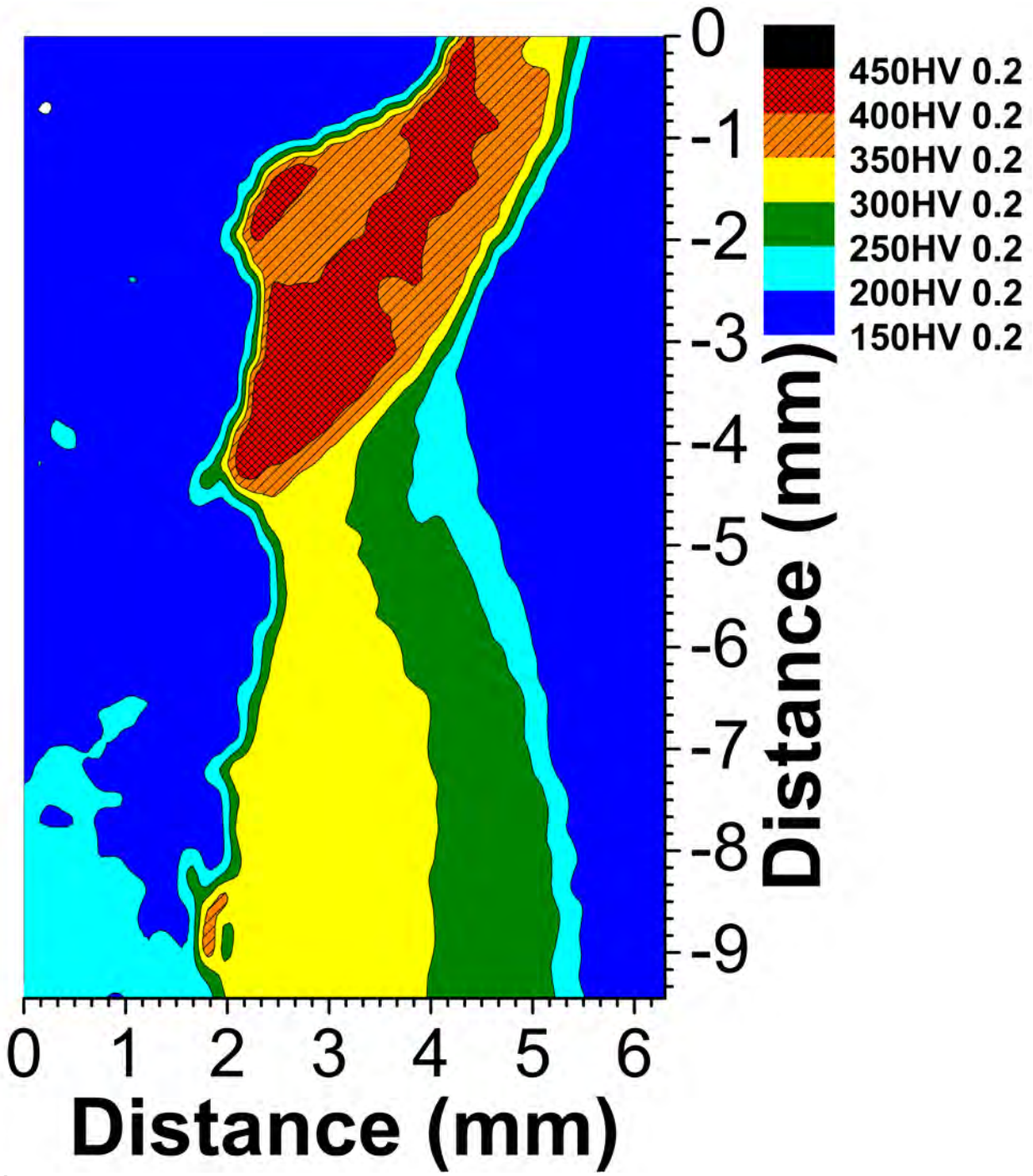

Figure 14
Consistent Layer Technique Hardness Map, 0° Bevel

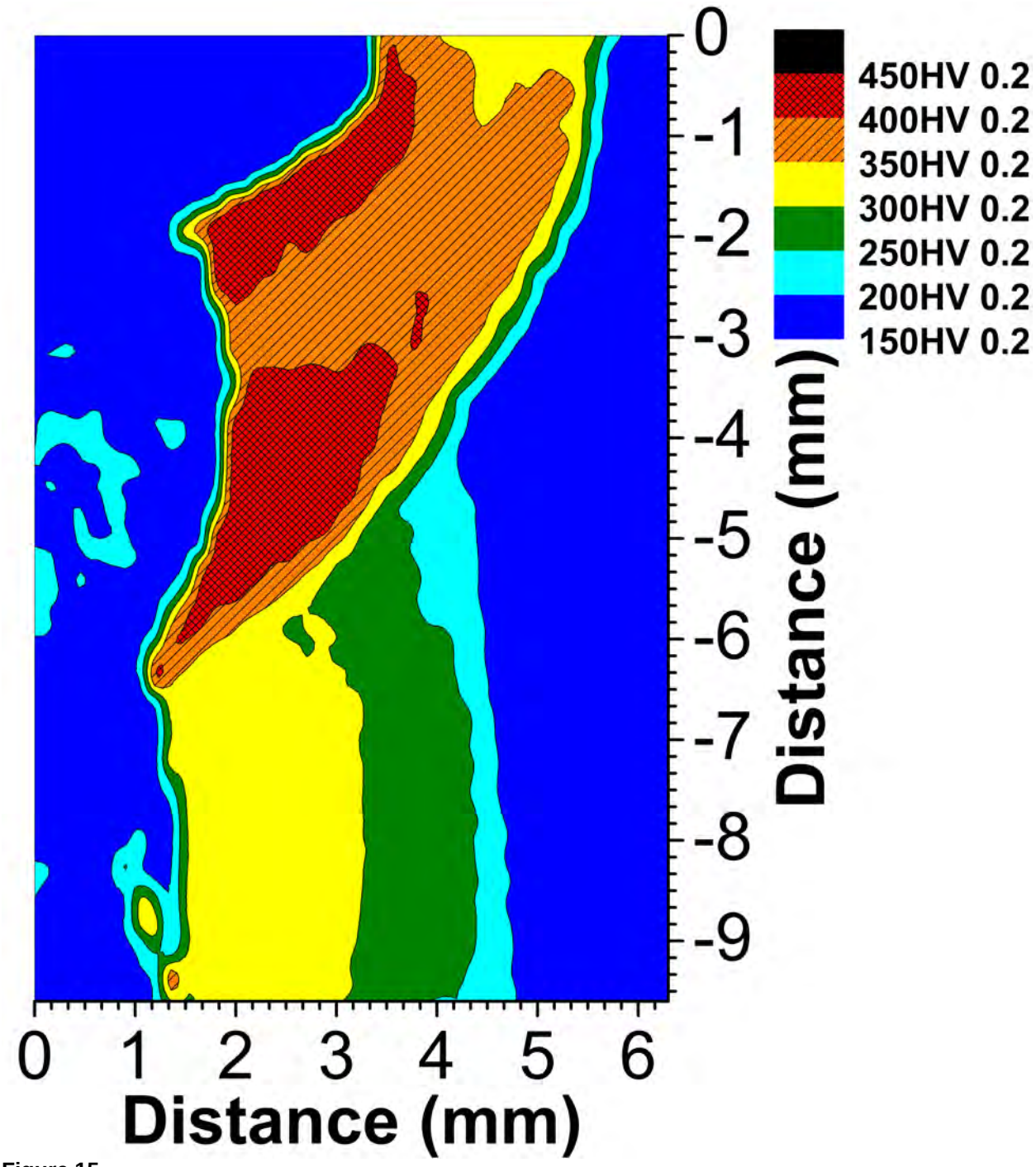

Figure 15
Controlled Deposition Technique, 0° Bevel

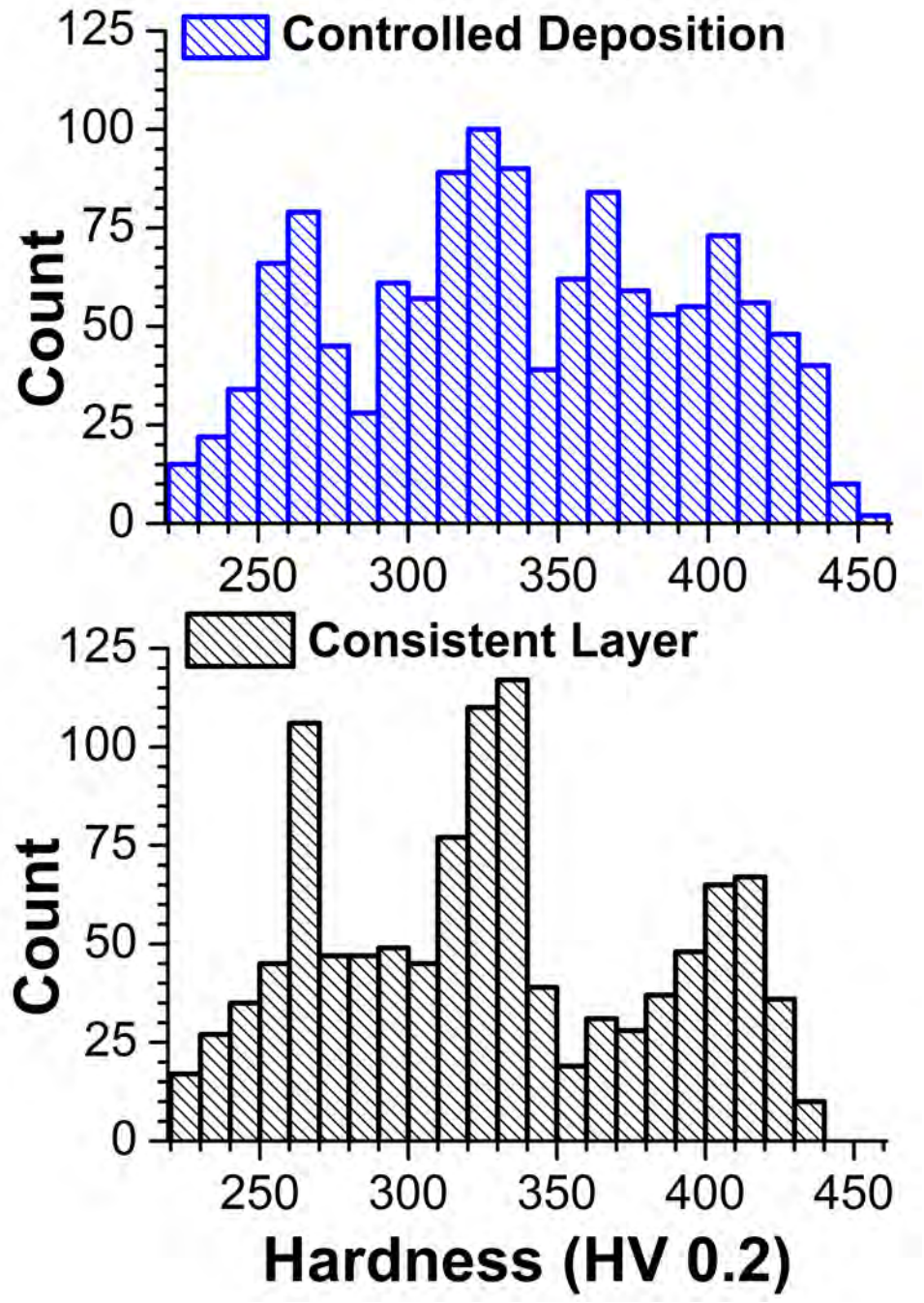

Figure 16
Histogram Comparison for Values above HV>225

Table 4
Percentage of Hardness Values for each Weldment above the Indicated Value

Weldment	>300HV	>325HV	>350HV	>375HV	>400HV	>425HV
Consistent Layer	65%	49%	34%	24%	15%	2%
Controlled Deposition	72%	56%	42%	28%	16%	5%

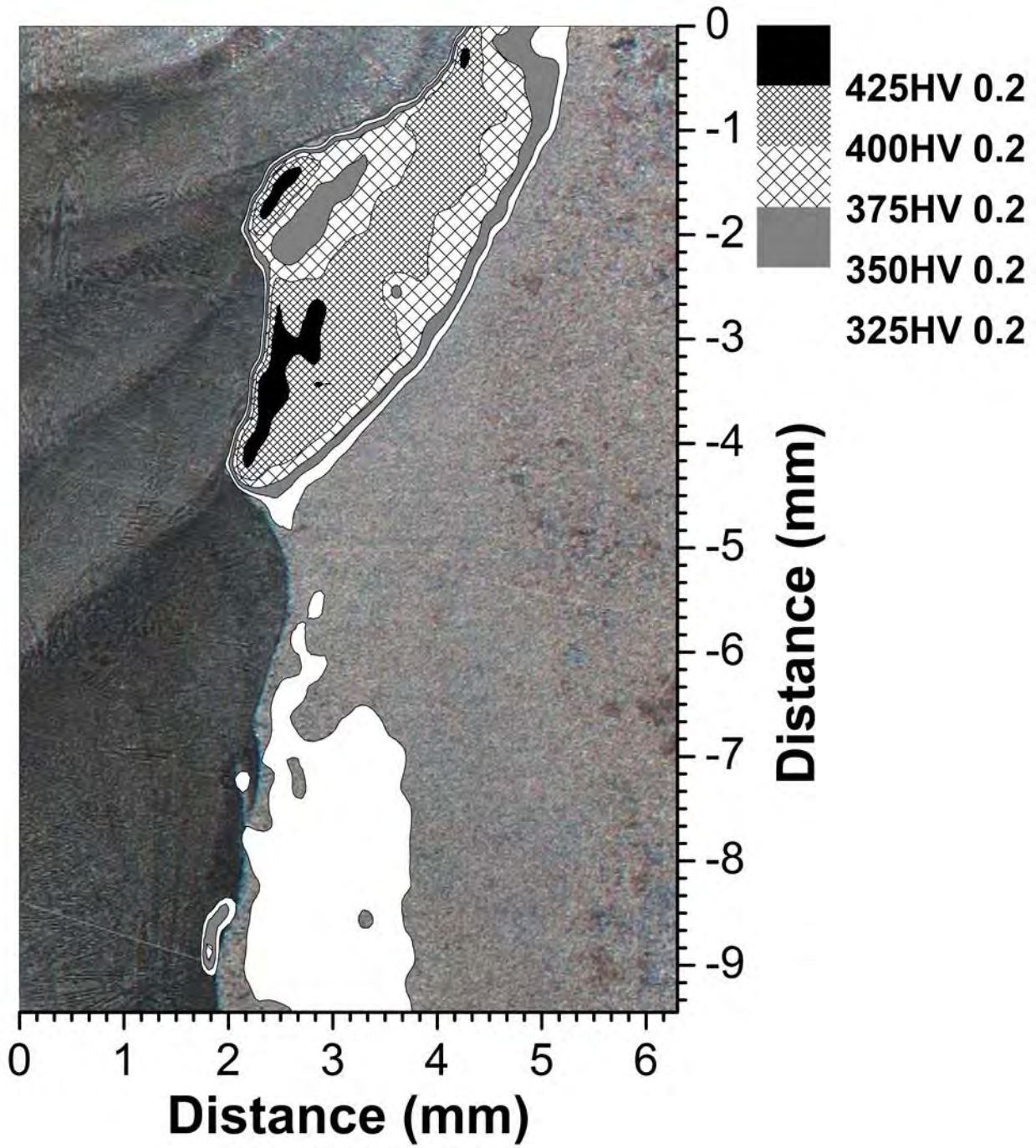

Figure 17
Location of Highest hardness Regions in the Consistent Layer Weldment

Discussion

The analysis of the 0° bevel of each procedure in Figures 14 and 15 show that ample tempering was achieved near the root and midwall on each weldment. Hardness data in typical Grade 91 weldments have shown values to approach 450HV in the HAZ. The data in Figures 14 and 15 indicate that virtually no data points lie above 450HV 0.2 with the vast majority of the data being below 400HV 0.2. To date, there has not been a systematic study governing acceptable hardness values in the HAZ of Grade 91, although hardness maximums have been instituted for as-received base material (263HV) and for the weld metal (295HV) following PWHT [9].

The consistent layer technique shows slightly better tempering through the entirety of the HAZ, as indicated in the histograms shown in Figure 16. The amount of data points below 350HV in the consistent layer technique are further shown in Table 4. The overall slight increase in tempering is likely attributed to the fact that there was one additional fill pass in this weldment as compared to the controlled deposition weldment. The increased heat input in the controlled deposition weldment appears to have had no significant affect in the tempering behavior of the Grade 91 HAZ. Based on these observations, it seems most beneficial to deposit as many fill passes as possible to increase the chances of tempering through the entirely of the HAZ.

A graph of the data points above 325HV overlaid on the analyzed area in Figure 17 shows the location of the hardest regions in the consistent layer technique. This graph clearly indicates that a great deal of the HAZ is below 325HV. The location of the hardest regions (in black) may be a result of the way in which the 0° bevel was welded. When approaching the 0° bevel, the automated voltage control will increase the arc length and cause the weld puddle to wash higher up on the wall (Figure 12, Fill 2). This added reinforcement on the wall may prevent adequate heat from overlying fill passes to penetrate the deposited weld pass to temper the HAZ.

Most of this preliminary analysis is concentrated around the measured hardness values. The importance of a threshold hardness value may have implications with respect to the stress corrosion cracking susceptibility (SCC) of the weldment. Although significant SCC has been documented in other CSEF steels (primarily Grades 23/24) [10, 11], the instances of SCC in Grade 91 weldments are not widely documented. In the few instances of documented SCC in Grade 91, the components were left in an uncontrolled environment for an extended period of time. More widespread cases of SCC have not been documented in Grade 91 due to the requirement of PWHT for *any* weld made in a Grade 91 component.

General SCC susceptibility is defined by the interaction of the environment, a susceptible material and the stress state. Because a wide variety of environments can pass through the ID of the tubing (acid cleaning, various steam qualities), it was especially prudent in these studies to reduce the hardness at the root of the weldment. The reduction in hardness at the root was evident in both procedures. Furthermore, it must be noted that the relationship between hardness and SCC susceptibility is not well understood for the CSEF family of alloys. Research on potential SCC mechanisms in Grade 24 weldments have revealed that the susceptibility of the material is not an obvious function of maximum hardness, but primarily on the water chemistry and secondarily to an acid cleaning environment passing through the tube [11]. Additionally, the application of Grade 24 in waterwalls induces this material to a very high restraint condition and

creates the necessary conditions for SCC. Because the intended application of the temper bead welding procedure described in this paper is in T91, it is conceivable that the residual stresses are substantially lower than in other highly restrained situations. The application of a temper bead procedure to T91 likely further limits its use to tubing that is present inside the boiler, and inherently shielding these locations from environmental conditions which might induce SCC on the outside diameter of the tubing.

Conclusions & Future Plans

As-welded HAZ values in Grade 91 for typical welding procedures regularly approach values 450HV. Tempering of Grade 91 using a temper bead technique and relying solely on the heat input from welding is a challenging prospect. Despite this, tempering was observed in the Grade 91, with overall hardness values being reduced by ~100HV in specific regions. A few conclusions from these preliminary set of studies are shown below:

1. Use of a nickel-base filler material offers unique advantages for repair applications in Grade 91 because it does not require tempering or removal of material (as in half-bead) to ensure adequate tempering through the thickness. This greatly reduces the complexity of the applied temper bead welding procedure.
2. The consistent layer technique demonstrated overall lower hardness values than the controlled deposition technique.
3. Regardless of welding technique, the majority (~75%) of the overall hardness values were below 375HV. Because Grade 91 HAZ hardness values regularly exceed 400HV and can reach 450HV, tempering of the Grade 91 HAZ below 375HV is encouraging considering that Grade 91 was purposely designed to be resistant to tempering.
4. The majority of the observed tempering in each weldment was documented in the root and midwall locations. Such observations suggest that there was ample heat input to temper the HAZ through ~half of the weldment. These same observations suggest that more fill passes may be required to more effectively temper the upper half of the weldment.
5. The least tempering was documented in the cap location and indicated that a low deposition wash pass was not adequate to achieve any noticeable tempering.

Planned destructive test evaluation and individual analysis on the effect of each layer will demonstrate the individual and/or cumulative effect of the fill passes on the tempering behavior of each of these weldments. Additional future studies, should address the potential implications of a temper bead procedure in Grade 91. Such studies should address the tempering characteristics of the Grade 91 HAZ in the as-welded state and at service temperature, the cross-weld creep behavior, stress corrosion cracking susceptibility and fracture toughness.

The initial hardness values indicate that the Grade 91 HAZ can be consistently tempered with relatively simple approaches and carefully controlled procedures. This tempering provides an encouraging step in the on-going examination of temper bead procedures for at least temporary repair options in T91 applications.

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11. Private Correspondence, 10/25/11.

EPRI ELECTRIC POWER RESEARCH INSTITUTE

Novel Approaches to Repair of Grade 91 Using Temperbead Welding Procedures

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National Board Inspection Code

Introduction

- Two on-going projects within EPRI
  - Temperbead of T91 Using EPRI P87 Filler Metal
  - Weld Repair of Grade 91 Piping and Components
- Motivation
  - Grade 91 components have been used for >20 years and widely put into service over the last 15 years
  - Little thought has been given to establishing the best repair method for specific components
  - PWHT adds a layer of complexity
  - Ensuring *good PWHT* can be very difficult
  - More life may be obtainable through eliminating PWHT

Temperbead Concept for Tubing Applications

- Nickel-base filler metal reduces complexity
- Carefully controlled procedure to temper the T91 HAZ
- Use of EPRI P87 nickel-base filler metal (matching to Grade 91 in C, Cr and carbide-formers) prevents two potential, long-term failure mechanisms:
  - Carbon migration (and the formation of a weak zone)
  - Type I carbide nucleation **and growth** along ferritic-side of fusion line (growth eventually results in creep cavitation at Type I carbides)
  - For more information, EPRI Report 1019786 (free)
- **Goal: Provide an alternative repair approach that results in safe operation without the need for PWHT.**

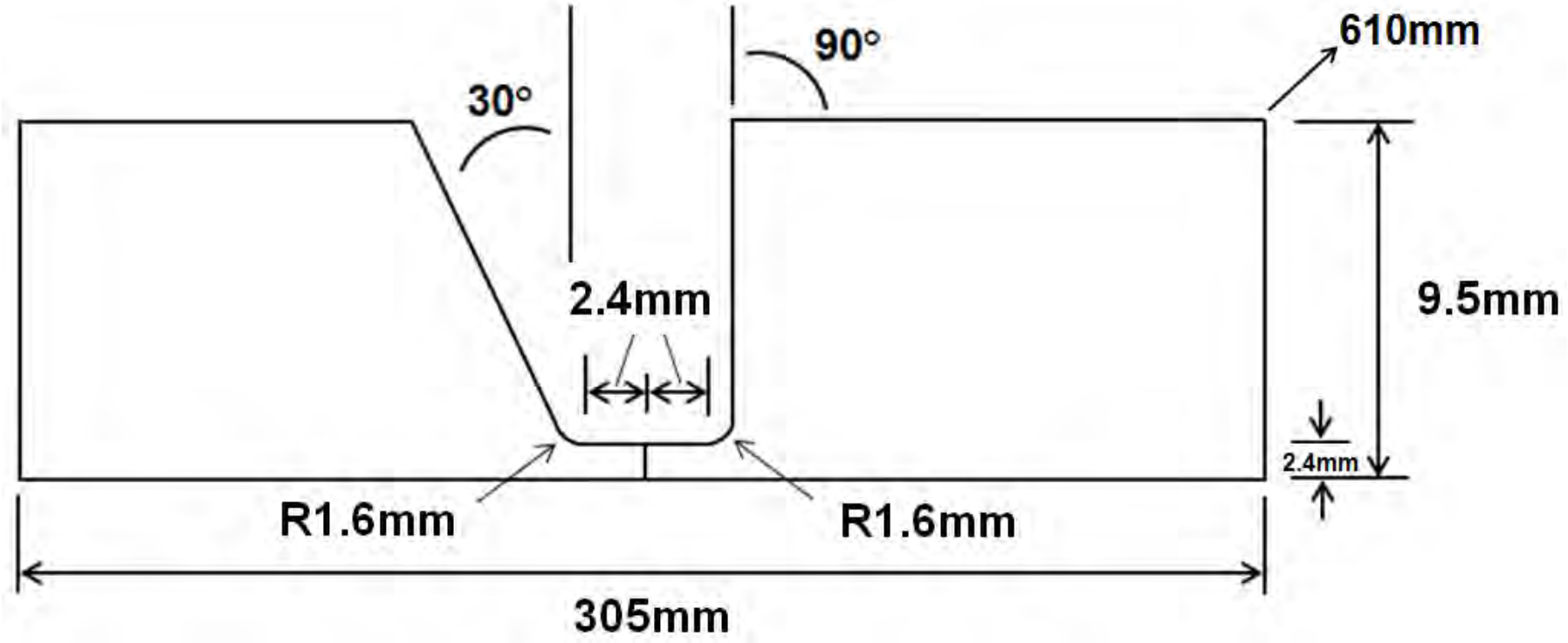
Approach

- Attempt two different, established temper bead welding techniques using automated GTAW process
  - **Consistent Layer** – heat input for fill passes was identical
  - **Controlled Deposition** – heat input was purposely increased through the thickness
- Weld was staggered to examine the effect of each layer on the tempering response of the Grade 91 HAZ
- Preheat 200°F with max interpass of 250°F to ensure complete transformation to martensite prior to deposition of the next, overlying layer

Procedure Validation and Testing

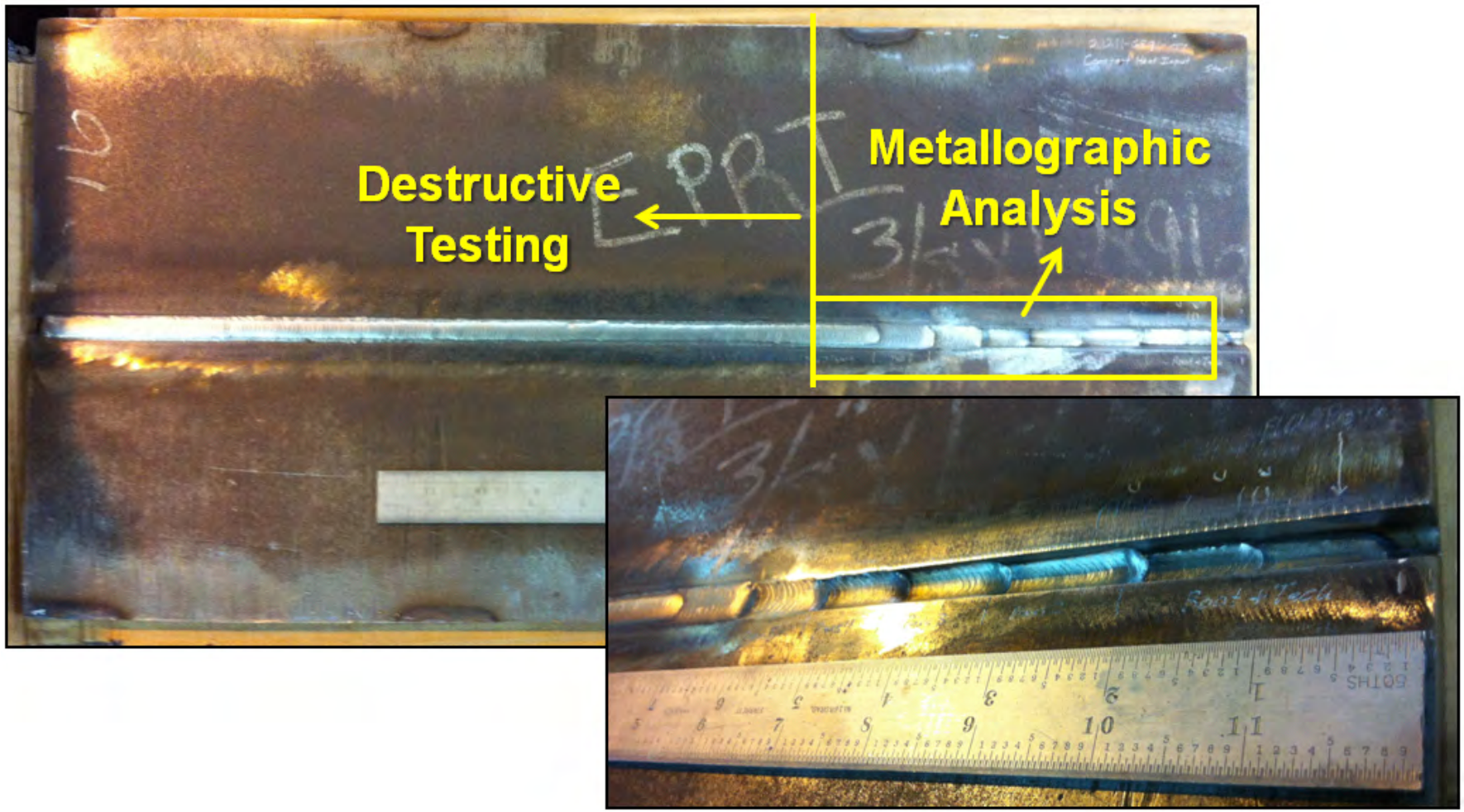
- Metallography
- Hardness (per procedure)
  - 200g Hardness Maps
  - 0.15mm spatial spacing
  - ~2800 indents per map on each side of the weld
- Mechanical Testing (per procedure)
  - Room temperature impact testing (10mm square)
  - ASME Section IX qualification (4 side bends + 2 RTTs)
  - Elevated temperature tensile testing (550-620°C @ 14°C increments)

Welding Geometry

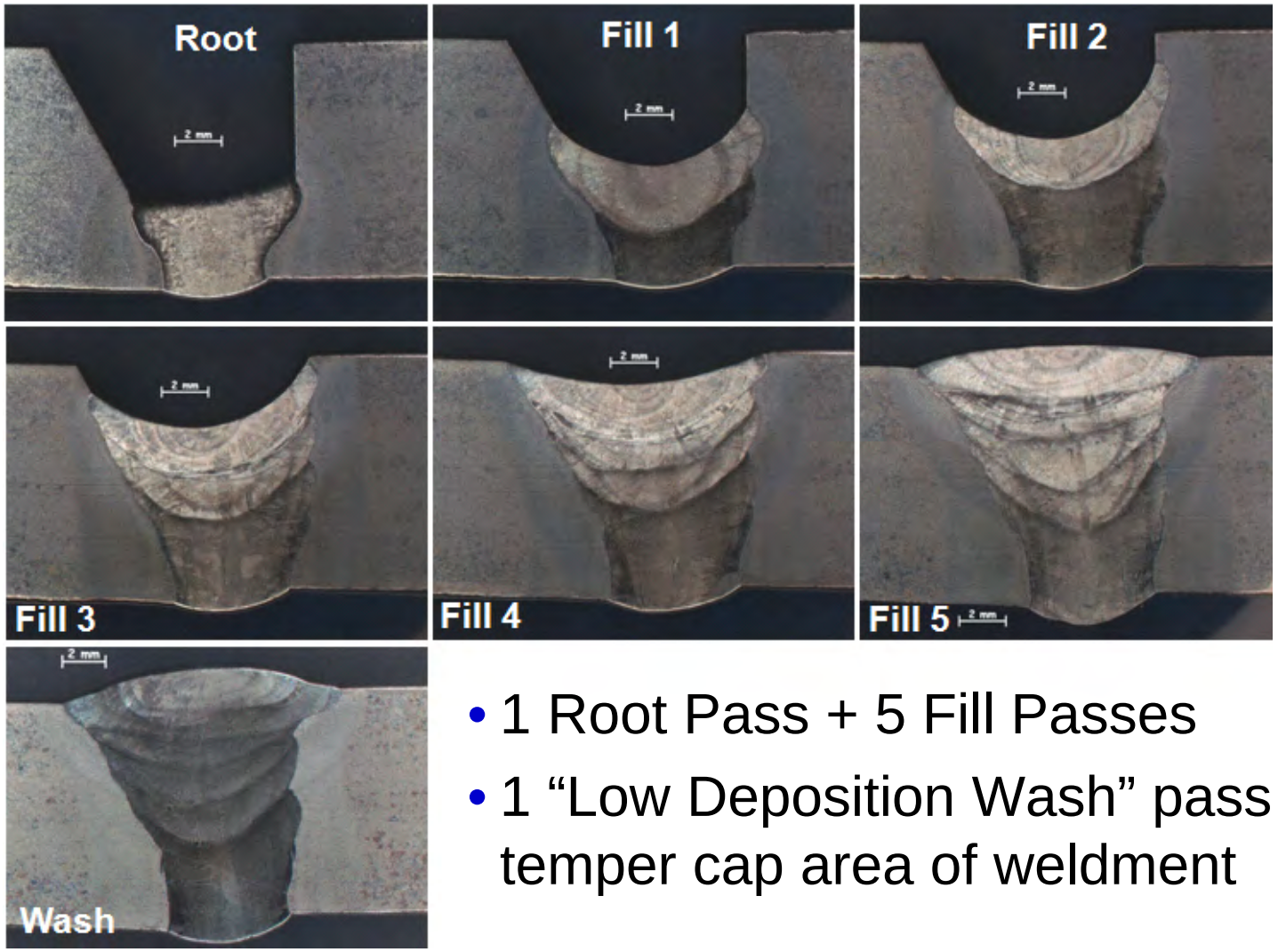


- Straight bevel was utilized for two reasons:
  - Potentially allows for impact strength measurement in HAZ
  - Establish if the bevel is a critical variable

Finished Weldment

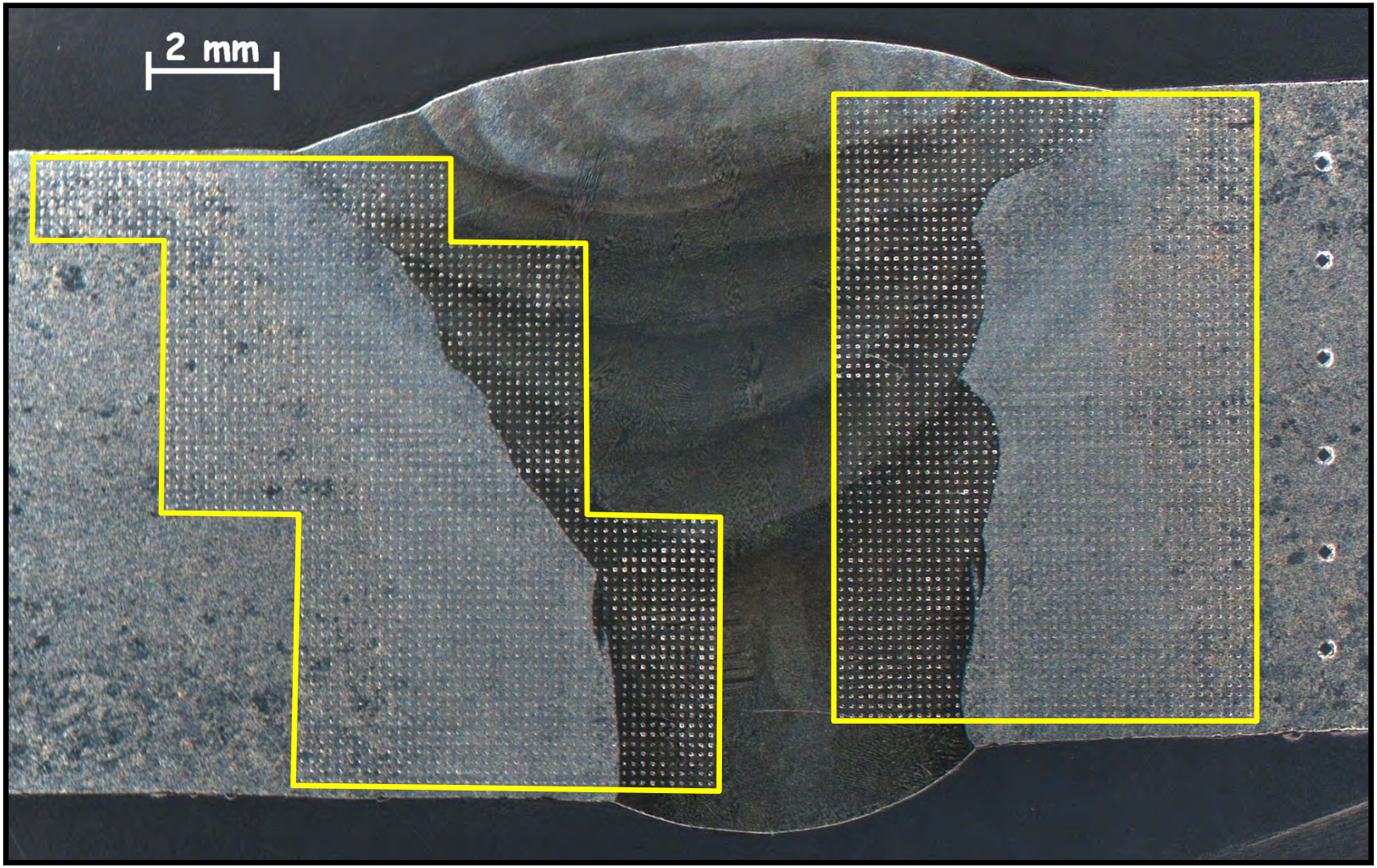


Consistent Layer Macro Images

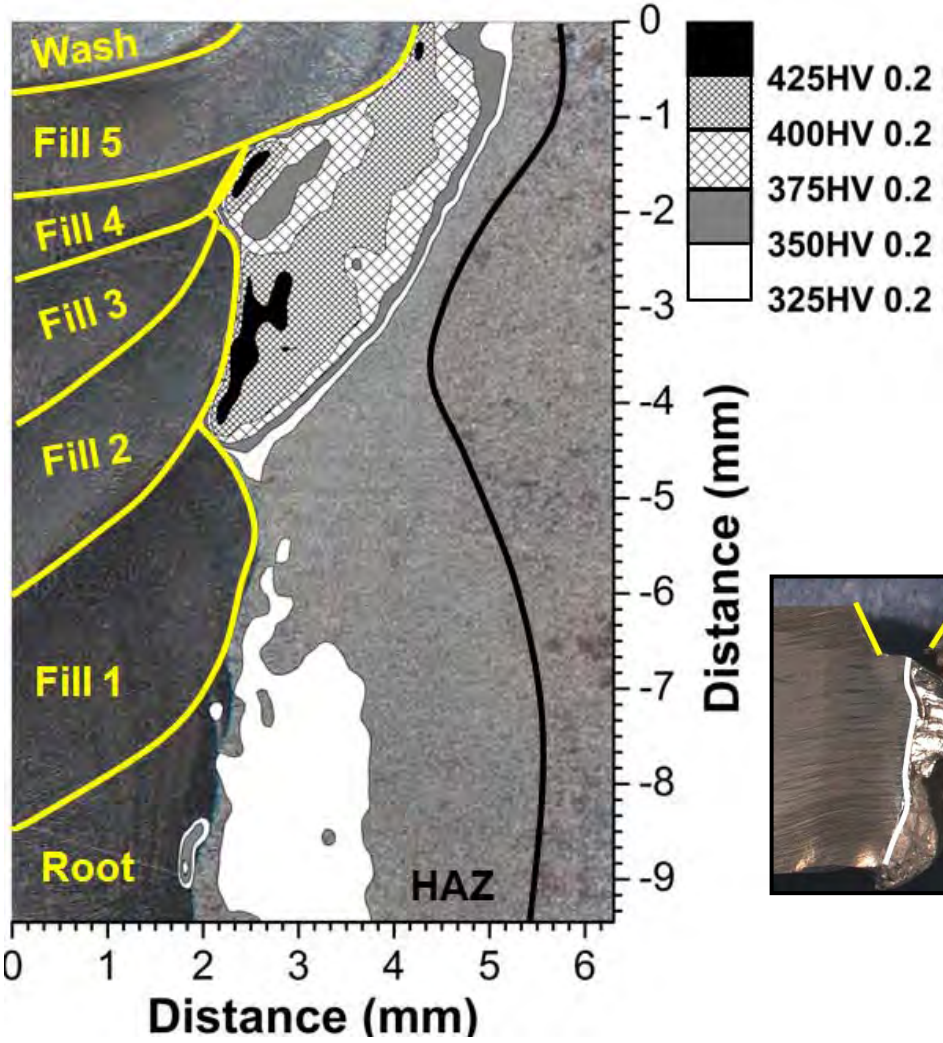


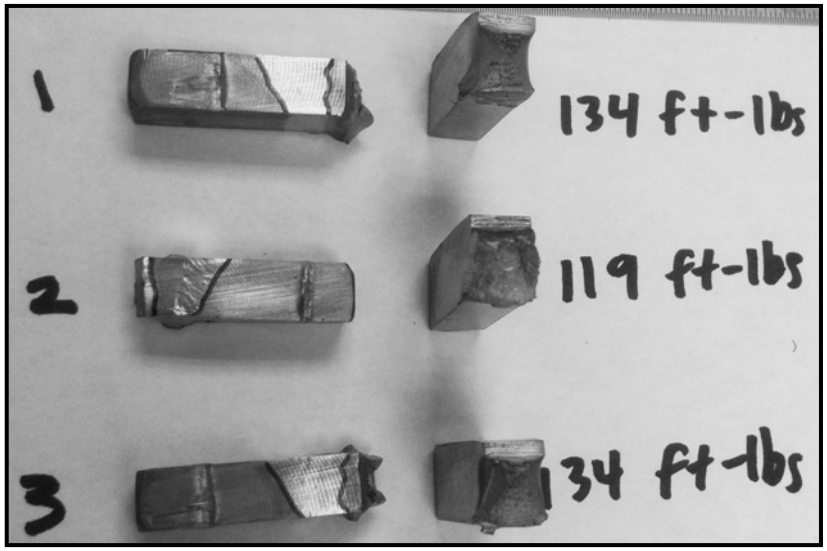
- 1 Root Pass + 5 Fill Passes
- 1 “Low Deposition Wash” pass to temper cap area of weldment

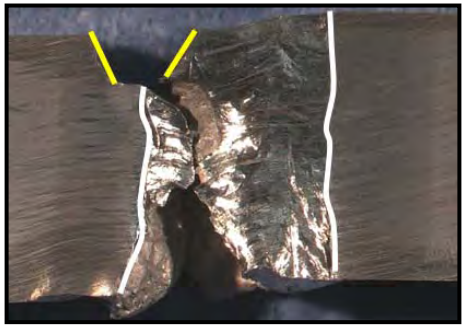
Consistent Layer Hardness Maps in Completed Weldment



Consistent Layer – Example of Data Analysis







Conclusions to Date and Future Work

- It is possible to temper the Grade 91 HAZ and a reduction of hardness (<350HV 0.2) at root appears feasible
- Destructive evaluation results (thus far) are promising

Future Work:

- Application manual GTAW
- Application to manual GTAW root + SMAW fill
- Metallographic, hardness and destructive evaluation

- **Questions or comments ?**

Weld Repair of Grade 91 Piping and Components

Objectives and Scope

- Ability to remove damaged material efficiently and effectively
- Design and execute repairs
- Guide to lifing and ongoing inspection requirements of repair

Value

- Minimize the time and costs associated with making a repair
- Maximize the potential that the repair will provide at least adequate in-service performance.

Details and Contact

- The participant total cost is $40,000 payable over 2 years.
- Qualifies for Tailored Collaboration

Jonathan Parker

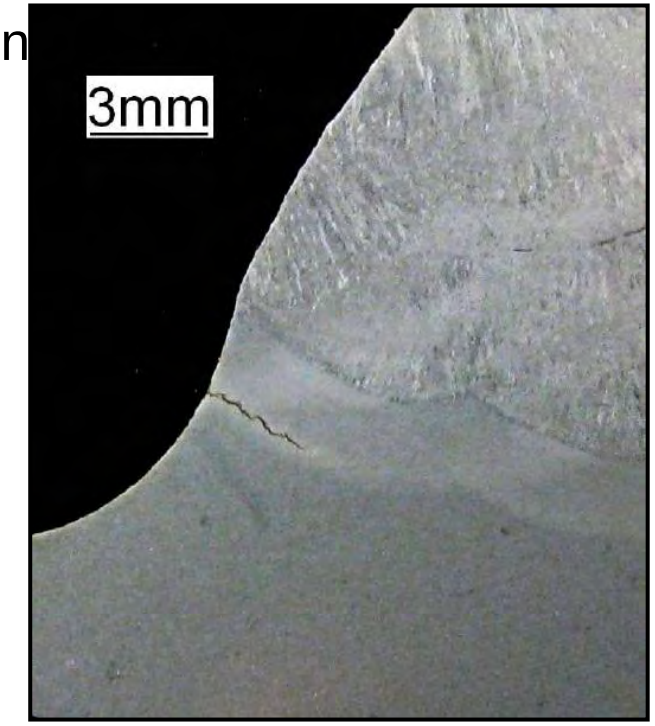
- jparker@epri.com, (704) 595-2791

SPN Number: 1022801

Have confidence that repair methods will be effective

Phase 1 – Ranking of Repair Performance

- Discussion of methods and extent of excavation
- Weld procedure considerations – identified variables:
  - Base material condition (Renormalized and service-exposed)
  - Filler metal selection (6 total)
  - Temperbead vs. normal procedure comparison
  - Proper vs. improper temperbead
  - Temperbead layer procedure (4 total)
  - Post weld heat treatment (3 total)
- Post repair evaluation of microstructure, damage, etc.
- Specimen geometry and testing conditions
- Development of test matrix



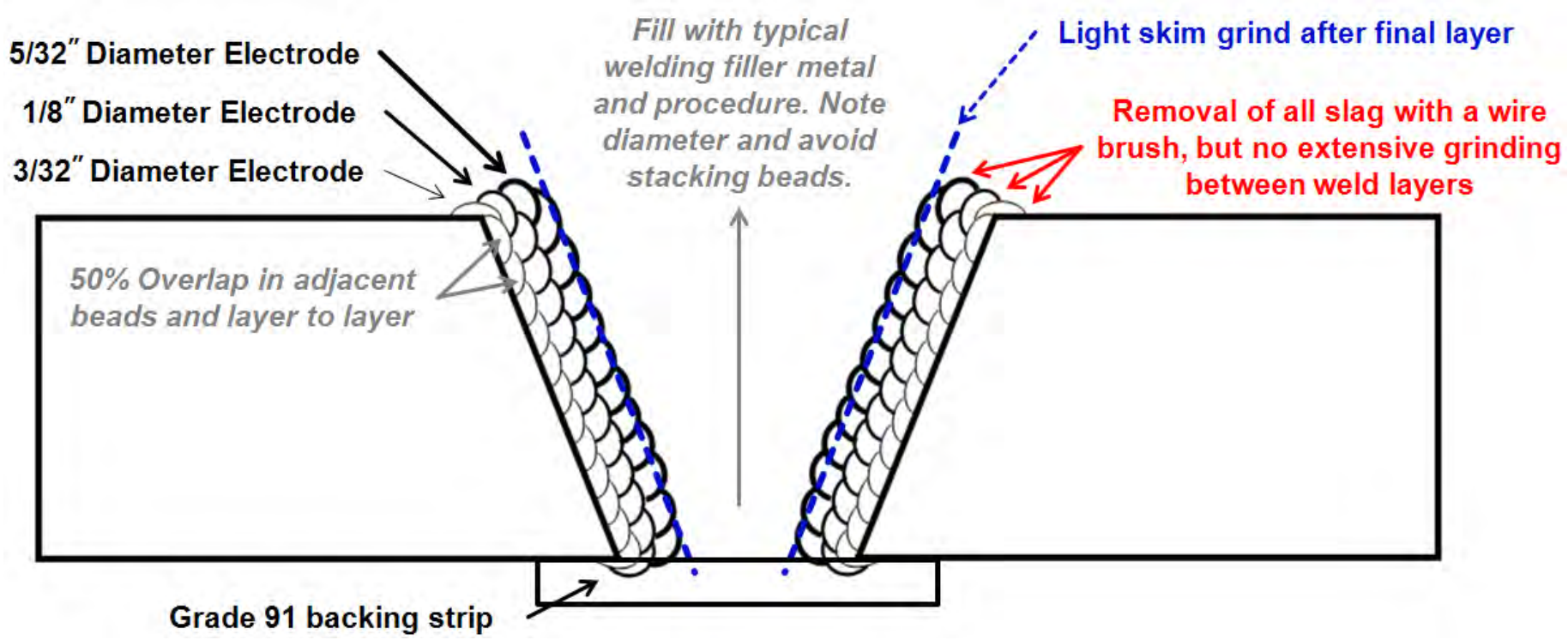
Analysis to identify best option repairs – generate ranking table

Phase 1 Welding Matrix – All Welds Completed

Weld	Base Material	Weld Metal		Preheat/ Interpass	Welding Procedure	PWHT
		AWS Desig.	Trade Name			
1A	As-received Grade 91 (Sample 8) "A" Material	E9015-B9 H4	Thermanit Chromo 9V Mod.	300°F/600°F	Normal + Rec'd. PWHT	1375±25°F/2h
2A				300°F/600°F	Normal + Min. PWHT	1250±10°F/2h
3A				300°F/600°F	Temperbead	None
4A				300°F/600°F	Poor Practice Temperbead	None
5A		E8015-B8	9Cr-1Mo	300°F/600°F	Temperbead	None
6A		E9015-G	Thermanit P23	300°F/600°F	Temperbead	None
7A				300°F/600°F	Normal + Rec'd. PWHT	1375±25°F/2h
8A		E9018-B3 H4	Bohler E9018-B3	300°F/600°F	Temperbead	None
9A		EPRI P87	EPRI P87	300°F/600°F	Temperbead	None
10A		ENiCrFe-2	INCO-WELD A	300°F/600°F	Temperbead	None
1B	Renormalized Grade 91 (Sample 8) "B" Material	E9015-B9 H4	Thermanit Chromo 9V Mod.	300°F/600°F	Normal + Renormalization + Temper	1930°F±20°F/2h 1375±25°F/2h
2B				300°F/600°F	Normal + Min. PWHT	1250±10°F/2h
3B				300°F/600°F	Temperbead	None
4B				300°F/600°F	Poor Practice Temperbead	None
5B		E8015-B8	9Cr-1Mo	300°F/600°F	Temperbead	None
6B		E9015-G	Thermanit P23	300°F/600°F	Temperbead	None
7B				300°F/600°F	Normal + Rec'd. PWHT	1375±25°F/2h
8B		E9018-B3 H4	Bohler E9018-B3	300°F/600°F	Temperbead	None
9B		EPRI P87	EPRI P87	300°F/600°F	Temperbead	None
10B		ENiCrFe-2	INCO-WELD A	300°F/600°F	Temperbead	None

Weldment 10B [ENiCrFe-2 Filler Metal, TBW]

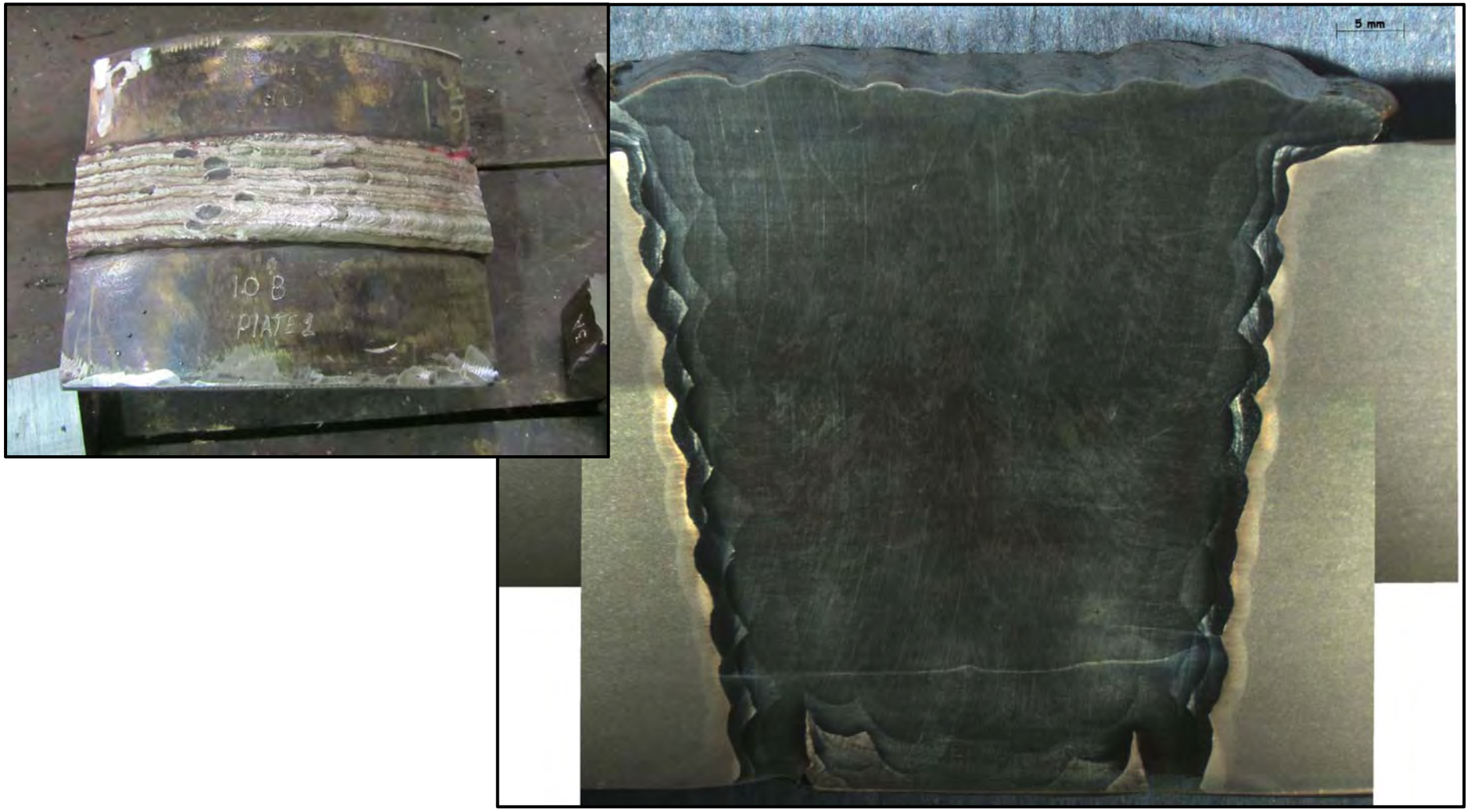
Welding Procedure for Three Layer Approach



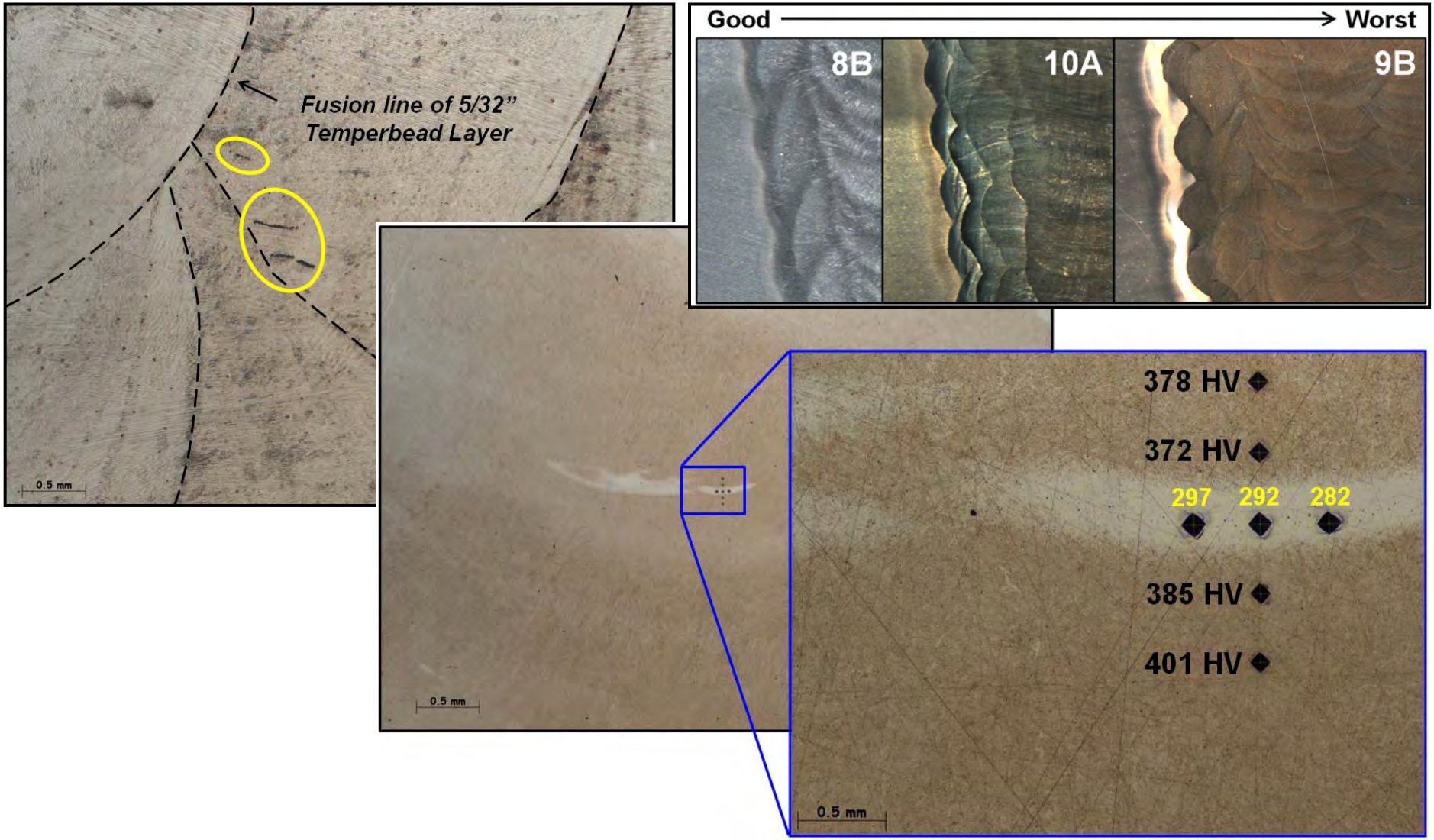
- SMAW Process
- 300°F (149°C) Preheat, 600°F (316°C) Interpass

Weldment 10B [ENiCrFe-2 Filler Metal, TBW]

Welding Assessment – Completed Weldment

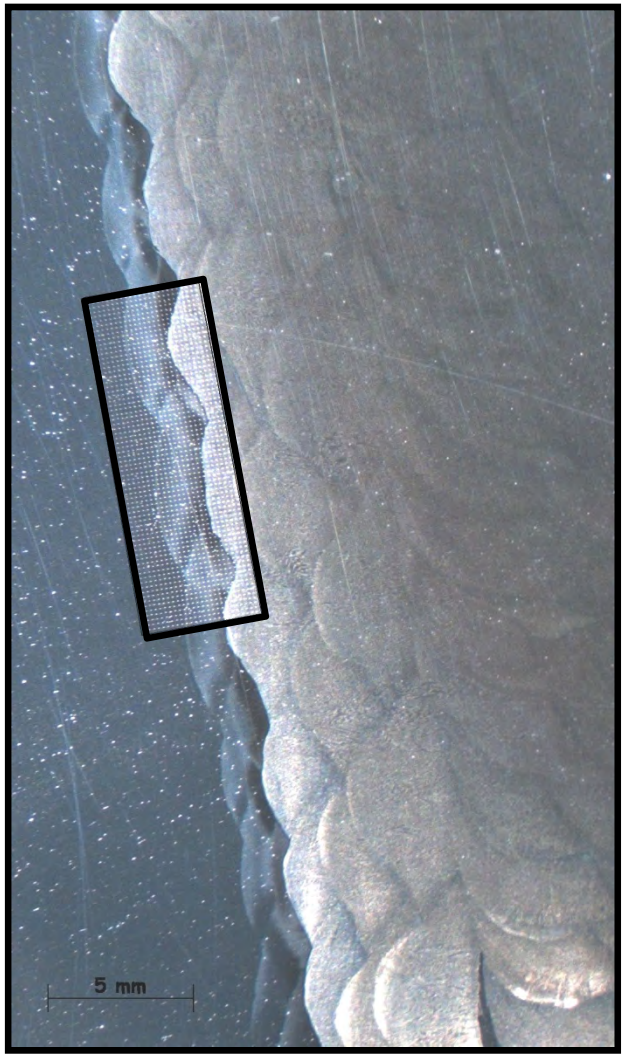


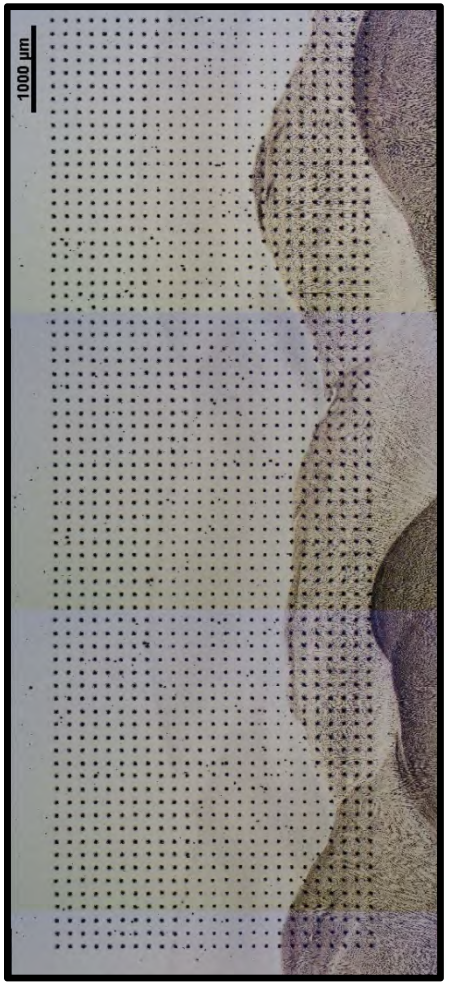
Metallographic Assessment

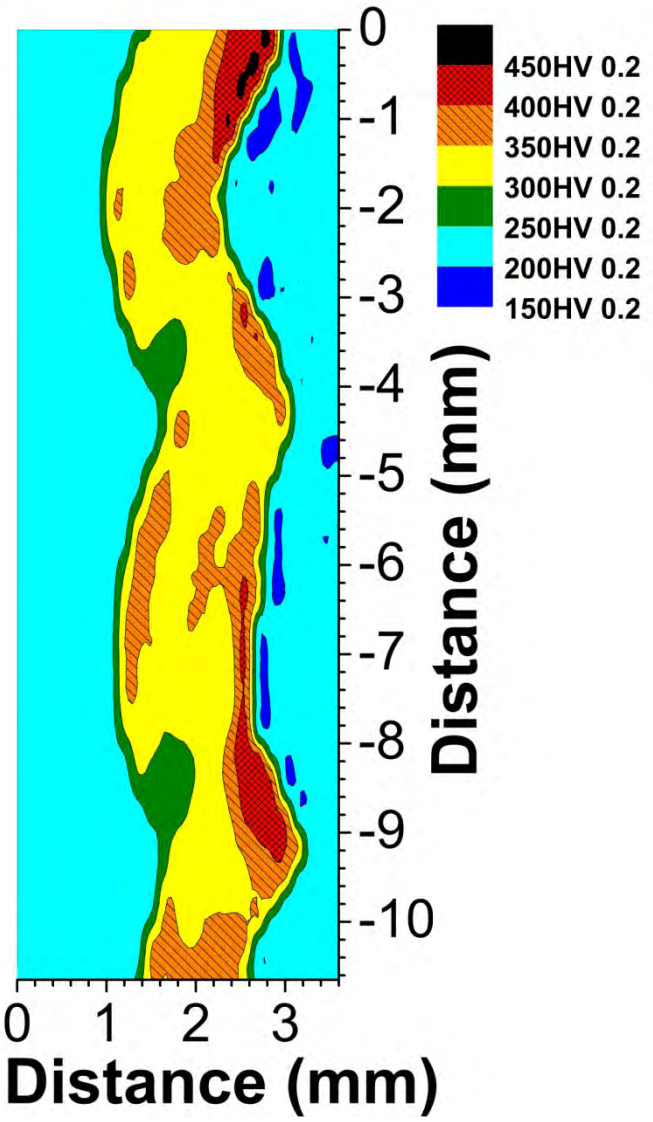


Weldment 10B [ENiCrFe-2, TBW]

Hardness Assessment – HAZ Hardness Map







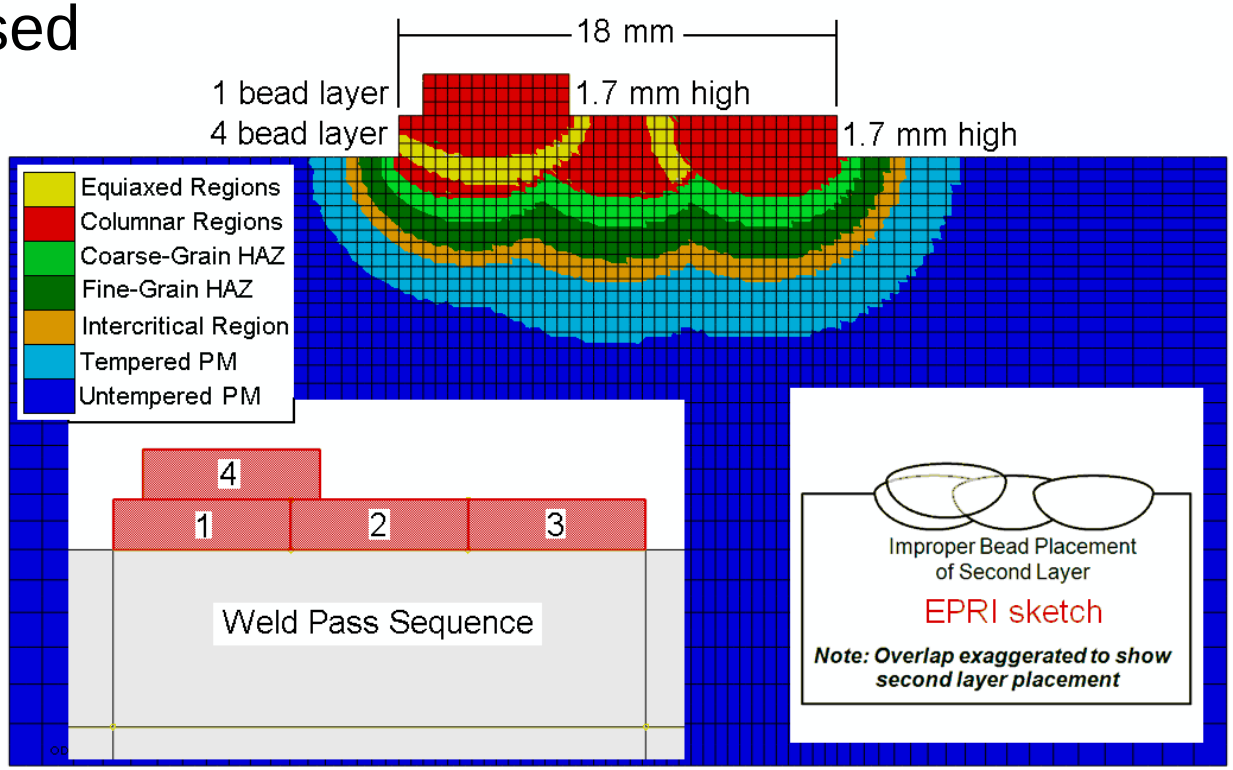
Machined and Tested Creep Samples

Creep testing being conducted at 625°C, 80MPa (~5,000 hr life)

Samples include the entirety of the weld metal and temperbead layers on either side of the weld

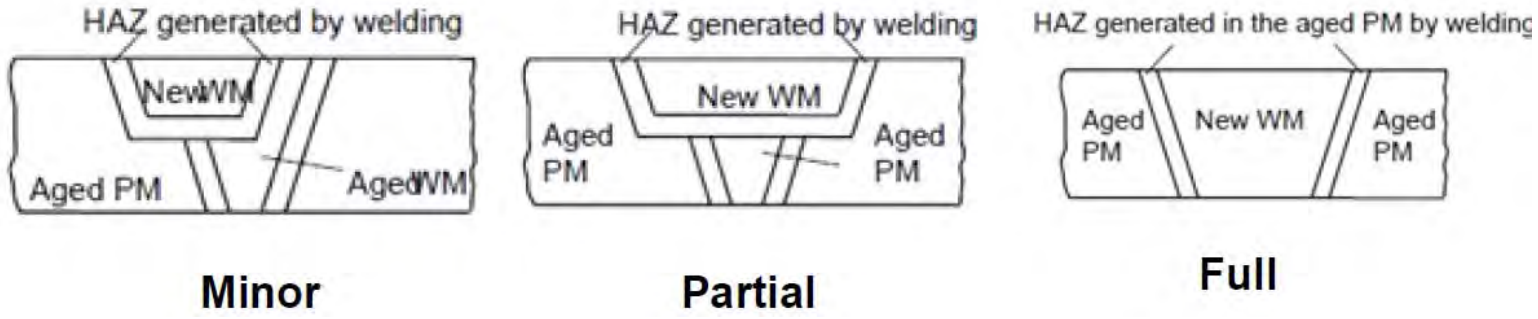
Modeling

- Modeling in Phase 1 is being conducted to understand procedure issues associated with temperbead welding (i.e. bead overlap, bead placement and electrode size)
- Modeling is focused in identifying the position and influence of overlapping thermal cycles

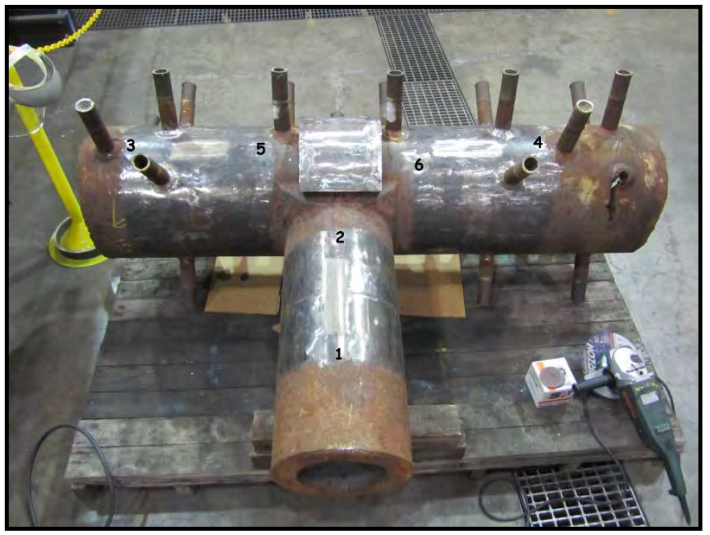


Phase 2 – Application of Best Option Repair Method(s) to Ex-service Header

- Discussion of methods and extent of excavation



- Weld procedure considerations
- Post repair evaluation of microstructure, damage, etc.
- Development of test matrix and cross-weld creep



Conclusions

- The 20 weldments have been completed and preliminary analysis has been conducted:
  - Metallographic
  - Hardness testing and mapping
  - Statistical analysis of hardness results
- Creep testing is underway of all weldments
  - Once completed, results will be presented to NBIC
- Modeling and bead on plate studies have provided insight to “best procedure guidelines” for future Phase 2 work
- Phase 2 to being ~September/October 2012
- **Questions or comments?**

Contact Information

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1.5.1 ACCREDITATION PROCESS

a) The National Board administers accreditation programs for authorization of organizations performing repairs and alterations to pressure-retaining items and/or pressure relief valves.

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) When the quality system requirements of this Section have been met, a Certificate of Authorization and appropriate National Board symbol stamp shall be issued.~~

d) ~~e)~~ 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.

~~**1.5.2 SCOPE ISSUANCE AND REVISION TO A QUALITY SYSTEM**~~

~~a) Any scope revision shall require authorized inspection agency acceptance of quality system changes. These changes shall be submitted to the National Board for acceptance. A program review may be required by the National Board or the Jurisdiction to ensure quality system requirements are met for scope changes. Upon acceptance of the changes, the National Board will issue a Certificate of Authorization with a revised scope.~~

~~b) The "VR" accreditation program provides requirements for organizations performing repairs to pressure relief valves. For scope issuance and revisions, refer to 1.7.~~

~~**1.6 ACCREDITATION OF "R" REPAIR ORGANIZATIONS**~~

~~**1.6.1 SCOPE**~~

~~a) This section provides requirements that must be met by organizations in order to obtain a National Board Certificate of Authorization to use the "R" Symbol Stamp for the~~

repair or alteration of pressure-retaining items. Organizations may be authorized to perform repairs only, or repairs and alterations.

b) The issuance of the "R" Stamp is not restricted to organizations whose primary business is to repair and alter pressure-retaining items, nor to manufacturers of pressure-retaining items. Owners and Users of pressure-retaining items and other organizations that qualify in accordance with these rules may also obtain the "R" Stamp.

c) Owners or users may be accredited for both a repair and inspection program provided the owner or user complies with the requirements of the "R" program and the National Board requirements of NB 371 for an Owner-User Inspection Organization. The requirements of 1.6.2(a) do not apply if the owner or user chooses to use the Owner-User Inspection Organization to accept the repair quality system when:

1) There is no conflict with jurisdictional requirements.

2) The line of authority for the Owner-User Inspection Organization shall be independent of the organization responsible for execution of "R" program work.

3) The process and Inspector limitations are described in the written Owner-User Inspection Organization's quality system manual.

1.6.2 PREREQUISITES FOR ISSUING A NATIONAL BOARD CERTIFICATE OF AUTHORIZATION

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

a) Have and maintain an Inspection Agreement with an Authorized Inspection Agency;

b) Have, in the English language, a written Quality System that complies with the requirements of this section and includes the expected scope of activities;

c) Have the current edition and addendum of the National Board Inspection Code, all parts; and

d) Have available a copy of the code of construction appropriate to the intended scope of work.

1.6.3 PROCEDURE FOR OBTAINING OR RENEWING A NATIONAL BOARD CERTIFICATE OF AUTHORIZATION

a) Prior to issuance or renewal of a National Board "R" Certificate of Authorization, the organization and its facilities are subject to a review of its Quality System. The implementation of the Quality System shall be satisfactorily demonstrated by the

~~organization. The National Board reserves the absolute right to cancel, refuse to issue, or renew such authorization.~~

e) ~~b)~~ 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.

~~d) Upon notification of the review dates from the National Board, it is the responsibility of the organization to make arrangements for the review.~~

~~e) The Review Team, as a minimum, shall consist of one representative each from the Authorized Inspection Agency and the Jurisdiction.[2]~~

~~f) The Review Team shall conduct an evaluation of the organization's Quality System. The organization shall demonstrate sufficient implementation of the Quality System to provide evidence of the organization's knowledge of welding, nondestructive examination, postweld heat treatment, and other repair or alteration activities performed appropriate for the requested scope of work. The demonstration may be performed using current work, a demonstration mock-up, or a combination of both.~~

~~g) A recommendation to issue, renew, or withhold the National Board Certificate of Authorization shall be included in a Review Report prepared by the Review Team. The completed Review Report shall be forwarded to the National Board.~~

~~h) If proper administrative fees are paid and all other requirements are met, a Certificate of Authorization will be issued evidencing permission to use the "R" Symbol Stamp. The certificate shall expire on the triennial anniversary date.~~

~~i) When an organization holding a National Board Certificate of Authorization changes ownership, name, location, or address, the National Board shall be notified. The Certificate of Authorization may be revised by submitting an application for National Board "R" Certificate of Authorization; however, a re-review may be required.~~

~~j) The holder of an ASME Code Symbol Stamp, whose facilities were reviewed (with the exception of "V," "UV," "HV," "NV," and "H" [cast iron]) may obtain National Board authorization without a review of its facilities, provided:~~

~~1) The organization has a Quality System to cover the scope of the repairs or alterations to be made, subject to review by the Jurisdiction; and~~

~~2) The application for the "R" Certificate of Authorization is submitted within 12 months from the issuance of the ASME Certificate of Authorization. The initial Certificate of Authorization shall be issued to expire concurrent with the ASME Certificate of Authorization. Subsequent certificates shall be renewed upon a successful review and implementation of its Quality System by a National Board Representative.~~

g) ~~k)~~ The Jurisdiction[2] may audit the Quality System and activities of an organization upon a valid request from an owner, user, inspection agency, or the National Board.

h) ~~l)~~ 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.

1.6.4 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) 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) 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.

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

1.6.~~5~~ 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.~~5~~.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**

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 maintain 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 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 assure 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 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 assuring that the required WPS or 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.

[3] NBIC Report Form: National Board Form R-1 for Repairs, Form R-2 for Alterations, or Form R-3 for Fabricated Parts or altered component can be considered in compliance with the NBIC.

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 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

1.5.1 ACCREDITATION PROCESS

a) The National Board administers accreditation programs for authorization of organizations performing repairs and alterations to pressure-retaining items and/or pressure relief valves.

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.

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g) The Jurisdiction may audit the Quality System and activities of an organization upon a valid request from an owner, user, inspection agency, or the National Board.

h) 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

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

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.

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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**

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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 maintain 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 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 assure 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 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 assuring that the required WPS or 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.

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 shall be described in the manual.

[3] NBIC Report Form: National Board Form R-1 for Repairs, Form R-2 for Alterations, or Form R-3 for Fabricated Parts or altered component can be considered in compliance with the NBIC.

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

1.7 ACCREDITATION OF "VR" REPAIR ORGANIZATIONS

1.7.1 SCOPE

a) These administrative rules and procedures are provided by the National Board for those who wish to obtain a National Board Certificate of Authorization for use of the "VR" (Repair of Pressure Relief Valves) symbol stamp. It should be noted that the issuance of the "VR" stamp is not restricted to companies whose primary business is the repair of pressure relief valves, nor to manufacturers or assemblers that hold an ASME "V," "HV," "UV," or "NV" Code symbol stamp. Owners and users of boilers and pressure vessels and other organizations that qualify in accordance with the National Board Rules and Regulations may also obtain the "VR" Certificate and stamp.

~~b) In order to provide due process in the issuance, renewal, and revocation of "VR" symbol stamps and certificates of authorization, the National Board Appeals Committee procedures provide an affected "VR" Certificate of Authorization applicant the right of appeal, or to provide additional information that may affect the Committee's decision.~~

1.7.2 JURISDICTIONAL PARTICIPATION

The National Board member jurisdiction in which the "VR" organization is located is encouraged to participate in the review and demonstration of the applicant's quality system. The Jurisdiction may require participation in the review of the repair organization and the demonstration and acceptance of the repair organization's quality system manual.

~~1.7.3 GENERAL RULES~~

~~The general rules of the National Board "VR" certification program apply only to the repair of National Board capacity certified ASME Code Section I "V" stamped, Section IV "HV" marked, and Section VIII "UV" stamped pressure relief valves that:~~

~~a) Have been in service or have been exposed to environmental or other conditions such that there is reason to question their ability to perform equivalent to the standards for new valves; or~~

~~b) Any or all of the valve's external adjustment seals have been broken, opened, or otherwise disturbed, regardless of the valve's age or service status.~~

~~1.7.4 REPAIR OF NUCLEAR VALVES~~

~~Provided that the requirements of Supplement 9 and applicable requirements of these rules are met, the "VR" certificate may be extended to apply to the repair of any ASME Code Section III, Class 1, 2, or 3, pressure relief devices that have been capacity certified by the National Board and have been in service, regardless of their intended function, in a nuclear system.~~

1.7.3 ~~1.7.5~~ ISSUANCE AND RENEWAL OF THE "VR" CERTIFICATE OF AUTHORIZATION

1.7.3.1 ~~1.7.5.1~~ GENERAL

Authorization to use the stamp bearing the official National Board "VR" symbol as shown in Section 5 of this Part, will be granted by the National Board pursuant to the provisions of the following administrative rules and procedures. ~~Supplement 9 of this Part, provides rules for the repair of ASME Section III "NV" stamped pressure relief devices.~~

1.7.3.2 ~~1.7.5.2~~ ISSUANCE OF CERTIFICATE

a) Repair organizations, manufacturers, assemblers, or users that make repairs to the American Society of Mechanical Engineers (ASME) Code symbol, stamped or marked (as applicable), and The National Board of Boiler and Pressure Vessel Inspectors (National Board) capacity certified pressure relief valves may apply to the National Board for a Certificate of Authorization to use the "VR" symbol. ~~The National Board may at any time, through the NBIC Committee, modify the regulations concerning the issuance and use of such valve repair symbol. All such modified regulations shall become binding upon holders of valid Valve Repair Certificates of Authorization.~~

~~b) Authorization to use the "VR" stamp may be granted or withheld by the National Board in its absolute discretion. If authorization is granted and proper administrative fees paid, a Certificate of Authorization will be issued evidencing permission to use such a symbol, expiring on the triennial anniversary date. The certificate will be signed by the National Board Chairman of the National Board of Trustees, the Executive Director, or any other duly authorized officer.~~

~~c) The certificate shall list the physical, permanent address of record for the certificate holder's shop/plant. For field-only scopes, this address of record shown on the Certificate of Authorization is where administrative, technical, and quality aspects of the business are controlled.~~

~~1.7.5.3 RENEWAL OF CERTIFICATE~~

~~The Certificate of Authorization is renewable every three (3) years subject to a review of the Quality System by a representative of the National Board, review and acceptance of the representative's report by the National Board, and successful completion of capacity verification tests. See 1.7.8 for exceptions. The applicant should apply to the National Board for renewal of authorization and re-issuance of the certificate prior to the date of expiration. The National Board reserves the absolute right to cancel, refuse to issue, or renew such authorization.~~

1.7.5.4 REVIEW OF APPLICANT'S FACILITY

a) Before issuance or renewal of pressure relief "VR" Certificates of Authorization, the repair organization, its written quality system, and its facilities are subject to a review and verification of implementation of its quality system by a representative of the National Board. The implementation demonstration shall include, as a minimum, disassembly, inspection, repair, application of special processes, reassembly, setting, and testing of valves within the scope of the applicant's quality system.

b) The applicant shall repair and submit for verification testing one (1) valve for each Code section (except Section III) and test fluid (steam, air/gas, liquid) which will appear on the Certificate of Authorization. A minimum of two (2) valves are required regardless of Code sections or test fluid. The valves shall be within the capabilities of the National Board accepted laboratory. When an applicant is using the provisions of 4.5.2, the applicant shall submit one additional Section VIII steam valve set on air for verification testing on steam.

c) The applicant shall have a copy of the National Board Pressure Relief Device Certifications publication, NB-18, dated within one year (available from the National Board Web page), the latest edition and addenda of the National Board Inspection Code (NBIC), all parts; and the ASME Code section(s) that the organization is including in its scope.

d) It is the responsibility of the valve repair organization to make arrangements for this review. Certificates cannot be issued or renewed until the National Board is in receipt of approval of this review. Wherever possible, National Board reviews of valve repair organizations shall be coordinated with ASME reviews, when applicable.

e) For field-only repair scopes, the review shall encompass both the applicant's address of record and field repair demonstration site. The demonstration site shall be representative of that typically encountered by the applicant (see 1.7.5.6).

1.7.5.5 VERIFICATION TESTING

a) Before the "VR" Certificate of Authorization and stamps may be issued or renewed, the demonstration valves must successfully complete capacity and operational verification tests at a National Board accepted testing laboratory. See 1.7.5.6 and 1.7.8 for exceptions. The valves shall be typical of those repaired by the organization and within the capabilities of the testing laboratory.

b) Tests conducted at the accepted testing laboratory shall be witnessed by a representative of the National Board. The purpose of the tests is to ensure that the repairs have been satisfactorily carried out and the function and operation of the valves meet the requirements of the section of the ASME Code to which they were manufactured.

c) Valves not meeting the function or operational requirements of the section of the ASME Code to which they were manufactured shall be considered to have failed. Replacement valves shall be repaired and selected for testing as stated above, at a rate of two (2) valves for each one (1) that failed.

1) If either or both of these replacement valves fail to meet the above criteria, the applicant shall document the cause of the noted deficiencies and actions taken to guard against future occurrence. Upon acceptance of this information by the National Board, one (1) additional valve for each replacement valve that failed shall be repaired and tested. The valve(s) shall be of the same ASME Code Section, fluid and set pressure scope, as the valve previously failing to meet the test requirement.
2) Failure of this valve(s) to meet the ASME Code to which the valve was manufactured shall be cause for consideration by the National Board of revocation of the "VR" Certificate of Authorization or acceptance of alternative corrective action.

1.7.5.6 VERIFICATION TESTING ALTERNATIVES

a) In such cases where all valves repaired by the applicant for a specified ASME Code Section or test fluid exceed the capabilities of the accepted testing laboratory, valves for that ASME Code Section or test fluid shall be selected as specified in 1.7.5.4, and a demonstration test shall be successfully performed in lieu of verification testing specified in 1.7.5.5 above. The demonstration tests shall be conducted at a facility mutually agreeable to the National Board representative, the facility owner, and the applicant. The purpose of these tests is to demonstrate, in the presence of a National Board representative, that the repaired valves shall have adequate seat tightness at the maximum expected operating pressure prior to lifting, shall open within the required set pressure tolerance, operate consistently without chatter, and reclose within the required blowdown.

b) If a valve lift-assist device is used by the applicant to establish set pressure after repairs, this device must also be used to set the demonstration valves.

c) If either of these valves fail to meet the above criteria, then replacement valves shall be repaired and tested at a rate of two valves for each one that failed.

1) If either or both of these replacement valves fail to meet the above criteria, the applicant shall document the cause of the noted deficiencies and actions taken to guard against future occurrence. Upon acceptance of this information by the National Board, one (1) additional valve for each replacement valve that failed shall be repaired and tested. The valve(s) shall be of the same ASME Code section, fluid, and set pressure scope as the valve previously failing to meet the test requirement.

~~2) Failure of this valve(s) to meet the ASME Code to which the valve was manufactured shall be cause for consideration by the National Board of revocation of the "VR" Certificate of Authorization or acceptance of alternative corrective action.~~

1.7.4 ~~1.7.6~~ USE OF THE "VR" AUTHORIZATION

1.7.4.1 ~~1.7.6.1~~ TECHNICAL REQUIREMENTS

The administrative requirements of ~~1.7~~ for use of the "VR" stamp shall be used in conjunction with the technical requirements for valve repair as described in Supplement 7 of the NBIC. Those requirements shall be mandatory when a "VR" repair is performed.

~~1.7.6.2~~ STAMP USE

Each "VR" symbol stamp shall be used only by the repair firm within the scope, limitations, and restrictions under which it was issued.

1.7.4.2 ~~1.7.6.3 RETURN OF STAMP~~

~~Each applicant shall agree, if authorization to use the stamp is granted, that the stamp is at all times the property of the National Board and will be promptly returned upon demand. If the applicant discontinues the repair of such valves or if the "VR" Certificate of Authorization issued to such applicant has expired and no new certificate has been issued, the stamp will be returned to the National Board.~~

~~1.7.6.4 MULTIPLE LOCATIONS~~

~~A holder of a National Board "VR" stamp shall not permit any others to use the "VR" symbol stamp loaned to it by the National Board. When a repair organization, manufacturer, or user has a repair department and/or equipment in fixed plants or shops located in more than one geographical area, it must submit separate applications for each plant or shop with the addresses of all such repair locations.~~

~~1.7.6.5 CERTIFICATE OF AUTHORIZATION CONTENTS~~

~~Qualification for repair location (shop, shop and field, or field only), code section (Section I, III, IV, and/or VIII valves), special processes, and test media shall be specified on the repair organization's "VR" Certificate of Authorization.~~

~~1.7.6.6 CHANGES TO CERTIFICATES OF AUTHORIZATION~~

~~a) When a "VR" Certificate Holder intends to change the address of record (location), the certificate holder shall notify the National Board in writing prior to relocating. The new facilities and related quality system for the new location shall be reviewed in~~

~~accordance with 1.7.5.4. Issuance of a new Certificate of Authorization is subject to the procedures herein.~~

~~b) When a "VR" Certificate Holder intends to change ownership or scope, the certificate holder shall notify the National Board in writing prior to the change. A review, in accordance with 1.7.5.4, may be required depending upon the nature and extent of the change to the quality system manual, repair procedures, or facilities. Issuance of a new Certificate of Authorization is subject to the procedures herein.~~

~~**1.7.6.7 ISSUANCE OF MORE THAN ONE "VR" SYMBOL STAMP TO A CERTIFICATE OF AUTHORIZATION HOLDER**~~

~~The holder of a Certificate of Authorization may obtain more than one "VR" symbol stamp provided its quality system manual controls the use of such stamps from the address of record shown on the Certificate of Authorization.~~

1.7.5 ~~1.7.7~~ QUALITY SYSTEM

1.7.5.1 ~~1.7.7.1~~ GENERAL

Each applicant for a new or renewed "VR" Certificate of Authorization shall have and maintain a quality system which shall establish that all of these rules and administrative procedures and applicable ASME Code requirements, including material control, fabrication, machining, welding, examination, setting, testing, inspection, sealing, and stamping will be met.

1.7.5.2 ~~1.7.7.2~~ WRITTEN DESCRIPTION

A written description, in the English language, of the system the applicant will use shall be available for review and shall contain, as a minimum, the features set forth in 1.7.7.5. This description may be brief or voluminous, depending upon the projected scope of work, and shall be treated confidentially. In general, the quality system shall describe and explain what documents and procedures the repair firm will use to validate a valve repair.

~~**1.7.7.3 REVIEW**~~

~~A review of the applicant's quality system will be performed by a representative of the National Board. The review will include a demonstration of the implementation of the provisions of the applicant's quality system.~~

1.7.5.3 ~~1.7.7.4~~ MAINTENANCE OF CONTROLLED COPY

Each applicant to whom a "VR" Certificate of Authorization is issued shall maintain thereafter a controlled copy of the accepted quality system manual with the National Board. Except for changes that do not affect the quality system, revisions to the quality system manual shall not be implemented until such revisions are accepted by the National Board.

1.7.5.4 ~~1.7.7.5~~ OUTLINE OF REQUIREMENTS FOR A QUALITY SYSTEM

The following establishes the minimum requirements of the written description of the quality system. It is required that each valve repair organization develop its own quality system that meets the requirements of its organization. For this reason it is not possible to develop one quality system that could apply to more than one organization. The written description shall include, as a minimum, the following features:

a) **Title Page**
The title page shall include the name and address of the company to which the National Board Certificate of Authorization is to be issued.

b) **Revision Log**
A revision log is required to assure revision control of the quality system manual. The log should contain sufficient space for date, description and section of revision, company approval, and National Board acceptance.

c) **Contents Page**

The contents page should list and reference, by paragraph and page number, the subjects and exhibits contained therein.

d) **Statement of Authority and Responsibility**

A statement of authority and responsibility shall be dated and signed by an officer of the company. It shall include:

1) A statement that the "VR" stamp shall be applied only to pressure relief valves that meet both of the following conditions:

a. Are stamped with an ASME "V", "UV", or "NV" Code symbol or marked with an ASME "HV" symbol and have been capacity certified by the National Board; and

b. Have been disassembled, inspected, and repaired by the Certificate Holder such that the valves' condition and performance are equivalent to the standards for new valves.

2) The title of the individual responsible to ensure that the quality system is followed and who has authority and freedom to effect the responsibility;

3) A statement that if there is a disagreement in the implementation of the written quality system, the matter is to be referred to a higher authority in the company for resolution; and

4) The title of the individual authorized to approve revisions to the written quality system and the method by which such revisions are to be submitted to the National Board for acceptance before implementation.

e) **Organization Chart**

A chart showing the relationship between management, purchasing, repairing, inspection, and quality control personnel is required and shall reflect the actual organization in place.

f) **Scope of Work**

1) The scope of work section shall indicate the scope and type of valve repairs, including conversions the organization is capable of and intends to perform. The location of repairs (shop, shop and field, or field only), ASME Code Section(s) to which the repairs apply, the test medium (air, gas, liquid, or steam, or combinations thereof), and special processes (machining, welding, postweld heat treatment, or nondestructive examination, or combinations thereof) shall be specifically addressed.

2) The types and sizes of valves to be repaired, pressure ranges and other limitations, such as engineering and test facilities, should also be addressed.

g) **Drawings and Specification Control**

The drawings and specification control system shall provide procedures assuring that the latest applicable drawings, specifications, and instructions required are used for valve repair, including conversions, inspection, and testing.

h) **Material and Part Control**

The material and part control section shall describe purchasing, receiving, storage, and issuing of parts.

1) State the title of the individual responsible for the purchasing of all
material.

2) State the title of the individual responsible for certification and other records as required.

3) All incoming material and parts shall be checked for conformance with the purchase order and, where applicable, the material specifications or drawings. Indicate how material or part is identified and how identity is maintained by the quality system.

i) **Repair and Inspection Program**

The repair and inspection program section shall include reference to a document (such as a report, traveler, or checklist) that outlines the specific repair and inspection procedures used in the repair of pressure relief valves. Repair procedures shall require verification that the critical parts meet the valve manufacturer's specification. Supplement S7.14 outlines recommended procedures covering some specific items. Provisions shall be made to retain this document for a period of at least five years.

1) Each valve or group of valves shall be accompanied by the document referred to above for processing through the plant. Each valve shall have a unique identifier (i.e., repair serial number, shop order number, etc.) appearing on the repair documentation and repair nameplate such that traceability is established.

2) The document referred to above shall describe the original nameplate information, including the ASME Code symbol stamping and the repair nameplate information, if applicable. In addition, it shall include material checks, replacement parts, conversion parts (or both), reference to items such as the welding procedure specifications (WPS), fitup, NDE technique, heat treatment, and pressure test methods to be used. Application of the "VR" stamp to the repair nameplate shall be recorded in this document. Specific conversions performed with the new Type/Model number shall be recorded on the document. There shall be a space for "signoffs" at each operation to verify that each step has been properly performed.

3) The system shall include a method of controlling the repair or replacement of critical valve parts. The method of identifying each spring shall be indicated.

4) The system shall also describe the controls used to ensure that any personnel engaged in the repair of pressure relief valves are trained and qualified in accordance with Supplement S7.

j) **Welding, NDE, and Heat Treatment** (when applicable)

The quality system manual shall indicate the title of the person(s) responsible for and describe the system used in the selection, development, approval, and qualification of welding procedure specifications, and the qualification of welders and welding operators in accordance with the provisions of S7.

1) The quality system manual may include controls for the "VR" Certificate Holder to have the pressure relief valve part repaired by a National Board "R" Certificate Holder, per Supplement S7.

2) The completed Form R-1 shall be noted on and attached to the "VR" Certificate Holder's document required in 1.7.7.5(i). Similarly, NDE and heat treatment techniques must be covered in the quality system manual. When outside services are used for NDE and heat treatment, the quality system manual shall describe the system whereby the use of such services meet the requirements of the applicable section of the ASME Code.

k) **Valve Testing, Setting, and Sealing**

The system shall include provisions that each valve shall be tested, set, and all external adjustments sealed according to the requirements of the applicable ASME Code Section and the National Board. The seal shall identify the "VR" Certificate Holder making the repair. Abbreviations or initials shall be permitted, provided such identification is acceptable to the National Board.

l) **Valve Repair Nameplates**

An effective valve stamping system shall be established to ensure proper stamping of each valve as required by 5.9.2. The manual shall include a description of the nameplate or a drawing.

m) **Calibration**

1) The manual shall describe a system for the calibration of examination, measuring, and test equipment used in the performance of repairs. Documentation of these calibrations shall include the standard used and the results.

2) All calibration standards shall be calibrated against certified equipment having known valid relationships to nationally recognized standards.

n) **Manual Control**

The quality system shall include:

1) Measures to control the issuance of and revisions to the quality system manual;

2) Provisions for a review of the system in order to maintain the manual current with these rules and the applicable sections of the ASME Code;
3) The title(s) of the individual(s) responsible for control, revisions, and review of the manual;

4) Provision of a controlled copy of the written quality system manual to be submitted to the National Board; and
5) Revisions shall be submitted for acceptance by the National Board prior to being implemented.

o) **Nonconformities**

The system shall establish measures for the identification, documentation, evaluation, segregation, and disposition of nonconformities. A nonconformity is a condition of any material, item, product, or process in which one or more characteristics do not conform to the established requirements. These may include, but are not limited to, data discrepancies, procedural and/or documentation deficiencies, or material defects. Also, the title(s) of the individual(s) involved in this process shall be included.

p) **Exhibits**

Forms used in the quality system shall be included in the manual with a written description. Forms exhibited should be marked SAMPLE and completed in a manner typical of actual valve repair procedures.

q) **Testing Equipment (See Supplement 8)**

The system shall include a means to control the development, addition, or modification of testing equipment to ensure the requirements of 4.5.1(b) are met.

r) Field Repairs (See Supplement S7.7)

If field repairs are included in the scope of work, the system shall address any differences or additions to the quality system required to properly control this activity, including the following:

1) Provisions for annual audits of field activities shall be included;

2) Provisions for receipt and inspection of replacement parts, including parts received from the owner-user, shall be addressed;

3) If owner-user personnel will assist with repairs, provisions for the use of owner-user personnel shall be included; and

4) Provisions for use of owner-user measurement and test equipment, if applicable, shall be addressed.

~~**1.7.8 ASME "V," "HV," OR "UV" CERTIFICATE HOLDERS**~~

~~a) A manufacturer holding a valid ASME Certificate of Authorization for use of an ASME "V", "HV", or "UV" Code symbol stamp may obtain the "VR" Certificate of Authorization for the repair of pressure relief valves covered by the ASME Certificate of Authorization and that meet the requirements of 1.7.3. This can be accomplished without a review of the facilities provided there is a written quality system to cover the scope of the repairs to be made and the repairs are carried out at the same location where the ASME valves are manufactured. Unless the repaired valves are tested on the same facilities and to the same procedures as new valves, two (2) repaired valves shall be selected by a National Board representative for verification tests.~~

~~b) The initial Certificate of Authorization shall be issued to expire concurrent with the ASME Certificate of Authorization. Subsequent certificates shall be renewed upon a successful review and verification of implementation of its quality system by a National Board representative. This review shall be performed concurrently with the ASME Certificate renewal review.~~

~~c) A manufacturer may also perform field repairs of pressure relief valves covered by the ASME Certificate of Authorization provided the provisions of Supplement S7.7 are met.~~

~~d) Assemblers holding ASME Certificates of Authorization shall qualify for the "VR" Certificate of Authorization as required elsewhere in these rules.~~
~~e) The quality system manual shall be submitted for review and acceptance by the National Board.~~

f) In order for an ASME Code symbol stamp holder to qualify for the National Board "VR" stamp, the following areas to the written quality system usually require attention.

1) Statement of Authority and Responsibility

This should clearly indicate that valve repairs are carried out in accordance with the requirements and the rules of the National Board and the quality system manual. In addition, the scope and type of valve repairs covered by the manual should be indicated.

2) Organization

Unless the functions which affect the quality of valve repairs are carried out by individuals other than those responsible for manufacturing or assembly, it should not be necessary to revise the organization chart.

3) General Quality Functions

Usually quality system requirements regarding valve repairs may be controlled in the same manner as for ASME manufacturing or assembly provided applicable shop and/or field activities are covered. If this is the case, the applicant for the "VR" stamp should include in its quality system manual a separate section covering valve repairs that references the applicable section of the manual. For a more explicit explanation see 1.7.7.5, Outline of Requirements for a Quality System.

1.7 ACCREDITATION OF "VR" REPAIR ORGANIZATIONS

1.7.1 SCOPE

a) The administrative rules and procedures are provided by the National Board for those who wish to obtain a National Board Certificate of Authorization for use of the "VR" (Repair of Pressure Relief Valves) symbol stamp. It should be noted that the issuance of the "VR" stamp is not restricted to companies whose primary business is the repair of pressure relief valves, nor to manufacturers or assemblers that hold an ASME "V," "HV," "UV," or "NV" Code symbol stamp. Owners and users of boilers and pressure vessels and other organizations that qualify in accordance with the National Board Rules and Regulations may also obtain the "VR" Certificate and stamp.

1.7.2 JURISDICTIONAL PARTICIPATION

The National Board member jurisdiction in which the "VR" organization is located is encouraged to participate in the review and demonstration of the applicant's quality system. The Jurisdiction may require participation in the review of the repair organization and the demonstration and acceptance of the repair organization's quality system manual.

1.7.2 ISSUANCE AND RENEWAL OF THE "VR" CERTIFICATE OF AUTHORIZATION

1.7.2.1 GENERAL

Authorization to use the stamp bearing the official National Board "VR" symbol as shown in Section 5 of this Part, will be granted by the National Board pursuant to the provisions of the following administrative rules and procedures

1.7.2.2 ISSUANCE OF CERTIFICATE

a) Repair organizations, manufacturers, assemblers, or users that make repairs to the American Society of Mechanical Engineers (ASME) Code symbol, stamped or marked (as applicable), and The National Board of Boiler and Pressure Vessel Inspectors (National Board) capacity certified pressure relief valves may apply to the National Board for a Certificate of Authorization to use the "VR" symbol.

1.7.3USE OF THE "VR" AUTHORIZATION

1.7.3.1 TECHNICAL REQUIREMENTS

The administrative requirements of ~~1.7~~ for use of the "VR" stamp shall be used in conjunction with the technical requirements for valve repair as described in Supplement 7 of the NBIC. Those requirements shall be mandatory when a "VR" repair is performed.

1.7.3.2 STAMP USE

Each "VR" symbol stamp shall be used only by the repair firm within the scope, limitations, and restrictions under which it was issued.

1.7.4 QUALITY SYSTEM

1.7.4.1 GENERAL

Each applicant for a new or renewed "VR" Certificate of Authorization shall have and maintain a quality system which shall establish that all of these rules and administrative procedures and applicable ASME Code requirements, including material control, fabrication, machining, welding, examination, setting, testing, inspection, sealing, and stamping will be met.

1.7.4.2 WRITTEN DESCRIPTION

A written description, in the English language, of the system the applicant will use shall be available for review and shall contain, as a minimum, the features set forth in 1.7.4.5. This description may be brief or voluminous, depending upon the projected scope of work, and shall be treated confidentially. In general, the quality system shall describe and explain what documents and procedures the repair firm will use to validate a valve repair.

1.7.4.3 MAINTENANCE OF CONTROLLED COPY

Each applicant to whom a "VR" Certificate of Authorization is issued shall maintain thereafter a controlled copy of the accepted quality system manual with the National Board. Except for changes that do not affect the quality system, revisions to the quality system manual shall not be implemented until such revisions are accepted by the National Board.

1.7.4.4 OUTLINE OF REQUIREMENTS FOR A QUALITY SYSTEM

The following establishes the minimum requirements of the written description of the quality system. It is required that each valve repair organization develop its own quality system that meets the requirements of its organization. For this reason it is not possible to develop one quality system that could apply to more than one organization. The written description shall include, as a minimum, the following features:

a) **Title Page**
The title page shall include the name and address of the company to which the National Board Certificate of Authorization is to be issued.

b) **Revision Log**

A revision log is required to assure revision control of the quality system manual. The log should contain sufficient space for date, description and section of revision, company approval, and National Board acceptance.

c) **Contents Page**

The contents page should list and reference, by paragraph and page number, the subjects and exhibits contained therein.

d) **Statement of Authority and Responsibility**

A statement of authority and responsibility shall be dated and signed by an officer of the company. It shall include:

1) A statement that the "VR" stamp shall be applied only to pressure relief valves that meet both of the following conditions:

a. Are stamped with an ASME "V", "UV", or "NV" Code symbol or marked with an ASME "HV" symbol and have been capacity certified by the National Board; and

b. Have been disassembled, inspected, and repaired by the Certificate Holder such that the valves' condition and performance are equivalent to the standards for new valves.

2) The title of the individual responsible to ensure that the quality system is followed and who has authority and freedom to effect the responsibility;

3) A statement that if there is a disagreement in the implementation of the written quality system, the matter is to be referred to a higher authority in the company for resolution; and

4) The title of the individual authorized to approve revisions to the written quality system and the method by which such revisions are to be submitted to the National Board for acceptance before implementation.

e) **Organization Chart**

A chart showing the relationship between management, purchasing, repairing, inspection, and quality control personnel is required and shall reflect the actual organization in place.

f) **Scope of Work**

1) The scope of work section shall indicate the scope and type of valve repairs, including conversions the organization is capable of

and intends to perform. The location of repairs (shop, shop and field, or field only), ASME Code Section(s) to which the repairs apply, the test medium (air, gas, liquid, or steam, or combinations thereof), and special processes (machining, welding, postweld heat treatment, or nondestructive examination, or combinations thereof) shall be specifically addressed.

2) The types and sizes of valves to be repaired, pressure ranges and other limitations, such as engineering and test facilities, should also be addressed.

g) **Drawings and Specification Control**

The drawings and specification control system shall provide procedures assuring that the latest applicable drawings, specifications, and instructions required are used for valve repair, including conversions, inspection, and testing.

h) **Material and Part Control**

The material and part control section shall describe purchasing, receiving, storage, and issuing of parts.

1) State the title of the individual responsible for the purchasing of all
material.

2) State the title of the individual responsible for certification and other records as required.

3) All incoming material and parts shall be checked for conformance with the purchase order and, where applicable, the material specifications or drawings. Indicate how material or part is identified and how identity is maintained by the quality system.

i) **Repair and Inspection Program**

The repair and inspection program section shall include reference to a document (such as a report, traveler, or checklist) that outlines the specific repair and inspection procedures used in the repair of pressure relief valves. Repair procedures shall require verification that the critical parts meet the valve manufacturer's specification. Supplement S7.14 outlines recommended procedures covering some specific items. Provisions shall be made to retain this document for a period of at least five years.

1) Each valve or group of valves shall be accompanied by the document referred to above for processing through the plant. Each valve shall have a unique identifier (i.e., repair serial number, shop order number, etc.) appearing on the repair documentation and repair nameplate such that traceability is established.

2) The document referred to above shall describe the original nameplate information, including the ASME Code symbol stamping and the repair nameplate information, if applicable. In addition, it shall include material checks, replacement parts, conversion parts (or both), reference to items such as the welding procedure specifications (WPS), fitup, NDE technique, heat treatment, and pressure test methods to be used. Application of the "VR" stamp to the repair nameplate shall be recorded in this document. Specific conversions performed with the new Type/Model number shall be recorded on the document. There shall be a space for "signoffs" at each operation to verify that each step has been properly performed.

3) The system shall include a method of controlling the repair or replacement of critical valve parts. The method of identifying each spring shall be indicated.

4) The system shall also describe the controls used to ensure that any personnel engaged in the repair of pressure relief valves are trained and qualified in accordance with Supplement S7.

j) **Welding, NDE, and Heat Treatment** (when applicable)

The quality system manual shall indicate the title of the person(s) responsible for and describe the system used in the selection, development, approval, and qualification of welding procedure specifications, and the qualification of welders and welding operators in accordance with the provisions of S7.

1) The quality system manual may include controls for the "VR" Certificate Holder to have the pressure relief valve part repaired by a National Board "R" Certificate Holder, per Supplement S7.

2) The completed Form R-1 shall be noted on and attached to the "VR" Certificate Holder's document required in 1.7.4.5(i). Similarly, NDE and heat treatment techniques must be covered in the quality system manual. When outside services are used for NDE and heat treatment, the quality system manual shall describe the system whereby the use of such services meet the requirements of the applicable section of the ASME Code.

k) **Valve Testing, Setting, and Sealing**

The system shall include provisions that each valve shall be tested, set, and all external adjustments sealed according to the requirements of the applicable ASME Code Section and the National Board. The seal shall identify the "VR" Certificate Holder making the repair. Abbreviations or initials shall be permitted, provided such identification is acceptable to the National Board.

l) **Valve Repair Nameplates**

An effective valve stamping system shall be established to ensure proper stamping of each valve as required by 5.9.2. The manual shall include a description of the nameplate or a drawing.

m) **Calibration**

1) The manual shall describe a system for the calibration of examination, measuring, and test equipment used in the performance of repairs. Documentation of these calibrations shall include the standard used and the results.

2) All calibration standards shall be calibrated against certified equipment having known valid relationships to nationally recognized standards.

n) **Manual Control**

The quality system shall include:

1) Measures to control the issuance of and revisions to the quality system manual;

2) Provisions for a review of the system in order to maintain the manual current with these rules and the applicable sections of the ASME Code;
3) The title(s) of the individual(s) responsible for control, revisions, and review of the manual;

4) Provision of a controlled copy of the written quality system manual to be submitted to the National Board; and
5) Revisions shall be submitted for acceptance by the National Board prior to being implemented.

o) **Nonconformities**

The system shall establish measures for the identification, documentation, evaluation, segregation, and disposition of nonconformities. A nonconformity is a condition of any material, item, product, or process in which one or more characteristics do not conform to the established requirements. These may include, but are not limited to, data discrepancies, procedural and/or documentation deficiencies, or material defects. Also, the title(s) of the individual(s) involved in this process shall be included.

p) **Exhibits**

Forms used in the quality system shall be included in the manual with a written description. Forms exhibited should be marked SAMPLE and completed in a manner typical of actual valve repair procedures.

q) **Testing Equipment (See Supplement 8)**

The system shall include a means to control the development, addition, or modification of testing equipment to ensure the requirements of 4.5.1(b) are met.

r) Field Repairs (See Supplement S7.7)

If field repairs are included in the scope of work, the system shall address any differences or additions to the quality system required to properly control this activity, including the following:

1) Provisions for annual audits of field activities shall be included;

2) Provisions for receipt and inspection of replacement parts, including parts received from the owner-user, shall be addressed;

3) If owner-user personnel will assist with repairs, provisions for the use of owner-user personnel shall be included; and

4) Provisions for use of owner-user measurement and test equipment, if applicable, shall be addressed.

1.8 "NR" ACCREDITATION REQUIREMENTS

1.8.1 SCOPE

a) ~~This section provides~~ The requirements ~~that must~~ to be met for an organization to obtain a National Board Certificate of Authorization to use the "NR" Symbol Stamp for the Repair/Replacement activities performed in accordance with this Part and ASME Section XI requirements.

b) The issuance of the "NR" stamp is not restricted to organizations whose primary business is to perform repair/replacement activities or to manufacturers or assemblers that hold an ASME "N"-type Code symbol stamp. Owners and users of nuclear components and other organizations that qualify in accordance with these rules may also obtain the "NR" stamp may be obtained from the National Board.

~~1.8.2 PREREQUISITES FOR ISSUING A NATIONAL BOARD "NR" CERTIFICATE OF AUTHORIZATION~~

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

~~a) Have and maintain an inspection agreement with an accredited Nuclear Inspection Agency in accordance with NB-360[4], NB-369[5], and ASME Section XI;~~

~~b) Have in the English language a written Quality System Program that complies with the requirements of this Section and addresses controls for the intended scope of activities;~~

~~c) Have a current edition and addenda of the NBIC, all parts; and~~
~~d) Have available copies of the original code of construction appropriate to the intended scope of work and the applicable edition and addenda of ASME Section XI, as required by the regulatory authority.[6]~~

~~1.8.3 PROCEDURES FOR OBTAINING OR RENEWING A NATIONAL BOARD "NR" CERTIFICATE OF AUTHORIZATION~~

~~a) Prior to issuance or renewal of a National Board "NR" Certificate of Authorization, the organization and its facilities are subject to a review of its Quality System Program. The implementation of the Quality System Program shall be satisfactorily demonstrated by the organization. Demonstration of implementation shall meet the most stringent code requirements for the scope of work to be performed by the organization. The National Board reserves the absolute right to cancel, refuse to issue,~~

1.8.2 ~~1.8.4~~ NATIONAL BOARD "NR" SYMBOL STAMP

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

~~b) The National Board, for a nominal fee, furnishes the "NR" Symbol Stamp. Each organization shall agree, if authorized to use the "NR" Symbol Stamp, that the "NR" 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 "NR" Symbol Stamp or if the Certificate of Authorization has expired and no new Certificate of Authorization has been issued, the "NR" Symbol Stamp shall be returned to the National Board.~~

~~c) The organization's Quality System Program shall provide for adequate control of the "NR" Symbol Stamp.~~

~~d) The organization authorized to use the "NR" Symbol Stamp may obtain more than one "NR" Symbol Stamp provided the organization's Quality System Program describes how the use of such stamps are controlled from the location shown on the "NR" Certificate of Authorization.~~

b) ~~e)~~ The organization shall not permit other organizations to use the "NR" Symbol Stamp loaned to it by the National Board.

1.8.3 ~~1.8.5~~ QUALITY SYSTEM PROGRAM

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

1.8.3.1 ~~1.8.5.1~~ OUTLINE OF REQUIREMENTS FOR A QUALITY SYSTEM PROGRAM FOR QUALIFICATION FOR THE NATIONAL BOARD "NR" SYMBOL STAMP

These rules set forth the requirements for planning, managing, and implementing the organization's Quality System Programs for controlling the quality of activities performed during repair/replacement activities of components and systems in nuclear power plants within the scope of the applicable edition and addenda of Section XI of the ASME Code. These

rules are to be the basis for evaluating such programs prior to the issuance of the National Board "NR" Certificate of Authorization.

a) **Organization**

1) The authority and responsibility of those in charge of the Quality System Program and activities affecting quality shall be clearly established and documented. The person and organization performing Quality System functions shall have sufficient and well-defined responsibility, authority, and organizational freedom to:

a. Identify quality problems;

b. Initiate action which results in solutions;

c. Verify implementation of solutions to those problems; and

d. Control further processing, delivery or installation of a nonconforming item, deficiency or unsatisfactory condition until proper disposition has been made.

2) The person and organization responsible for defining and for measuring the overall effectiveness of the Quality System Program shall be designated sufficiently independent from the pressure of production, have direct access to responsible management at a level where appropriate action can be required and report regularly on the effectiveness of the program. Assurance of quality requires management measures which provide that the individual or group assigned the responsibility of inspection, testing, checking, or otherwise verifying that an activity has been correctly performed, is independent of the individual or group directly responsible for performing the specific activity. The specific responsibilities of the Quality Assurance organization of the "NR" Certificate Holder shall include the review of written procedures and monitoring of all activities concerned with the Quality System Program as covered in these rules.

b) **Quality System Program**

1) Before becoming a holder of an "NR" Certificate of Authorization, the applicant shall establish a Quality System Program for the control of the quality of work to be performed. The program shall define the organizational structure within which the Quality System Program is to be implemented and shall clearly delineate the responsibilities, levels of authority, and lines of communication for the various individuals involved. The program shall be documented in detail in a Quality System Manual that shall be a major basis for

demonstration of compliance with the NBIC. The applicant's Quality System Program shall be documented by written policies, procedures, and instructions and shall be based on the organization's scope of work to be performed.

2) The applicant's program need not be in the same format or sequential arrangement as the requirements in these rules as long as all applicable program requirements have been covered. The program shall provide for the accomplishment of activities affecting quality under suitably controlled conditions. Controlled conditions include the use of appropriate equipment, suitable environmental conditions for accomplishing the activity and assurance that prerequisites for the activity have been satisfied. The program shall take into account the need for special controls, processes, test equipment, tools, and skills to attain the required quality and need for the verification of quality by inspection and test. The program shall provide for ready detection of nonconforming material and items and for timely and positive corrective actions.

3) The program shall provide for indoctrination and training of personnel performing activities affecting quality as necessary to assure that suitable proficiency is achieved and maintained. It shall be the responsibility of the "NR" Certificate Holder to ensure that all personnel performing quality functions within the scope of these rules, including personnel of subcontracted services, are qualified as specified in these rules. The assignment of qualified personnel shall be at the discretion of the "NR" certificate holder.

4) The "NR" Certificate Holder shall be responsible for advising his Authorized Nuclear Inspection Agency of any proposed changes to the Quality System Manual and shall have acceptance of the Authorized Nuclear Inspection Agency's Authorized Nuclear Inspector Supervisor before putting such changes into effect. The "NR" Certificate Holder shall make a current copy of the Quality System Manual available to the Authorized Nuclear Inspector. The "NR" Certificate Holder shall be responsible for promptly notifying the Authorized Nuclear Inspector of such accepted changes, including evidence of acceptance by the Authorized Nuclear Inspection Agency.

5) The quality of all repair/replacement activities shall be controlled at all points necessary to ensure conformance with the requirements of these rules and the "NR" Certificate Holder's Quality System Manual.

6) The Certificate Holder shall make available to the Authorized Nuclear Inspector such drawings and process sheets as are necessary to make the Quality System Program intelligible.

c) **Design Control**

1) ASME Section XI establishes that the owner is responsible for design in connection with repair/replacement activities. The "NR" Certificate Holder must ensure that the design specification, drawings, or other specifications or instructions furnished by the owner satisfy the code edition and addenda of the owner's design specification. To satisfy this requirement, the "NR" Certificate Holder shall establish requirements that correctly incorporate the owner's design specification requirements into their specifications, drawings, procedures, and instructions, which may be necessary to carry out the work. The "NR" Certificate Holder's system shall include provisions to ensure that the appropriate quality standards are specified and included in all quality records. These records shall be reviewed for compliance with the owner's design specification and the requirements of Section XI of the ASME Boiler and Pressure Vessel Code.

2) If the "NR" Certificate Holder's specifications, drawings, procedures, and instructions conflict with the owner's design specification, a system must be implemented that will resolve or eliminate the deficiency. This system must be reconciled with the owner and the "NR" Certificate Holder in accordance with IWA-4000 of Section XI of the ASME Code.

d) **Procurement Document Control**

Documents for procurement of materials, items, and subcontracted services shall include requirements to the extent necessary to ensure their compliance with the owner's design specifications and IWA-4000 of Section XI of the ASME Code. To the extent necessary, procurement documents shall require suppliers to maintain a Quality System Program consistent with the applicable requirements of the edition and addenda of the code of construction to which the items are constructed. Measures shall be established

to ensure that all purchased material, items, and services conform to these requirements.

e) **Instructions, Procedures and Drawings**

Activities affecting quality shall be prescribed by documented instructions, procedures or drawings of a type appropriate to the circumstances and shall be accomplished in accordance with these instructions, procedures, or drawings. Instructions, procedures, or drawings shall include appropriate quantitative and qualitative criteria for determining that activities affecting quality have been satisfactorily accomplished. The "NR" Certificate Holder shall maintain a written description of procedures, instructions, or drawings used by his organization for control of quality and examination requirements detailing the implementation of the Quality System requirements. Copies of these procedures shall be readily available to the Authorized Nuclear Inspector.

f) **Document Control**

The program shall include measures to control the issuance, use, and disposition of documents, such as specifications, instructions, procedures, and drawings, including changes thereto. These measures shall ensure that the latest applicable documents, including changes, are reviewed for adequacy and approved for release by authorized personnel and distributed for use at the location where the prescribed activity is performed.

g) **Control of Purchased Material, Items, and Services**

Measures shall be established to ensure that all purchased material, items, and services conform to the requirements of the owner's design specifications and applicable edition and addenda of the code of construction and Section XI of the ASME Code. These measures shall include identification for material traceability. Provisions shall be identified for source evaluation and objective evidence shall be provided evidencing quality standards for material examination upon receipt.

h) **Identification and Control of Material and Items**

1) Measures shall be established for identification and control of material and items, including partially fabricated assemblies. These measures shall ensure that identification is maintained and traceable, either on the material or component, or on records throughout the repair/replacement activity. These measures shall be designed to prevent the

use of incorrect or defective items and those which have not received the required examinations, tests, or inspections.
2) Permanent or temporary unit identification marks shall be applied using methods and materials that are legible and not detrimental to the component or system involved. Such identification shall be located in areas that will not interfere with the function or quality aspects of the item.

3) Certified Material Test Reports shall be identified as required by the applicable material specification in Section II of the ASME Code and shall satisfy any additional requirements specified in the original code of construction. The Certified Material Test Report or Certificate of Compliance need not be duplicated for submission with compliance documents when a record of compliance and satisfactory reviews of the Certified Material Test Report and Certificates of Compliance is provided. Documents shall provide a record that the Certified Material Test Report and Certificates of Compliance have been received, reviewed, and found acceptable. When the "NR" Certificate Holder Scope authorizes the organization to perform examinations and tests in accordance with the original code of construction, the "NR" Certificate Holder shall certify compliance either on a Certified Material Test Report or Certificate of Conformance that the material satisfies the original code of construction requirements.

i) **Control of Processes**

1) The "NR" Certificate Holder shall operate under a controlled system such as process sheets, checklists, travelers, or equivalent procedures. Measures shall be established to assure that processes such as welding, nondestructive examination, and heat treating are controlled in accordance with the rules of the applicable section of the ASME Code and are accomplished by qualified personnel using qualified procedures.

2) Process sheets, checklists, travelers, or equivalent documentation shall be prepared, including the document numbers and revisions to which the process conforms with space provided for reporting results of completion of specific operations at checkpoints of repair/replacement activities.

j) **Examinations, Tests and Inspections**

1) In-process and final examinations and tests shall be established to assure conformance with specifications, drawings, instructions, and procedures which incorporate or reference the requirements and acceptance limits contained in applicable design documents. Examination activities to verify the quality of work shall be performed by persons other than those who performed the activity being examined. Such persons shall not report directly to the immediate supervisors responsible for the work being examined.

2) Process sheets, travelers, or checklists shall be prepared, including the document numbers and revision to which the examination or test is to be performed, with space provided for recording results.

3) Mandatory hold/inspection points at which witnessing is required by the "NR" Certificate Holder's representative or the Authorized Nuclear Inspector shall be indicated in the controlling documents. Work shall not proceed beyond mandatory hold/inspection points without the consent of the "NR" Certificate Holder's representative or the Authorized Nuclear Inspector, as appropriate.

k) **Test Control**

1) Testing shall be performed in accordance with the owner's written test procedures that incorporate or reference the requirements and acceptance limits contained in applicable design documents.

2) Test procedures shall include provisions for assuring that prerequisites for the given test have been met, that adequate instrumentation is available and used, and that necessary monitoring is performed. Prerequisites may include calibrated instrumentation, appropriate equipment, trained personnel, condition of test equipment and the item to be tested, suitable environmental conditions, and provisions for data acquisition.

3) Test results shall be documented and evaluated to assure that test requirements have been satisfied.

l) **Control of Measuring and Test Equipment**

Measures shall be established and documented to assure that tools, gages,

instruments, and other measuring and testing equipment and devices used in activities affecting quality are of the proper range, type, and accuracy to verify conformance to established requirements. A procedure shall be in effect to assure that they are calibrated and properly adjusted at specified periods or use intervals to maintain accuracy within specified limits. Calibration shall be traceable to known national standards, where these standards exist, or with the device manufacturer's recommendation.
m) Quality Records

1) The owner is responsible for designating records to be maintained. Measures shall be established for the "NR" Certificate Holder to maintain these records [See 1.8.5.1(m)(2)] required for Quality Assurance of repair/replacement activities. These shall include documents such as records of materials, manufacturing, examination, and test data taken before and during repair/replacement activity. Procedures, specifications, and drawings used shall be fully identified by pertinent material or item identification numbers, revision numbers, and issue dates. The records shall also include related data such as qualification of personnel, procedures, equipment, and related repairs. The "NR" Certificate Holder shall take such steps as may be required to provide suitable protection from deterioration and damage for all records while in his care. Also, it is required that the "NR" Certificate Holder have a system for correction or amending records that satisfies the owner's requirements. These records may be either the original or a reproduced, legible copy and shall be transferred to the owner at his request.

2) Records to be maintained as required in 1.8.5.1(m)(1) above may include the following:

a. An index that details the location and who is responsible for maintaining the records;

b. Data reports, properly executed, for each replacement component, part, appurtenance, piping system, and piping
assembly, when required by the design specification or the owner;

c. The required as-constructed drawings certified as to correctness;

d. Copies of applicable Certified Material Test Reports and Certificates of Compliance;

e. As-built sketch(es) including tabulations of materials repair/replacement procedures, and instructions to achieve compliance with Section XI of the ASME Code;

f. Nondestructive examination reports including results of examinations shall identify the ASNT, SNT-TC-1A, CP-189, or ACCP level of personnel interpreting the examination results. The ASNT Central Certification Program (ACCP) may be used to fulfill the examination and demonstration requirement of the employer's written practice. Final radiographs shall be included where radiography has been performed;

g. Records of all heat treatments may be either the heat treatment charts or a summary description of heat treatment time and temperature data certified by the "NR" Certificate Holder. Heat treatments performed by the material manufacturer to satisfy requirements of the material specifications may be reported on the Certified Material Test Report; or

h. Any and all nonconformance reports shall satisfy IWA-4000 of Section XI of the ASME Code and shall be reconciled by the owner
prior to certification of the Form NR-1 or NVR-1, as applicable.

3) After a repair/replacement activity, all records including audit reports required to verify compliance with the applicable engineering documents and the "NR" Certificate Holder's Quality System Program, except those required by the owner or listed in 1.8.5.1(m)(2)(a) thru (g) above, shall be maintained at a place mutually agreed upon by the owner and the "NR" Certificate Holder. These records shall be maintained for a period of five years after completion of the repair/replacement activity.

4) The original of the completed Form NR-1 or Form NVR-1, as applicable, shall be registered with the National Board and, if required, a copy forwarded to the Jurisdiction where the nuclear power plant is located.

n) **Examination or Test Status**

Measures shall be established to indicate examination and test status of parts, items, or components during the repair/replacement activity. The system used shall provide positive identification of the part, item, or component by means of stamps, labels, routing cards, or other acceptable methods. The system shall include any procedures or instructions to achieve compliance. Also, measures shall be provided for the identification of acceptable and unacceptable items. They shall also include procedures for control of status indicators, including the authority for application and removal of status indicators.

o) **Nonconforming Materials or Items**

Measures shall be established to control materials or items that do not conform to requirements in order to prevent their inadvertent use, including measures to identify and control the proper installation of items and to preclude nonconformance with the requirements of these rules. These measures shall include procedures for identification, documentation, segregation, and disposition. Nonconforming items shall be reviewed for acceptance, rejection, or repair in accordance with documented procedures. The responsibility and authority for the disposition of nonconforming items shall be defined. Repaired or modified items shall be re-examined in accordance with the applicable procedures. Measures that control further processing of a nonconforming or defective item, pending a decision on its disposition, shall be established and maintained. Ultimate disposition of nonconforming items shall be documented.

p) **Corrective Action**

1) Measures shall be established to ensure that conditions adverse to quality such as failures, malfunctions, deficiencies, deviations, defective material and equipment, and other nonconformances are promptly identified and corrected.

2) In the case of significant conditions adverse to quality, the measures shall also ensure that the cause of these conditions be determined and corrected to preclude repetition. The identification of significant conditions adverse to quality, the cause, and condition and the corrective action taken shall be documented and reported to the appropriate levels of management.

3) The requirements shall also extend to the performance of subcontractors' corrective action measures.

q) **Audits**

A comprehensive system of planned and periodic audits shall be carried out by the "NR" Certificate Holder's organization to ensure compliance with the Quality System Program and to determine its effectiveness. Audits shall be performed in accordance with written procedures or checklists by personnel not having direct responsibilities in the areas being audited. Audit results shall be documented by the auditing personnel for review by management having responsibility in that area. Follow-up action, including re-audit of deficient areas, shall be taken where indicated. Audit results shall be made available to the Authorized Nuclear Inspector.

r) **Authorized Nuclear Inspector**

Measures shall be taken to reference the commissioned Rules for National Board Authorized Nuclear Inspector, qualified in accordance with the Rules for National Board Inservice and New Construction Commisioned Inspectors, to ensure that the latest documents including the Quality System Program will be made available to the inspector. The Authorized Nuclear Inspector shall be consulted prior to the issuance of a repair/replacement program in order that the Inspector may select any inspection or hold points in the program. The Authorized Nuclear Inspector shall not sign Form NR-1 or Form NVR-1, as applicable, unless satisfied that all work carried out is in accordance with the NBIC, ASME Section XI, and any jurisdictional requirements.

s) **Exhibits**

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

1.8.6 INTERFACE WITH THE OWNER'S REPAIR/REPLACEMENT ~~PROGRAM~~

~~Interface with the owner's repair/replacement program shall meet the following:~~

~~a) The repair/replacement plan shall be subject to the acceptance of the Jurisdiction and the owner's Authorized Nuclear In-service Inspector (ANII).~~

b) Repair/replacement activities of nuclear components shall meet the requirements of Section XI of the ASME Boiler and Pressure Vessel Code and the Jurisdiction where the nuclear power plant is located.

c) Documentation of the repair/replacement activities of nuclear components shall be recorded on the National Board Report of Nuclear Repair/Modification or Replacement activities, Form NR-1, or Form NVR-1, as applicable. The completed forms shall be signed by a representative of the authorized nuclear repair organization and the Authorized Nuclear Inspector if the repair/replacement activity meets the requirements of ASME Section XI. For repair/replacement activities that involve design changes as specified in 1.8.5.1(c), Form NR-1, or Form NVR-1, as applicable, shall indicate the responsible organization satisfying the owner's design specification requirements.

d) The authorized nuclear repair organization shall provide a copy of the signed Form NR-1 or Form NVR-1, as applicable, to the owner, if required, the Jurisdiction, and the Authorized Nuclear Inspection Agency. The original Form NR-1 or Form NVR-1, as applicable, shall be registered with the National Board by the authorized nuclear repair organization.

e) The authorized nuclear repair organization shall provide a nameplate/stamping for repair/replacement activities for each nuclear component unless otherwise required by the Owner's Quality System Program. The required information and format shall be as shown in Section 5 of this Part.

1.8 "NR" ACCREDITATION REQUIREMENTS

1.8.1 SCOPE

a) The requirements to be met for an organization to obtain a National Board Certificate of Authorization to use the "NR" Symbol Stamp for the Repair/Replacement activities performed in accordance with this Part and ASME Section XI requirements.

b) The issuance of the "NR" stamp is not restricted to organizations whose primary business is to perform repair/replacement activities or to manufacturers or assemblers that hold an ASME "N"-type Code symbol stamp. Owners and users of nuclear components and other organizations that qualify in accordance with these rules may also obtain the "NR" stamp may be obtained from the National Board.

1.8.2 NATIONAL BOARD "NR" SYMBOL STAMP

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

b) The organization shall not permit other organizations to use the "NR" Symbol Stamp loaned to it by the National Board.

1.8.3 QUALITY SYSTEM PROGRAM

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

1.8.3.1 OUTLINE OF REQUIREMENTS FOR A QUALITY SYSTEM PROGRAM FOR QUALIFICATION FOR THE NATIONAL BOARD "NR" SYMBOL STAMP

These rules set forth the requirements for planning, managing, and implementing the organization's Quality System Programs for controlling the quality of activities performed during repair/replacement activities of components and systems in nuclear power plants within the scope of the applicable edition and addenda of Section XI of the ASME Code. These rules are to be the basis for evaluating such programs prior to the issuance of the National Board "NR" Certificate of Authorization.

a) **Organization**

1) The authority and responsibility of those in charge of the Quality System Program and activities affecting quality shall be clearly established and documented. The person and organization performing Quality System functions shall have sufficient and well-defined responsibility, authority, and organizational freedom to:

a. Identify quality problems;

b. Initiate action which results in solutions;

c. Verify implementation of solutions to those problems; and

d. Control further processing, delivery or installation of a nonconforming item, deficiency or unsatisfactory condition until proper disposition has been made.

2) The person and organization responsible for defining and for measuring the overall effectiveness of the Quality System Program shall be designated sufficiently independent from the pressure of production, have direct access to responsible management at a level where appropriate action can be required and report regularly on the effectiveness of the program. Assurance of quality requires management measures which provide that the individual or group assigned the responsibility of inspection, testing, checking, or otherwise verifying that an activity has been correctly performed, is independent of the individual or group directly responsible for performing the specific activity. The specific responsibilities of the Quality Assurance organization of the "NR" Certificate Holder shall include the review of written procedures and monitoring of all activities concerned with the Quality System Program as covered in these rules.

b) **Quality System Program**

1) Before becoming a holder of an "NR" Certificate of Authorization, the applicant shall establish a Quality System Program for the control of the quality of work to be performed. The program shall define the organizational structure within which the Quality System Program is to be implemented and shall clearly delineate the responsibilities, levels of authority, and lines of communication for the various individuals involved. The program shall be documented in detail in a Quality System Manual that shall be a major basis for demonstration of compliance with the NBIC. The applicant's Quality System Program shall be documented by written policies,

procedures, and instructions and shall be based on the organization's scope of work to be performed.

2) The applicant's program need not be in the same format or sequential arrangement as the requirements in these rules as long as all applicable program requirements have been covered. The program shall provide for the accomplishment of activities affecting quality under suitably controlled conditions. Controlled conditions include the use of appropriate equipment, suitable environmental conditions for accomplishing the activity and assurance that prerequisites for the activity have been satisfied. The program shall take into account the need for special controls, processes, test equipment, tools, and skills to attain the required quality and need for the verification of quality by inspection and test. The program shall provide for ready detection of nonconforming material and items and for timely and positive corrective actions.

3) The program shall provide for indoctrination and training of personnel performing activities affecting quality as necessary to assure that suitable proficiency is achieved and maintained. It shall be the responsibility of the "NR" Certificate Holder to ensure that all personnel performing quality functions within the scope of these rules, including personnel of subcontracted services, are qualified as specified in these rules. The assignment of qualified personnel shall be at the discretion of the "NR" certificate holder.

4) The "NR" Certificate Holder shall be responsible for advising his Authorized Nuclear Inspection Agency of any proposed changes to the Quality System Manual and shall have acceptance of the Authorized Nuclear Inspection Agency's Authorized Nuclear Inspector Supervisor before putting such changes into effect. The "NR" Certificate Holder shall make a current copy of the Quality System Manual available to the Authorized Nuclear Inspector. The "NR" Certificate Holder shall be responsible for promptly notifying the Authorized Nuclear Inspector of such accepted changes, including evidence of acceptance by the Authorized Nuclear Inspection Agency.

5) The quality of all repair/replacement activities shall be controlled at all points necessary to ensure conformance

with the requirements of these rules and the "NR" Certificate Holder's Quality System Manual.

6) The Certificate Holder shall make available to the Authorized Nuclear Inspector such drawings and process sheets as are necessary to make the Quality System Program intelligible.

c) **Design Control**

1) ASME Section XI establishes that the owner is responsible for design in connection with repair/replacement activities. The "NR" Certificate Holder must ensure that the design specification, drawings, or other specifications or instructions furnished by the owner satisfy the code edition and addenda of the owner's design specification. To satisfy this requirement, the "NR" Certificate Holder shall establish requirements that correctly incorporate the owner's design specification requirements into their specifications, drawings, procedures, and instructions, which may be necessary to carry out the work. The "NR" Certificate Holder's system shall include provisions to ensure that the appropriate quality standards are specified and included in all quality records. These records shall be reviewed for compliance with the owner's design specification and the requirements of Section XI of the ASME Boiler and Pressure Vessel Code.

2) If the "NR" Certificate Holder's specifications, drawings, procedures, and instructions conflict with the owner's design specification, a system must be implemented that will resolve or eliminate the deficiency. This system must be reconciled with the owner and the "NR" Certificate Holder in accordance with IWA-4000 of Section XI of the ASME Code.

d) **Procurement Document Control**

Documents for procurement of materials, items, and subcontracted services shall include requirements to the extent necessary to ensure their compliance with the owner's design specifications and IWA-4000 of Section XI of the ASME Code. To the extent necessary, procurement documents shall require suppliers to maintain a Quality System Program consistent with the applicable requirements of the edition and addenda of the code of construction to which the items are constructed. Measures shall be established to ensure that all purchased material, items, and services conform to these requirements.

e) **Instructions, Procedures and Drawings**

Activities affecting quality shall be prescribed by documented instructions, procedures or drawings of a type appropriate to the circumstances and shall be accomplished in accordance with these instructions, procedures, or drawings. Instructions, procedures, or drawings shall include appropriate quantitative and qualitative criteria for determining that activities affecting quality have been satisfactorily accomplished. The "NR" Certificate Holder shall maintain a written description of procedures, instructions, or drawings used by his organization for control of quality and examination requirements detailing the implementation of the Quality System requirements. Copies of these procedures shall be readily available to the Authorized Nuclear Inspector.

f) **Document Control**

The program shall include measures to control the issuance, use, and disposition of documents, such as specifications, instructions, procedures, and drawings, including changes thereto. These measures shall ensure that the latest applicable documents, including changes, are reviewed for adequacy and approved for release by authorized personnel and distributed for use at the location where the prescribed activity is performed.

g) **Control of Purchased Material, Items, and Services**

Measures shall be established to ensure that all purchased material, items, and services conform to the requirements of the owner's design specifications and applicable edition and addenda of the code of construction and Section XI of the ASME Code. These measures shall include identification for material traceability. Provisions shall be identified for source evaluation and objective evidence shall be provided evidencing quality standards for material examination upon receipt.

h) **Identification and Control of Material and Items**

1) Measures shall be established for identification and control of material and items, including partially fabricated assemblies. These measures shall ensure that identification is maintained and traceable, either on the material or component, or on records throughout the repair/replacement activity. These measures shall be designed to prevent the use of incorrect or defective items and those which have not received the required examinations, tests, or inspections.

2) Permanent or temporary unit identification marks shall be applied using methods and materials that are legible and not detrimental to the component or system involved. Such identification shall be located in areas that will not interfere with the function or quality aspects of the item.

3) Certified Material Test Reports shall be identified as required by the applicable material specification in Section II of the ASME Code and shall satisfy any additional requirements specified in the original code of construction. The Certified Material Test Report or Certificate of Compliance need not be duplicated for submission with compliance documents when a record of compliance and satisfactory reviews of the Certified Material Test Report and Certificates of Compliance is provided. Documents shall provide a record that the Certified Material Test Report and Certificates of Compliance have been received, reviewed, and found acceptable. When the "NR" Certificate Holder Scope authorizes the organization to perform examinations and tests in accordance with the original code of construction, the "NR" Certificate Holder shall certify compliance either on a Certified Material Test Report or Certificate of Conformance that the material satisfies the original code of construction requirements.

i) **Control of Processes**

1) The "NR" Certificate Holder shall operate under a controlled system such as process sheets, checklists, travelers, or equivalent procedures. Measures shall be established to assure that processes such as welding, nondestructive examination, and heat treating are controlled in accordance with the rules of the applicable section of the ASME Code and are accomplished by qualified personnel using qualified procedures.

2) Process sheets, checklists, travelers, or equivalent documentation shall be prepared, including the document numbers and revisions to which the process conforms with space provided for reporting results of completion of specific operations at checkpoints of repair/replacement activities.

j) **Examinations, Tests and Inspections**

1) In-process and final examinations and tests shall be established to assure conformance with specifications,

drawings, instructions, and procedures which incorporate or reference the requirements and acceptance limits contained in applicable design documents. Examination activities to verify the quality of work shall be performed by persons other than those who performed the activity being examined. Such persons shall not report directly to the immediate supervisors responsible for the work being examined.

2) Process sheets, travelers, or checklists shall be prepared, including the document numbers and revision to which the examination or test is to be performed, with space provided for recording results.

3) Mandatory hold/inspection points at which witnessing is required by the "NR" Certificate Holder's representative or the Authorized Nuclear Inspector shall be indicated in the controlling documents. Work shall not proceed beyond mandatory hold/inspection points without the consent of the "NR" Certificate Holder's representative or the Authorized Nuclear Inspector, as appropriate.

k) **Test Control**

1) Testing shall be performed in accordance with the owner's written test procedures that incorporate or reference the requirements and acceptance limits contained in applicable design documents.

2) Test procedures shall include provisions for assuring that prerequisites for the given test have been met, that adequate instrumentation is available and used, and that necessary monitoring is performed. Prerequisites may include calibrated instrumentation, appropriate equipment, trained personnel, condition of test equipment and the item to be tested, suitable environmental conditions, and provisions for data acquisition.

3) Test results shall be documented and evaluated to assure that test requirements have been satisfied.

l) **Control of Measuring and Test Equipment**

Measures shall be established and documented to assure that tools, gages,
instruments, and other measuring and testing equipment and devices used in activities affecting quality are of the proper range,

type, and accuracy to verify conformance to established requirements. A procedure shall be in effect to assure that they are calibrated and properly adjusted at specified periods or use intervals to maintain accuracy within specified limits. Calibration shall be traceable to known national standards, where these standards exist, or with the device manufacturer's recommendation.
m) Quality Records

1) The owner is responsible for designating records to be maintained. Measures shall be established for the "NR" Certificate Holder to maintain these records [See 1.8.5.1(m)(2)] required for Quality Assurance of repair/replacement activities. These shall include documents such as records of materials, manufacturing, examination, and test data taken before and during repair/replacement activity. Procedures, specifications, and drawings used shall be fully identified by pertinent material or item identification numbers, revision numbers, and issue dates. The records shall also include related data such as qualification of personnel, procedures, equipment, and related repairs. The "NR" Certificate Holder shall take such steps as may be required to provide suitable protection from deterioration and damage for all records while in his care. Also, it is required that the "NR" Certificate Holder have a system for correction or amending records that satisfies the owner's requirements. These records may be either the original or a reproduced, legible copy and shall be transferred to the owner at his request.

2) Records to be maintained as required in 1.8.5.1(m)(1) above may include the following:

a. An index that details the location and who is responsible for maintaining the records;

b. Data reports, properly executed, for each replacement component, part, appurtenance, piping system, and piping
assembly, when required by the design specification or the owner;

c. The required as-constructed drawings certified as to correctness;

d. Copies of applicable Certified Material Test Reports and Certificates of Compliance;

e. As-built sketch(es) including tabulations of materials repair/replacement procedures, and instructions to achieve compliance with Section XI of the ASME Code;

f. Nondestructive examination reports including results of examinations shall identify the ASNT, SNT-TC-1A, CP-189, or ACCP level of personnel interpreting the examination results. The ASNT Central Certification Program (ACCP) may be used to fulfill the examination and demonstration requirement of the employer's written practice. Final radiographs shall be included where radiography has been performed;

g. Records of all heat treatments may be either the heat treatment charts or a summary description of heat treatment time and temperature data certified by the "NR" Certificate Holder. Heat treatments performed by the material manufacturer to satisfy requirements of the material specifications may be reported on the Certified Material Test Report; or

h. Any and all nonconformance reports shall satisfy IWA-4000 of Section XI of the ASME Code and shall be reconciled by the owner
prior to certification of the Form NR-1 or NVR-1, as applicable.

3) After a repair/replacement activity, all records including audit reports required to verify compliance with the applicable engineering documents and the "NR" Certificate Holder's Quality System Program, except those required by the owner or listed in 1.8.5.1(m)(2)(a) thru (g) above, shall be maintained at a place mutually agreed upon by the owner and the "NR" Certificate Holder. These records shall be maintained for a period of five years after completion of the repair/replacement activity.

4) The original of the completed Form NR-1 or Form NVR-1, as applicable, shall be registered with the National Board and, if required, a copy forwarded to the Jurisdiction where the nuclear power plant is located.

n) **Examination or Test Status**

Measures shall be established to indicate examination and test status of parts, items, or components during the repair/replacement activity. The system used shall provide positive identification of the part, item, or component by means of stamps, labels, routing cards, or other acceptable methods. The system shall include any procedures or instructions to achieve compliance. Also, measures shall be provided for the identification of acceptable and unacceptable items. They shall also include procedures for control of status indicators, including the authority for application and removal of status indicators.

o) **Nonconforming Materials or Items**

Measures shall be established to control materials or items that do not conform to requirements in order to prevent their inadvertent use, including measures to identify and control the proper installation of items and to preclude nonconformance with the requirements of these rules. These measures shall include procedures for identification, documentation, segregation, and disposition. Nonconforming items shall be reviewed for acceptance, rejection, or repair in accordance with documented procedures. The responsibility and authority for the disposition of nonconforming items shall be defined. Repaired or modified items shall be re-examined in accordance with the applicable procedures. Measures that control further processing of a nonconforming or defective item, pending a decision on its disposition, shall be established and maintained. Ultimate disposition of nonconforming items shall be documented.

p) **Corrective Action**

1) Measures shall be established to ensure that conditions adverse to quality such as failures, malfunctions, deficiencies, deviations, defective material and equipment, and other nonconformances are promptly identified and corrected.

2) In the case of significant conditions adverse to quality, the measures shall also ensure that the cause of these conditions be determined and corrected to preclude repetition. The identification of significant conditions adverse to quality, the cause, and condition and the corrective action taken shall be documented and reported to the appropriate levels of management.

3) The requirements shall also extend to the performance of subcontractors' corrective action measures.

q) **Audits**

A comprehensive system of planned and periodic audits shall be carried out by the "NR" Certificate Holder's organization to ensure compliance with the Quality System Program and to determine its effectiveness. Audits shall be performed in accordance with written procedures or checklists by personnel not having direct responsibilities in the areas being audited. Audit results shall be documented by the auditing personnel for review by management having responsibility in that area. Follow-up action, including re-audit of deficient areas, shall be taken where indicated. Audit results shall be made available to the Authorized Nuclear Inspector.

r) **Authorized Nuclear Inspector**

Measures shall be taken to reference the commissioned Rules for National Board Authorized Nuclear Inspector, qualified in accordance with the Rules for National Board Inservice and New Construction Commisioned Inspectors, to ensure that the latest documents including the Quality System Program will be made available to the inspector. The Authorized Nuclear Inspector shall be consulted prior to the issuance of a repair/replacement program in order that the Inspector may select any inspection or hold points in the program. The Authorized Nuclear Inspector shall not sign Form NR-1 or Form NVR-1, as applicable, unless satisfied that all work carried out is in accordance with the NBIC, ASME Section XI, and any jurisdictional requirements.

s) **Exhibits**

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

NBIC Sub-Group Repairs & Alterations

Subject:	Review Form R-2 and Instructions accepted by Main Committee Letter Ballot September 2010

NB-Item number:	Initiated by NB-staff ➡**NB12-1101**

Explanation of assignment needed:	Mr. Terry Parks initiated this item to revisit the configuration of the "as-published" Form R-2 after receiving numerous comments as to how the Form was to work within the industry as well as within the National Board. To that end, Mr. Parks proposed a TG-approach with N-BD staff to clarify the objectives of the Form R-2 and best use the time between January 2012 and January 2013 to develop or introduce any other changes prior to issuing the 2013-Edition. This assignment represents: ✓ • Affirm the direction of the Committee to portray the natural continuity of work flow, and as described in the book at 5.2.2 when preparing a Form R-2, emphasizing the need to complete the design certification and review PRIOR to the start of construction. ✓ • Enhance the scope of work description fields to better afford the completion of the Form R-2 outside of an electronic format. ***No betterment Ø*** • Affirm the perception of betterment in separating the form as sheet 1 and sheet 2 for the purpose of expediting communication & registration. ✓ • Interact with N-BD staff as a TG to understand the fallout of the noted tasks and to recognize any obstacles to overcome within the Natl. -BD's EDT-system. ✓ • Review the Instruction sheet developed by N-BD staff for inclusion into the Instructions for completing N-BD Forms @ 5.13.4.1.

Assigned to:	M. Webb, Ron Pulliam, Wayne Jones, Nikki Estep and Donna Radcliff (N-BD staff), Ben Schaefer, Bob Wielgoszinski

Background:	The Form R-2 as published in the 2011-Edition of NB-23 was published in error and does not reflect the accepted Form by MC-Letter Ballot in September 2010. See Ballot Archives, NB08-0304. The N-BD will use the "as-published" Form R-2 until the correction or other action is adopted for the 2013 code Edition.

Existing Text in '11-Edition **5.13.4.1 INSTRUCTIONS FOR COMPLETING NATIONAL BOARD FORM "R" REPORTS**	**Proposed Change #1** (Proposed changes are double-underlined) **5.13.4.1 INSTRUCTIONS: ITEM 2**	Rationale
5.13.4.1 INSTRUCTIONS FOR COMPLETING NATIONAL BOARD FORM "R" REPORTS 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 5.6, a log shall be maintained identifying sequentially, any "R"-forms registered with the National Board. For re-rating only, the Design Organization registers the R-2. Where physical work is also performed, the Construction Organization registers the R-2. →	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 5.6, a log shall be maintained identifying sequentially, any "R"-forms registered with the National Board. The requirements for registration can be found at Part 3, 5.5. Information is relocated to: ***5.5.2 b) REGISTRATION OF ALTERATIONS*** →	As instructions for line 2, the language specifically identifying registration requirements may be better profiled as a reference to the applicable section of the Code; Part 3, 5.5.2 a) - c). ***RELOCATED TO 5.5.2 b)- PROPOSED CHANGE 2*** -For re-rating only, the Design Organization registers the R-2. Where physical work is also performed, the Construction Organization registers the R-2.

Accepted Text NB-item: NB10-0701 **5.5.2 REGISTRATION FOR ALTERATIONS**	**Proposed Change #2** (Proposed changes are double-underlined) **5.5.2 REGISTRATION FOR ALTERATIONS**	Rationale
a) If the pressure retaining item is originally registered with the National Board, an original Form R-2, together with attachments, shall be registered with the National Board. *b)* If the item was not *originally* registered with the National Board, one original Form R-2 *meeting the requirements of the Code*, together with attachments *when the exact scope of work is not described,* may be registered with the National board or retained as required by *The Quality Manual System.* As shown the ***italicized script*** represents item NB10-0701 accepted by Main Committee **"b" is relocated as "d".**	a) No Change b) For re-rating or design-only where no physical work is performed, the Design Organization assigns a unique sequential number shown on the Form R-2; front and back, as instructed at 5.13.4.1 item 2 and when required, is responsible for registering the Form R-2 Report with the National Board. c) Where physical work is also performed, the Construction Organization assigns a unique sequential number shown on the Form R-2; front and back, as instructed at 5.13.4.1 item 2 and when required, is responsible for registering the Form R-2 Report with the National Board. d) If the item was not *originally* registered with the National Board, one original Form R-2 *meeting the requirements of the Code*, together with attachments *when the exact scope of work is not described,* may be registered with the National board or retained as required by *The Quality Manual System.*	The proposed relocation of information shown as "b" and "c" is from Instruction item #2. The subject matter @ 5.5.2 "REGISTRATION FOR ALTERATIONS" goes beyond an Instruction item for line 2 and describes Code-responsibilities of the Design and Construction organizations. The Task Group suggests it may be better suited as Code-text rather than as an instruction item.

Existing Text in '11-Edition **5.2.2 PREPARATION OF FORM R-2**	**Proposed Change #3** (Proposed changes are double-underlined)	Rationale
c) …The construction organization shall complete the Form R-2 provided by the design organization, including the "Construction Certification" section of the form. When no construction work is performed (e.g., a re-rating with no physical changes), the "R" Certificate Holder responsible for the design shall prepare the Form R-2, including the gathering and attaching of the supporting reports.	c) …The construction organization shall complete the Form R-2 provided by the design organization, including the "Construction Certification" section of the form. When no construction work is performed (e.g., a re-rating or design-only with no physical changes), the "R" Certificate Holder responsible for the design shall prepare the Form R-2, including the gathering and attaching of the supporting reports and other information pertaining to the work.	Adding design only merely represents consistency to the thought of limited scope throughout the section. The addition reflecting the reports and other information pertaining to the work. merely affirms instruction item-12 and instruction item-15 @ 5.13.4.1.

Accepted by MC by Letter Ballot, (NOT PUBLISHED) for '11-Edition- 2-Page, single side

Separated Form R-2- DESIGN REPORT- Sheet 1

FORM R-2 REPORT OF ALTERATION
in accordance with provisions of the *National Board Inspection Code*

DESIGN REPORT SHEET 1 OF 2

1. Design performed by _____ (name of "R" organization responsible for design) _____ (Form "R" Registration No.)
_____ (address) _____ (P.O. No., Job No., etc.)
2. Owner _____ (name)
_____ (address)
3. Location of installation _____ (name)
_____ (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)
7. Description of Design Scope: _____
(use supplemental sheet, Form R-4, if necessary) ☐ 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)
_____
_____
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 _____ _____ (name of design organization) Signed _____ (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 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 _____ (inspector) Commissions _____ (National Board and jurisdiction no.)

Separated form R-2- CONSTRUCTION REPORT- Sheet 2

FORM R-2 REPORT OF ALTERATION
in accordance with provisions of the *National Board Inspection Code*

CONSTRUCTION REPORT SHEET 2 OF 2

1. Construction performed by _____ (name of "R" organization responsible for construction) _____ (Form "R" Registration No.)
_____ (address) _____ (P.O. No., Job No., etc.)
2. Owner _____ (name)
_____ (address)
3. Location of installation _____ (name)
_____ (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)

CERTIFICATE of DESIGN _____ (Identify the design organization's Form "R" Registration No.) **, ACKNOWLEDGED by CONSTRUCTION OGANIZATION** (or referencing P.O., job, or tracking number if the Form "R" Report is not registered)
I, _____ acknowledge the provisions and requirements of design described on the DESIGN REPORT, sheet 1, and the design was introduced into the construction scope as required by the *National Board Inspection Code*.
Date _____ _____ (name of construction organization) Signed _____ (authorized representative)

7. Description of Construction Scope: _____
(use supplemental sheet, Form R-4, if necessary) ☐ 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)
_____
_____
9. Remarks: _____

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 _____ _____ (name of alteration organization) Signed _____ (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 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 _____ (inspector) Commissions _____ (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-229 Rev. 5

PROPOSED Change #4- - RETURN TO 1-PAGE, 2-SIDED FORM (See objectives page 1)

PROPOSED- Front page

FORM R-2 REPORT OF ALTERATION
in accordance with provisions of the *National Board Inspection Code*

_____ (Form "R" Registration No.)

_____ (P.O. 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 _____
(name)

(address)

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

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)

PROPOSED- Back page

Form R-2 (back)

_____ (Form "R" Registration No.)

_____ (P.O. No., Job No., etc.)

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 _____ _____ (name of design organization) Signed _____ (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 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 _____ (inspector) Commissions _____ (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 _____ _____ (name of alteration organization) Signed _____ (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 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 _____ (inspector) Commissions _____ (National Board and jurisdiction no.)

Action Item

NB12-2001

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: NBIC Part 3, 5.13.4.1

12. Provide a summary describing the exact scope of work that was completed to a Pressure Retaining I (PRI). The information to be included when describing the scope of work shall consider items such a: 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 ren a defect or as allowed by 3.3.4.8 to remain in place, the welding process and procedure when used, special processes required such as PWHT; noting the soak time and temperatures recorded, and an acceptable in-process and final NDE-examinations or tests performed. When additional space is nee to fully describe the scope of work, a Form R-4 shall be used and attached.

b) Statement of Need

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

Revise text in this section to address the inconsistent interpretations of item 12 of the R Form. This item will be handled by the same TG handling NB12-1101.

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.

NB-12-2001 NBIC Part 3, 5.13.4.1

12. Provide a 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 (e.g. welding, bonding, plugging) , the specific location on the PRI of the work completed, the steps taken to remove a defect or as allowed by NBIC Part 3, 3.3.4.8 to remain in place, the method of repair or alterations described as listed in the examples of Part 3, Section 3, 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 Form.

NB 12-2101

Toledo Refining Company

May 30, 2012

Shawn Tiedeken
Inspection Superintendent
Toledo Refining Company, LLC
1819 Woodville Road
Oregon, OH 43616

Secretary, NBIC Committee
The National Board of Boiler and Pressure Vessel Inspectors
1055 Crupper Avenue
Columbus, OH 43229
NBICinquiry@nationalboard.org

Re: Revision inquiry to 2011 National Board Inspection Code (NBIC), Part 3, Section 4, Subsection 4.2, Nondestructive Examination

Dear NBIC Committee Secretary,

National Board Inspection Code (NBIC), 2011 edition, Part 3, Section 4, Repairs and Alterations – Examination and Testing, Subsection 4.2 Nondestructive Examination, paragraph (b) states, " 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 Non-destructive Testing Personnel Qualification and Certification (~~2001~~ 2006 edition), or ASNT CP-189, Standard for Qualification and Certification of Nondestructive Testing Personnel (~~2001~~ 2006 edition), shall be used as a guideline for employers to establish their written practice."

It is recommended to revise the "2001 edition" requirements to state "2006 edition" requirements. (See Attachment 1)

This revision is being requested such that there will be consistency between the NBIC required editions of ASNT SNT TC-1A and those specified in the latest versions of ASME Section VIII, ASME Section V, B31.1 codes of construction. The following provides background requirements from the applicable codes of construction. The numbering of each code reference is consistent the attached references.

1. Within the 2010 with 2011 Addenda, ASME Boiler and Pressure Vessel Code, Section VIII, Rules for the Construction of Pressure Vessels, Table U-3, the 2006 edition is specified for both ASNT CP-189 and SNT-TC-1A.
2. In 2010 ed., ASME B31.1, Power Piping, Chapter VI, Inspection, Examination, and Testing, paragraph 136.3.2, NDE personnel are qualified and certified per a developed program consisting of training, on the job training, oral or written examination, vision acuity examination, and documented certification. As an alternative, Section V, ASME Boiler and Pressure Vessel Code, Section V, Article 1 can be used for the qualification of NDE personnel.

Toledo
Refining Company

3. 2010 with 2011 addenda, ASME Boiler and Pressure Vessel Code, Section V, Nondestructive Examination, Subsection A, Nondestructive Methods of Examination, Article 1, General Requirements, Paragraph T-120, General, sub paragraph (e) requires that NDE personnel are qualified and certified per their employer's written practice, which shall be in accordance with one of the following: (1), SNT-TC-1A (footnote 3) Personnel Qualification and Certification in Nondestructive Testing or (2) ANSI/ASNT CP-189 (footnote 3), ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel. Footnote 3 states that the 2006 edition is required for both SNT-TC-1A and ANSI/ASNT CP-189.
4. ASME B31.3, Process Piping Code, Section 342, Examination Personnel, Paragraph 342.1, it states that NDE personnel or "examiners" shall have training and experience commensurate with the needs of the examination type or method. The footnote reference specifies that SNT-TC-1A may be used as a guide to develop the training and respective experience requirements in performing the examination type or method. No year is specified.

In all the referenced code paragraphs, it is clear that the latest versions of the codes applicable to NBIC specify the 2006 edition of SNT-TC-1A and ANSI/ASNTCP-189.

Should there be any question, please do not hesitate to contact the undersigned at (419) 698-7445.

Sincerely,

Shawn J. Tiedeken
Inspection Superintendent
Toledo Refining Company, LLC

Attachment 1

PART 3, SECTION 4
REPAIRS AND ALTERATIONS — EXAMINATION AND TESTING

4.1 SCOPE

This section provides requirements and guidelines for performing examinations and tests for repairs and alterations to pressure-retaining items.

4.2 NONDESTRUCTIVE EXAMINATION

a) The nondestructive examination (NDE) requirements, including technique, extent of coverage, procedures, personnel qualification, and acceptance criteria, shall be in accordance with the original code of construction for the pressure-retaining item. Weld repairs and alterations shall be subjected to the same nondestructive examination requirements as the original welds. Where this is not possible or practicable, alternative NDE methods acceptable to the Inspector and the Jurisdiction where the pressure-retaining item is installed, where required, may be used.

b) NDE personnel shall be qualified and certified in accordance with the requirements of the original code of construction. When this is not possible or practicable, NDE personnel may be qualified and certified in accordance with their employer's written practice. ASNT SNT-TC-1A, *Recommended Practice Nondestructive Testing Personnel Qualification and Certification* (2001 edition), or ASNT CP-189, *Standard for Qualification and Certification of Nondestructive Testing Personnel* (2001 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.

4.3 PRESSURE GAGES, MEASUREMENT, EXAMINATION, AND TEST EQUIPMENT

The calibration of pressure gages, measurement, examination, and test equipment, and documentation of calibration shall be performed, as required, by the applicable standard used for construction.

4.4 EXAMINATION AND TEST FOR REPAIRS AND ALTERATIONS

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

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

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

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

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

Reference 1

(10)
(a)

TABLE U-3
YEAR OF ACCEPTABLE EDITION OF REFERENCED STANDARDS IN THIS DIVISION

Title	Number	Year
Seat Tightness of Pressure Relief Valves	API Std. 527	1991 (R2007)(1)
Unified Inch Screw Threads (UN and UNR Thread Form)	ASME B1.1	Latest edition
Pipe Threads, General Purpose (Inch)	ANSI/ASME B1.20.1	Latest edition
Cast Iron Pipe Flanges and Flanged Fittings, Classes 25, 125, and 250	ASME B16.1	2005
Pipe Flanges and Flanged Fittings	ASME B16.5	2009(2)
Factory-Made Wrought Buttwelding Fittings	ASME B16.9	Latest edition
Forged Fittings, Socket-Welding and Threaded	ASME B16.11	Latest edition
Cast Bronze Threaded Fittings, Classes 125 and 250	ASME B16.15	Latest edition
Metallic Gaskets for Pipe Flanges — Ring-Joint, Spiral-Wound, and Jacketed	ASME B16.20	Latest edition
Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500, and 2500	ASME B16.24	2006
Ductile Iron Pipe Flanges and Flanged Fittings, Class 150 and 300	ASME B16.42	1998 (R2006)
Large Diameter Steel Flanges, NPS 26 Through NPS 60	ASME B16.47	2006
Square and Hex Nuts (Inch Series)	ASME B18.2.2	Latest edition
Welded and Seamless Wrought Steel Pipe	ASME B36.10M	Latest edition
Guidelines for Pressure Boundary Bolted Flange Joint Assembly	ASME PCC-1	2010
Repair of Pressure Equipment and Piping	ASME PCC-2	2008
Pressure Relief Devices	ASME PTC 25	2008
Qualifications for Authorized Inspection	ASME QAI-1	Latest edition (3)
ASNT Central Certification Program	ACCP	Rev 7
ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel	ANSI/ASNT CP-189	2006
Recommended Practice for Personnel Qualification and Certification in Nondestructive Testing	SNT TC 1A	2006
Standard Test Methods for Flash Point by Tag Closed Tester	ASTM D 56	Latest edition
Standard Test Methods for Flash Point by Pensky-Martens Closed Tester	ASTM D 93	Latest edition
Standard Guide for Preparation of Metallographic Specimens	ASTM E 3	2001 (R2007)
Pressure Relieving and Depressuring Systems	ANSI/API Std. 521	5th Ed., January 2007
Reference Photographs for Magnetic Particle Indications on Ferrous Castings	ASTM E 125	1963 (R2008)(1)
Hardness Conversion Tables for Metals	ASTM E 140	Latest edition
Standard Reference Radiographs for Heavy-Walled [2 to 4½-in. (51 to 114-mm)] Steel Castings	ASTM E 186	1998 (R2004)
Method for Conducting Drop-Weight Test to Determine Nil-Ductility Transition Temperature of Ferritic Steels	ASTM E 208	2006
Standard Reference Radiographs for Heavy-Walled (4½ to 12-in. (114 to 305-mm)) Steel Castings	ASTM E 280	2010
Standard Reference Radiographs for Steel Castings up to 2 in. (51 mm) in Thickness	ASTM E 446	2010
Marking and Labeling Systems	ANSI/UL-969	1995

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Reference 2

Chapter VI
Inspection, Examination, and Testing

136 INSPECTION AND EXAMINATION

136.1 Inspection

136.1.1 General. This Code distinguishes between "examination" and "inspection." Inspection is the responsibility of the Owner and may be performed by employees of the Owner or a party authorized by the Owner, except for the inspections required by para. 136.2. Prior to initial operation, a piping installation shall be inspected to ensure compliance with the engineering design and with the material, fabrication, assembly, examination, and test requirements of this Code.

136.1.2 Verification of Compliance. Compliance with the requirements of this Code shall be verified by an Authorized Inspector when a Code stamp is required by Section I of the ASME Boiler and Pressure Vessel Code. The rules of this Code and the quality control system requirements of Appendix A-300 of Section I of the ASME Boiler and Pressure Vessel Code shall apply. The quality control system requirements are shown in Appendix J of this Code. The duty of the Inspector shall be as defined in PG-90, Section I, of the ASME Boiler and Pressure Vessel Code. Data Report Forms are included in the Appendix of ASME Section I for use in developing the necessary inspection records. The Inspector shall assure himself/herself that the piping has been constructed in accordance with the applicable requirements of this Code.

136.1.3 Rights of Inspectors. Inspectors shall have access to any place where work concerned with the piping is being performed. This includes manufacture, fabrication, heat treatment, assembly, erection, examination, and testing of the piping. They shall have the right to audit any examination, to inspect the piping using any appropriate examination method required by the engineering design or this Code, and to review all certifications and records necessary to satisfy the Owner's responsibility as stated in para. 136.1.1.

136.1.4 Qualifications of the Owner's Inspector

(A) The Owner's Inspector shall be designated by the Owner and shall be an employee of the Owner, an employee of an engineering or scientific organization, or of a recognized insurance or inspection company acting as the Owner's agent. The Owner's Inspector shall not represent nor be an employee of the piping manufacturer, fabricator, or erector unless the Owner is also the manufacturer, fabricator, or erector.

(B) The Owner's Inspector shall have not less than 10 years of experience in the design, manufacture, erection, fabrication, or inspection of power piping. Each year of satisfactorily completed work toward an engineering degree recognized by the Accreditation Board for Engineering and Technology shall be considered equivalent to 1 year of experience, up to 5 years total.

(C) In delegating the performance of inspections, the Owner is responsible for determining that a person to whom an inspection function is delegated is qualified to perform that function.

136.2 Inspection and Qualification of Authorized Inspector for Boiler External Piping

136.2.1 Piping for which inspection and stamping is required as determined in accordance with para. 100.1.2(A) shall be inspected during construction and after completion and at the option of the Authorized Inspector at such stages of the work as he/she may designate. For specific requirements see the applicable parts of Section I of the ASME Boiler and Pressure Vessel Code, PG-104 through PG-113. Each manufacturer, fabricator, or assembler is required to arrange for the services of Authorized Inspectors.

136.2.1.1 The inspections required by this Section shall be performed by an Inspector employed by an ASME accredited Authorized Inspection Agency.

136.2.2 Certification by stamping and Data Reports, where required, shall be as per PG-104, PG-105, PG-109, PG-110, PG-111, and PG-112 of Section I of the ASME Boiler and Pressure Vessel Code.

136.3 Examination

136.3.1 General. Examination denotes the functions performed by the manufacturer, fabricator, erector, or a party authorized by the Owner that include nondestructive examinations (NDE), such as visual, radiography, ultrasonic, eddy current, liquid penetrant, and magnetic particle methods. The degree of examination and the acceptance standards beyond the requirements of this Code shall be a matter of prior agreement between the manufacturer, fabricator, or erector and the Owner.

136.3.2 Qualification of NDE Personnel. Personnel who perform nondestructive examination of welds shall be qualified and certified for each examination method in accordance with a program established by the

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Reference 2

employer of the personnel being certified, which shall be based on the following minimum requirements:

(A) instruction in the fundamentals of the nondestructive examination method.

(B) on-the-job training to familiarize the NDE personnel with the appearance and interpretation of indications of weld defects. The length of time for such training shall be sufficient to ensure adequate assimilation of the knowledge required.

(C) an eye examination performed at least once each year to determine optical capability of NDE personnel to perform the required examinations.

(D) upon completion of (A) and (B) above, the NDE personnel shall be given an oral or written examination and performance examination by the employer to determine if the NDE personnel are qualified to perform the required examinations and interpretation of results.

(E) certified NDE personnel whose work has not included performance of a specific examination method for a period of 1 yr or more shall be recertified by successfully completing the examination of (D) above and also passing the visual examination of (C) above. Substantial changes in procedures or equipment shall require recertification of the NDE personnel.

As an alternative to the preceding program, the requirements of the ASME Boiler and Pressure Vessel Code, Section V, Article 1 may be used for the qualification of NDE personnel. Personnel qualified to AWS QC1 may be used for the visual examination of welds.

136.4 Examination Methods of Welds

136.4.1 Nondestructive Examination. Nondestructive examinations shall be performed in accordance with the requirements of this Chapter. The types and extent of mandatory examinations for pressure welds and welds to pressure retaining components are specified in Table 136.4. For welds other than those covered by Table 136.4, only visual examination is required. Welds requiring nondestructive examination shall comply with the applicable acceptance standards for indications as specified in paras. 136.4.2 through 136.4.6. As a guide, the detection capabilities for the examination method are shown in Table 136.4.1. Welds not requiring examination (i.e., RT, UT, MT, or PT) by this Code or the engineering design shall be judged acceptable if they meet the examination requirements of para. 136.4.2 and the pressure test requirements specified in para. 137. NDE for P-Nos. 3, 4, 5A, 5B, and 15E material welds shall be performed after postweld heat treatment unless directed otherwise by engineering design. Required NDE for welds in all other materials may be performed before or after postweld heat treatment.

136.4.2 Visual Examination. Visual examination as defined in para. 100.2 shall be performed in accordance with the methods described in Section V, Article 9, of the ASME Boiler and Pressure Vessel Code. Visual examinations may be conducted, as necessary, during the fabrication and erection of piping components to provide verification that the design and WPS requirements are being met. In addition, visual examination shall be performed to verify that all completed welds in pipe and piping components comply with the acceptance standards specified in (A) below or with the limitations on imperfections specified in the material specification under which the pipe or component was furnished.

(A) Acceptance Standards. The following indications are unacceptable:

(A.1) cracks — external surface.

(A.2) undercut on surface that is greater than $\frac{1}{32}$ in. (1.0 mm) deep.

(A.3) weld reinforcement greater than specified in Table 127.4.2.

(A.4) lack of fusion on surface.

(A.5) incomplete penetration (applies only when inside surface is readily accessible).

(A.6) any other linear indications greater than $\frac{3}{16}$ in. (5.0 mm) long.

(A.7) surface porosity with rounded indications having dimensions greater than $\frac{3}{16}$ in. (5.0 mm) or four or more rounded indications separated by $\frac{1}{16}$ in. (2.0 mm) or less edge to edge in any direction. Rounded indications are indications that are circular or elliptical with their length less than three times their width.

136.4.3 Magnetic Particle Examination. Whenever required by this Chapter (see Table 136.4), magnetic particle examination shall be performed in accordance with the methods of Article 7, Section V, of the ASME Boiler and Pressure Vessel Code.

(A) Evaluation of Indications

(A.1) Mechanical discontinuities at the surface will be indicated by the retention of the examination medium. All indications are not necessarily defects; however, certain metallurgical discontinuities and magnetic permeability variations may produce similar indications that are not relevant to the detection of unacceptable discontinuities.

(A.2) Any indication that is believed to be nonrelevant shall be reexamined to verify whether or not actual defects are present. Surface conditioning may precede the reexamination. Nonrelevant indications that would mask indications of defects are unacceptable.

(A.3) Relevant indications are those that result from unacceptable mechanical discontinuities. Linear indications are those indications in which the length is more than three times the width. Rounded indications are indications that are circular or elliptical with the length less than three times the width.

(A.4) An indication of a discontinuity may be larger than the discontinuity that causes it; however, the size of the indication and not the size of the discontinuity is the basis of acceptance or rejection.

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NB13-0201

Subject: 2007 Edition, Part 3, Supplement 2, S2.13.10.1 – Weld Buildup of Wastage and Grooving in Stayed Areas

File Number: NB13-0201

Prop. Page: 159 & 160

Proposal: Update text to clarify additional requirements, fix 2 typo's and removes a reference that is incorrect.

Explanation This area currently is confusing and can be updated and corrected to fix these issues. There are four issues to address.

1. Remove "welding shall not cover rivet or stay bolt heads" due to redundancy with c)
2. Add the following text at the end of the requirement statement match the others in S2.13.10.2 & S2.13.10.3. "apply with the following additional requirements identified below."
3. Remove typo ";and"
4. Remove d) completely. Figure has no reference to weld buildup. The figure is for Part 3, supplement 2, S2.13.10.3 and is referenced there.

Update text can be found on page 3

Item # 2

"apply with the following additional requirements identified below."

Item # 1

Remove text

S2.13.10.1 WELD BUILDUP OF WASTAGE AND GROOVING IN STAYED AREAS

Requirements specified in NBIC Part 3, S2.13.9.1 shall ~~be followed. Welding shall not cover rivet or staybolt heads.~~

a) Prior to welding the rivets and or staybolts in the wasted areas should be removed.

b) Threaded staybolt holes shall be retapped after welding.

c) Welding shall not cover rivet or staybolt heads; ~~and~~

d) ~~See NBIC Part 3, Figure S2.13.10.3-a.~~

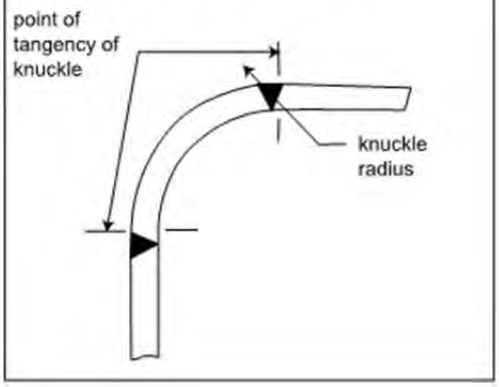
Item # 3

Remove text

Item # 4

Remove text

FIGURE S2.13.10.3-a
Knuckle Point of Tangency



Updated text and Diagram

S2.13.10.1 – Weld Buildup of Wastage and Grooving in Stayed Areas

Requirements specified in NBIC Part 3, S2.13.9.1 shall apply with the following additional requirements identified below.

a) Prior to welding the rivets and or staybolts in the wasted areas should be removed.

b) Threaded staybolt holes shall be retapped after welding.

c) Welding shall not cover rivet or staybolt heads.

NB13-0201

Subject: 2007 Edition, Part 3, Supplement 2, S2.13.10.2 – Weld Repair of Cracks in Stayed Area's

File Number: NB13-0201

Prop. Page: 159

Proposal: Update text to clarify additional requirements, fix 2 typo's and removes a reference that is incorrect.

Explanation This area currently is confusing and can be updated and corrected to fix these issues. There are four issues to address.

1. Remove b) c) and d) due to redundancy with requirements in 2.13.9.2
2. Add a new b) that states "Threaded staybolt holes shall be retapped after welding."

Update text can be found on page 3

Item # 1

Remove text for b) c) & d)

S2.13.10.2 WELDED REPAIR OF CRACKS IN STAYED AREAS

Requirements specified in NBIC Part 3, S2.13.9.2 shall apply with the following additional requirements identified below:

a) If the crack extends into a staybolt hole, the staybolt shall be removed prior to making the repair;

~~b) In riveted joints, tack bolts should be placed in alternating holes to hold the plate laps firmly;~~

~~c) Rivets holes should be reamed after welding; and~~

~~d) Welding shall not cover rivet or staybolt heads.~~

Item #2
Add Text
b) Threaded staybolt holes shall be retapped after welding.

Updated text and Diagram

S2.13.10.2 – Weld Repair of Cracks in Stayed Area's

Requirements specified in NBIC Part 3, S2.13.9.1 shall apply with the following additional requirement identified below.

a) If the crack extends into a staybolt hole, the staybolt shall be removed prior to make the repair.

b) Threaded staybolt holes shall be retapped after welding.

NB13-0201

Subject: 2007 Edition, Part 2, Supplement 2, S2.13.10.4 –Repair of Stayed Firebox Sheets Grooved or Wasted at the Mudring

File Number: NB13-0201

Prop. Page: 161

Proposal: Change the wording in providing more guidance for evaluating local pitting corrosion versus general corrosion.

Explanation: Clarify the 60% minimum required thickness and make the description the same in all area's that figure S.2.13.9.1 reference.

1. Change text in b) to include the area exceeding 3 sq. in. (1,950 sq. mm)." Text would state "For mudrings of the locomotive style (See NBIC Part 3, Figure S2.13.10.4), weld buildup shall not be used if the affected section of plate has wasted below 60% of the minimum required thickness per Part 2, Supplement 2 in an area exceeding 3 sq. in. (1,950 sq. mm). (See NBIC Part 3, Figure S2.13.9.1) Repair by weld buildup cannot be used if the wastage extends below the waterside surface of the mudring or if the strength of the structure will be impaired. If extensive welding is required, the affected area shall be removed and replaced with a flush patch."

2. Change text in c) to state "Wasted sections that have wasted below 60% of the minimum required thickness and have an area exceeding 3 sq. in. (1,950 sq. mm) shall be repaired by installing a flush patch using full penetration welds."

Update text can be found on page 3

Item #1
Update Text

Item #2
Update Text

S2.13.10.4 REPAIR OF STAYED FIREBOX SHEETS GROOVED OR WASTED AT THE MUDRING

a) Mudrings of the Ogee style (knuckle) shall be repaired in accordance with NBIC Part 3, S2.13.11.

b) For Mudrings of the locomotive style (see NBIC Part 3, Figure S2.13.10.4), grooved or wasted firebox sheets having greater than 60% of the minimum required thickness (see NBIC Part 3, Figure S2.13.9.1) remaining may be repaired by weld buildup provided the wastage does not extend below the waterside surface of the mudring and the strength of the structure will not be impaired. If extensive welding is required, the affected area shall be removed and replaced with a flush patch.

c) If the sheet thickness has been reduced to less than 60% of the minimum required thickness, the affected section shall be removed and replaced with a flush patch.

d) If wastage and grooving extends below the mudring waterside surface and if the plate thickness remaining has been reduced to less than the minimum required thickness, the affected section shall be removed and replaced with a flush patch. (See NBIC Part 3, Figure S2.13.10.4).

e) Flush patches shall be arranged to include the mudring rivets and at least the first row of staybolts above the mudring. (See NBIC Part 3, Figure S2.13.10.4-a).

f) For mudrings of the locomotive style, pitted and wasted sections of mudrings may be built up by welding provided the strength of the mudring will not be impaired. Where extensive weld buildup is employed, the Inspector may require an appropriate method of NDE for the repair.

g) Cracked or broken mudrings may be repaired by welding or installing flush patches using full penetration welds. Patches shall be made from material that is at least equal in strength and thickness to the original material. Patches shall fit flush on waterside surfaces. Where necessary, firebox sheets on both sides of the defect may be removed to provide access for inspection and welding.

FIGURE S2.13.10.4
Mudring Wastage Repair

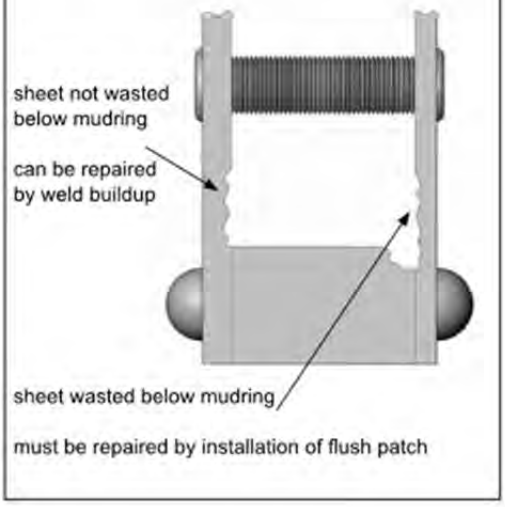
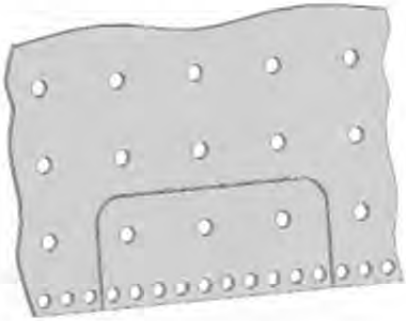


FIGURE S2.13.10.4-a
Mudring Flush Patch



S2.13.10.4 REPAIR OF STAYED FIREBOX SHEETS GROOVED OR WASTED AT THE MUDRING

b) For mudrings of the locomotive style (See NBIC Part 3, Figure S2.13.10.4), weld buildup shall not be used if the affected section of plate has wasted below 60% of the minimum required thickness per Part 2, Supplement 2 in an area exceeding 3 sq. in. (1,950 sq. mm). (See NBIC Part 3, Figure S2.13.9.1) Repair by weld buildup cannot be used if the wastage extends below the waterside surface of the mudring or if the strength of the structure will be impaired. If extensive welding is required, the affected area shall be removed and replaced with a flush patch."

c) Wasted sections that have wasted below 60% of the minimum required thickness and have an area exceeding 3 sq. in. (1,950 sq. mm) shall be repaired by installing a flush patch using full penetration welds.

NB13-0201

Subject: 2007 Edition, Part 3, Supplement 2, S2.13.14.2 – Repair of Handhole Openings

File Number: NB13-0201

Prop. Page: 170 & 171

Proposal: Change the wording in providing more guidance for evaluating local pitting corrosion versus general corrosion.

Explanation: Clarify the 60% minimum required thickness and make the description the same in all area's that figure S.2.13.9.1 reference.

1. Add "in an area exceeding 3 sq. in. (1,950 sq. mm)." to a)
2. Move Text "Weld buildup of wasted areas shall not exceed 100 sq. in. (65,000 sq. mm)." to item d) to match other area's of the NBIC repair section.
3. Add "and have an area exceeding 3 sq. in. (1,950 sq. mm)" to c)

Update text and diagram can be found on page 3

Item #1
Add the text below:

in an area exceeding 3 sq. in. (1,950 sq. mm).

S2.13.14.2 REPAIR OF HANDHOLE OPENINGS

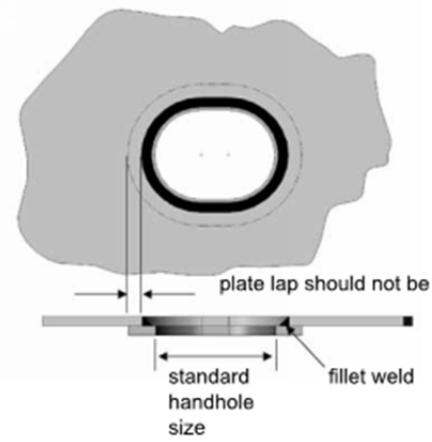
a) Weld buildup shall not be used if the affected section of plate has wasted below 60% of the original thickness per NBIC Part 3, Supplement 2. (See NBIC Part 3, Figure S2.13.9.1.) Weld buildup of wasted areas shall not exceed 100 sq. in. (65,000 sq. mm).

Item #2
Move circle text to new item d)

b) Weld buildup is to replace material that has been lost due to wastage and grooving, and is not to replace thickness on the opposite side of the sheet. Weld buildup must be applied to the side of the sheet that is wasted or grooved.

c) Wasted sections that have wasted below 60% of the minimum required thickness shall be repaired by installing a flush patch using full penetration welds or by the installation of a ring on the inside (pressure side) of the sheet. (See NBIC Part 3, Figure S2.13.14.2).

FIGURE S2.13.14.2
Repair of Handhole Opening



Item #3
Add the text below:

and have an area exceeding 3 sq. in. (1,950 sq. mm).

S2.13.14.2 Repair of Handhole Openings

a) Weld buildup shall not be used if the affected section of plate has wasted below 60% of the minimum required thickness per Part 2, Supplement 2 in an area exceeding 3 sq. in. (1,950 sq. mm). (See NBIC Part 3, Figure S2.13.9.1)

b) Weld buildup is to replace material that has been lost due to wastage and grooving, and is not to replace thickness on the opposite side of the sheet. Weld buildup must be applied to the side of eth sheet that is wasted or grooved.

c) Wasted sections that have wasted below 60% of the minimum required thickness and have an area exceeding 3 sq. in. (1,950 sq. mm), shall be repaired by installing a flush patch using full penetration welds.

d) Weld buildup of wasted areas shall not exceed 100 sq. in. (65,000 sq. mm).

NB13-0201

Subject: 2007 Edition, Part 3, Supplement 2, S2.13.14.2 – Repair of Handhole Openings

File Number: NB13-0201

Prop. Page: 170 & 171

Proposal: Change the wording in providing more guidance for evaluating local pitting corrosion versus general corrosion.

Explanation: Clarify the 60% minimum required thickness and make the description the same in all area's that figure S.2.13.9.1 reference.

1. Add "in an area exceeding 3 sq. in. (1,950 sq. mm)." to a)
2. Move Text "Weld buildup of wasted areas shall not exceed 100 sq. in. (65,000 sq. mm)." to item d) to match other area's of the NBIC repair section.
3. Add "and have an area exceeding 3 sq. in. (1,950 sq. mm)" to c)

Update text and diagram can be found on page 3

Technical Inquiry for NBIC, 2011 Edition, Part 2, Section 2.5.8
Purpose: Requests for Interpretation

Inquirer: Adam M. Renaldo, PE
Address: Praxair, Inc., 175 East Park Dr, Building 1, Rm 110, Tonawanda, NY 14150
Telephone: 716-879-2928
Fax: 866-710-0972
Email: Adam_Renaldo@Praxair.com

Subject: NBIC, 2011 Edition, Part 2, Section 2.5.8

Question 1: The table of suggested inspection and test frequencies in 2.5.8 (f) does not include a column for "Test Frequency." Is the suggested test frequency the same as the suggested inspection frequency?

Proposed Reply: Yes

Question 2: When test records and/or inspection histories are available, can the guidelines in 2.5.8 (g) be used to establish inspection and test frequencies, even if a suggested frequency is given in the table in 2.5.8 (f)?

Proposed Reply: Yes

Question 3: For relief devices on a pressure vessel in clean dry gas service, if testing records are available, and a testing frequency is established in accordance with 2.5.8 (g), may the interval between relief device tests exceed 5 years?

Proposed Reply: Yes

Question 4: For relief devices on a pressure vessel in clean dry gas service, if testing records and inspection histories are available, and a testing frequency is established in accordance with 2.5.8 (g), may the interval between inspections be different than the interval between tests. For example, in clean dry gas service, would it be acceptable if the relief devices were inspected every 2 years, but tested every 6 years?

Proposed Reply: Yes

Question 5: Once an acceptable relief device test interval has been established per 2.5.8 (g), is it acceptable to replace the relief devices with new devices, of the same make and design, at the established test frequency, in lieu of testing the relief devices? For example, in clean dry gas service, would it be acceptable if the relief devices were inspected every 2 years, and replaced every 6 years in lieu of functional testing, with a random sample of replaced devices being bench tested to confirm that the 6-year interval is still acceptable?

Proposed Reply: Yes

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Background:

Excerpt from NBIC, 2011 Edition, Part 2, Section 2.5.8

f) Pressure Vessels and Piping
Frequency of test and inspection of pressure relief devices for pressure vessel and piping service is greatly dependent on the nature of the contents and operation of the system and only general recommendations can be given. Inspection frequency should be based on previous inspection history. If valves are found to be defective or damaged by system contents during inspection, intervals should be shortened until acceptable inspection results are obtained. Where test records and/or inspection history are not available, the following inspection and test frequencies are suggested:

Service	Inspection Frequency
Steam	Annual
Air and Clean Dry Gases	Every three years
Pressure relief valves in combination with rupture disks	Every five years
Propane, Refrigerant	Every five years
All Others	Per inspection history

g) Establishment of Inspection and Test Intervals
Where a recommended test frequency is not listed, the valve user and Inspector must determine and agree on a suitable interval for inspection and test. Some items to be considered in making this determination are:
1) Jurisdictional requirements;
2) Records of test data and inspections from similar processes and similar devices in operation at that facility;
3) Recommendations from the device manufacturer…

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PROPOSED INTERPRETATION

Inquiry No.	IN12-0301 A				
Source	Adam Renaldo				
Subject	Part 2, 2.5.8				
Edition	2011 Edition				
Question	The table of suggested inspection and test frequencies in 2.5.8 (f) does not include a column for "test frequency". Is the suggested test frequency the same as the suggested inspection frequency?				
Reply	Yes				
Committee's Question	The table of suggested inspection and test frequencies in 2.5.8 (f) does not include a column for "test frequency. Does the column heading "Inspection Frequency" include Inspection and Testing"?				
Committee's Reply	Yes				
Rationale	Paragraphs 2.5.8 f) and 2.5.8 g) indicates this information applies to inspection and test frequencies.				
SC Vote	Unanimous X	No. Affirmative	No. Negative	No. Abstain	No. Not Voting
NBIC Vote	Unanimous	No. Affirmative	No. Negative	No. Abstain	No. Not Voting
Negative Vote Comments					

PROPOSED INTERPRETATION

Inquiry No.	IN12-0301 B				
Source	Adam Renaldo				
Subject	Part 2, 2.5.8				
Edition	2011 Edition				
Question	When test records and/or inspection histories are available, can the guidelines in 2.5.8 (g) be used to establish inspection and test frequencies, even if a suggested frequency is given in the table in 2.5.8 (f)?				
Reply	Yes				
Committee's Question	May the guidelines for establishing inspection and test frequencies in 2.5.8 g) be used for establishing the frequencies of inspection and test for fluids in the table in 2.5.8 f)?				
Committee's Reply	Yes				
Rationale	2.5.8 indicates this information is "recommended" therefore the guidelines can be used.				
SC Vote	Unanimous X	No. Affirmative	No. Negative	No. Abstain	No. Not Voting
NBIC Vote	Unanimous	No. Affirmative	No. Negative	No. Abstain	No. Not Voting
Negative Vote Comments					

PROPOSED INTERPRETATION

Inquiry No.	IN12-0301 C				
Source	Adam Renaldo				
Subject	Part 2, 2.5.8 g)				
Edition	2011 Edition				
Question	For relief devices on a pressure vessel in clean dry gas service, if testing records are available, and a testing frequency is established in accordance with 2.5.8 g) may the interval between relief device tests exceed 5 years?				
Reply	Yes				
Committee's Question	See below				
Committee's Reply					
Rationale					
SC Vote	Unanimous X	No. Affirmative	No. Negative	No. Abstain	No. Not Voting
NBIC Vote	Unanimous	No. Affirmative	No. Negative	No. Abstain	No. Not Voting
Negative Vote Comments	Move and seconded to close with no action. Previous IN12-0301B also addresses this item. Committee to advise inquirer. Action passes unanimously.				

PROPOSED INTERPRETATION

Inquiry No.	IN12-0301 D				
Source	Adam Renaldo				
Subject	Part 2, 2.5.8				
Edition	2011 Edition				
Question	Proposed question: For relief devices on a pressure vessel in clean dry gas service, if testing records and inspection histories are available, and a testing frequency is established in accordance with 2.5.8 g), may the interval between inspections be different than the interval between inspections be different than the interval between tests. For example, in clean dry gas service, would it be acceptable if the relief devices were inspected every 2 years, but tested every 6 years?				
Reply	Yes				
Committee's Question					
Committee's Reply					
Rationale					
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	Comment: Questions was withdrawn by the inquirer.				

PROPOSED INTERPRETATION

Inquiry No.	IN12-0301 E				
Source	Adam Renaldo				
Subject	Part 2, 2.5.8				
Edition	2011 Edition				
Question	Proposed question: Once an acceptable relief device test interval has been established per 2.5.8 g) is it acceptable to replace the relief devices with new devices of the same make and design, at the established test frequency, in lieu of testing the relief devices? For example, in clean dry gas service, would it be acceptable if the relief devices were inspected every 2 years, and replaced every 6 years in lieu of functional testing, with a random sample of replaced devices being bench tested to confirm that the 6 year interval is still acceptable?				
Reply	Yes				
Committee's Question	Once an acceptable pressure relief device service interval has been established per 2.5.8 h) is it acceptable to replace the pressure relief devices with a new device at the established service interval in lieu of servicing?				
Committee's Reply	Yes				
Rationale	2.5.8 h)1) permits replacement of PRV's and 2.5.8 h) limits the interval to less than 3 inspection intervals.				
SC Vote	Unanimous	No. Affirmative 6	No. Negative	No. Abstain 2	No. Not Voting
NBIC Vote	Unanimous	No. Affirmative	No. Negative	No. Abstain	No. Not Voting
Negative Vote Comments					

PROPOSED INTERPRETATION

Inquiry No.	IN13-0101				
Source	Alton Cox				
Subject	Part 3, Par. 1.7				
Edition	2011				
Question	May the VR stamp be applied to pressure relief valves bearing the ASME Certification mark with the V, HV, UV, or NV designator?				
Reply	Yes				
Committee's Question	same				
Committee's Reply					
Rationale	The new ASME Certification mark with the appropriate Designator is equivalent to the existing V, UV, HV or NV stamps.				
SC Vote	Unanimous X	No. Affirmative	No. Negative	No. Abstain	No. Not Voting
NBIC Vote	Unanimous	No. Affirmative	No. Negative	No. Abstain	No. Not Voting
Negative Vote Comments					

NB12-1701

NBIC action item request
Joe Ball to: Allen
Cc: "Bruce", obrienc, Robin Hough

02/22/2012 04:46 PM

Dear Mr. Tannis,

By copy of your note below I am forwarding this item to Robin Hough who coordinates the secretarial duties of the NBIC committee with a request that an action item number be assigned to your request below.

However I will also give you my personal comment that it may be difficult for the NBIC Committee to address an item such as this request. The National Board does not have any regulatory enforcement authority over the actions of valve manufacturers for post construction activities. The certificate holders in the National Board VR program are the regulated entities where enforcement actions can be taken. In the new construction area, it may also be difficult to write Code rules to address this kind of topic, because after the valve goes into service, as long as the valve manufacturer has followed their accepted quality program, the effects of environmental or service related problems is not directly a new construction issue that the ASME Code can regulate.

Please note that NBIC Part 2 gives requirements for periodic inspection and testing of in-service pressure relief devices where potential problems would hopefully be uncovered and addressed by valve repair or replacement.

Please call or write with any questions or concerns.

Sincerely,

Joseph F. Ball, P. E.
Director, Pressure Relief Department

National Board Testing Laboratory
7437 Pingue Drive
Worthington OH 43085

National Board Main Phone: 614-888-8320
Direct line phone no.: 614-431-3209
Jball@nationalboard.org
http://www.nationalboard.org
Fax: 614-848-3474

"Allen"

02/20/2012 01:51:50 PM

From:	"Allen" <Allen@nasvi.com>
To:	<jball@nationalboard.org>
Cc:	<obrienc@asme.org>, "Bruce" <Bruce@nasvi.com>
Date:	02/20/2012 01:51 PM
Subject:	FW:

I would like both the VR committee and the ASME SC-SVR to make it mandatory for manufacturers to make it public to all assemblers and VR stamp holders if there is a problem with their valves. Whether it be, and not limited to, recalls and service bulletins.

09, 1/2

PRD

A very large example is attached to this email. It is imperative that everyone in the "safety valve world" know about things like this.

I would like the committees to take this request under advisement and move as quickly as possible before something bad happens.

Sincerely yours,

Allen Tanis
President

North American Safety Valve
1500 Iron Street
North Kansas City, MO 64116

1-800-800-8682 Phone
1-816-421-0297 Fax

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PRD

THE NATIONAL BOARD
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June 30, 2012

Mr. Allen Tannis
North American Safety Valve
1500 iron Street
North Kansas City MO 64116

Dear Mr. Tannis:

The National Board Inspection Code Committee and its Sub Committee on Pressure Relief Devices reviewed your request contained in your e-mail of February 20, 2012 at its meetings during the week of July 16, 2012. The NBIC Committee appreciates your concerns and understands the criticality of the issue. As a group including Manufacturers, Repair stamp holders, Jurisdictions, Insurance, Users and General Interest members, we agree that publicized information of valve problems would be ideal. However, this issue is beyond the scope of the National Board Inspection Code because it concerns organizations not controlled or regulated by the National Board.

Thank you for your concern on this issue.

Sincerely,

Robin Hough
Secretary, NBIC Committee
: rmh