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THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS

NATIONAL BOARD INSPECTION CODE COMMITTEE

MINUTES

Meeting of January 16th, 2020
San Diego, CA

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1. **Call to Order**

The NBIC Main Committee Chair Mr. Bob Wielgoszinski called the meeting to order at 8:05 AM local time. He then gave his appreciation to National Board staff for the work they did throughout the week to keep the meetings running smoothly.
Mr. Wielgoszinski announced the passing of Mr. Don Cook, Mr. Kevin Simmons, and Mr. David Martinez. Each of them served on various NBIC committees for several years. Mr. Wielgoszinski then asked everyone to take a moment of silence in remembrance of Mr. Cook, Mr. Simmons, and Mr. Martinez.

2. **Introduction of Members and Visitors**

Mr. Wielgoszinski asked all who were present to introduce themselves, starting with Main Committee members. During introductions, it was announced that Mr. Matt Sansone and Mr. Wayne Jones would be sitting in for Mr. Rob Troutt and Mr. Paul Welch, respectively. Mr. Michael Richards was the only Main Committee member not present or represented by an alternate.

3. **Check for a Quorum**

After introductions were concluded, Mr. Wielgoszinski announced that 16 committee members were present, which was enough to establish a quorum.

4. **Awards/Special Recognition**

National Board Executive Director Mr. Joel Amato presented Mr. George Galanes with an award pin for 20 years of service on Main Committee.

5. **Announcements**

Mr. Wielgoszinski announced that the meeting will break for lunch at 11:30 AM and resume at 12:30 PM.

6. **Adoption of the Agenda**

Before adopting the agenda, Mr. Wielgoszinski asked if any additions or changes needed to be made.

Ms. Melissa Wadkinson, Chair of Subcommittee Installation, asked to add Mr. Don Patten to the list of subcommittee reappointments, Mr. Milton Washington to the list of new subcommittee appointments, and for items 19-80 and 19-81 to be added to the list of Subcommittee Installation action items. She also announced that Mr. Eddie Wiggins was approved to be Vice Chair of Subcommittee Installation.

Mr. Jim Getter, Chair of Subcommittee Inspection, asked for item 19-93 to be added to the list of Subcommittee Inspection action items.

Mr. Terry Hellman, Secretary of Subcommittee Repairs & Alterations (R&A), asked for items 20-1, 20-2, 20-3 be added to the list of R&A interpretations, and for item 20-4 to be added to the list of R&A action items.

Ms. Marianne Brodeur, Chair of Subcommittee Pressure Relief Devices (PRD), asked for item 19-9 to be added to the list of PRD action items. She also announced that item 19-49 has been transferred from Subcommittee Installation to Subcommittee PRD.

A motion was made, seconded, and approved unanimously to incorporate the changes listed above and adopt the agenda.

7. Approval of the Minutes of the July 17th, 2019 Meeting

The minutes are available for review on the National Board website, www.nationalboard.org.

A motion was made, seconded, and unanimously approved to accept the minutes from the July 2019 meeting.

8. Review of Rosters

The following membership business was handled in an executive session that occurred after all subcommittee and liaison reports were completed.

a. Membership Nominations

Main Committee members:

- Mr. Alfred Donaldson – Manufacturers
- Mr. Thakor Patel – Manufacturers
- Mr. Randy Austin – Users

The Main Committee spent time reviewing the nominees' credentials and participation on their respective subgroups and subcommittees. The committee voted unanimously to approve Mr. Thakor Patel and Mr. Randy Austin for Main Committee membership. They did not vote on Mr. Alfred Donaldson, suggesting that he spend more time gaining experience at the subgroup and subcommittee level. Mr. Patel's and Mr. Austin's membership requires final approval from the Chair of the Board of Trustees.

Subcommittee Members:

- Milton Washington (Jurisdictional Authorities) – Subcommittee Installation
- Mr. Jeff Petersen (Users) – Subcommittee Inspection
- Mr. Vincent Scarcella (AIA) – Subcommittee Inspection
- Mr. Del Schirmer (AIA) – Subcommittee Pressure Relief Devices
- Mr. Jon Wolf (AIA) – Subcommittee Pressure Relief Devices
- Mr. Alfred Donaldson (Manufacturers) – Subcommittee Pressure Relief Devices

The Main Committee voted unanimously to approve the above list of subcommittee appointments. Their memberships require final approval from the Chair of the Board of Trustees.

b. Membership Reappointments

- Mr. Jim Getter – Main Committee
- Mr. Brian Morelock – Main Committee, Subcommittee Repairs & Alterations

- Mr. Venus Newton – Main Committee
- Ms. Melissa Wadkinson – Main Committee
- Mr. Stanley Konopacki – Subcommittee Installation
- Mr. Rex Smith – Subcommittee Installation
- Mr. Eddie Wiggins – Subcommittee Installation
- Mr. Don Patten – Subcommittee Installation
- Mr. Darrell Graf – Subcommittee Inspection
- Mr. Thomas Vandini – Subcommittee Inspection
- Mr. Kim Beise – Subcommittee Pressure Relief Devices
- Mr. David McHugh – Subcommittee Pressure Relief Devices

The Main Committee voted unanimously to approve the above list of Main Committee and Subcommittee reappointments. Their reappointments require final approval from the Chair of the Board of Trustees.

c. Officer Positions

Mr. Eddie Wiggins was unanimously approved by Subcommittee Installation to become the subcommittee's new Vice Chair. His appointment to the position requires final approval from the Chair of the Board of Trustees.

9. Items Approved for 2021 NBIC

a. Part 1

i. NB12-0302 – new supplement for PVHO installation
ii. Item NB15-0108A – new supplement in Part 1 for High-Temperature Water Boilers
iii. Item 17-121 – changes to installation and discharge requirements for pressure relief valves (Part 1, 2.9.6)
iv. Item 17-125 – changes to inlet opening diameter requirements for steam heating boiler pressure relief valves (Part 1, 3.9.2)
v. Item 17-130 – simplified definition of where pressure relief devices will discharge pressure (Part 1, 4.5.6)
vi. Item 17-159 – hot water storage tanks (Part 1, 4.7)
vii. Item 18-26 – installation requirements for CO2 vessels (Part 1, S3.4)
viii. Item 18-44 – making modular limits in Part 1, 3.7.8.1 a) consistent with ASME Section IV
ix. Item 19-51 – safety valve requirements for boilers up to 4000 lb/hr (Part 1, 2.9.1.1)

b. Part 2

i. Item 18-27 – requirements for CO2 vessels (Part 2, S12.5)
ii. Items 18-61 and 18-101 – additional inspection requirements for PVHOs (Part 2, 2.3.6.8)
iii. Item 18-79 – changing should to shall in Part 2, S12.3 b) 4), S12.5, and S12.7
iv. Item 18-89 – correcting the text in Part 2, S2.4 to reference Part 2, Section 3 instead of Part 3, Section 3
v. Item 19-30 – Temporary ASME nameplate removal for inspection (Part 2, S7.9)
vi. Item 19-33 – changes to Part 2, 1.1
vii. Item 19-65 – Changes to Yankee Dryer supplement (Part 2, S5.2.3)

c. Part 3

i. Item 17-166 – reducing maximum nozzle diameter for nozzle replacement routine repairs in graphite pressure vessels (Part 3, S3.3)

ii. Item 18-12 – revision to welding method 6 to allow for external weld metal buildup (Part 3, 2.5.3.6)
iii. Item 18-67 – new definitions for brazing, fusing, and welding (All Parts, 9.1)
iv. Item 18-83 – clarifying when an increase in the heating surface or steaming capacity is considered an alteration (Part 3, 3.4.4 e))
v. Item 18-84 – use of patch bolts in accordance with ASME BPVC (Part 3, S1.2.8)
vi. Item 18-85 – SWPS updates (Part 3, Table 2.3)
vii. Item 18-88 – correcting the reference in S2.6 a) from "NBIC Part 3, 1.6" to "NBIC Part 3, 1.5"
viii. Item 18-95 – Revision to Part 3, S1.1.4 to account for new rules for riveted construction
ix. Item 18-98 – updated definition for replacement parts in S2.7.2 that refers back to Part 3, 3.2.2
x. Item 19-12 – revisions to clarify Quality Assurance Program (Part 3, 1.6.3 b))
xi. Item 19-13 – revise Part 3, 1.6.6.2, 1.6.7.2, and 1.6.8.2 to clarify responsibilities for performing audits
xii. Item 19-15 – ASME Section VIII Div. 2 Class 1/Class 2 distinction (Part 3, 3.3.5.2 and 3.4.5.1)
xiii. Item 19-21 – additional wording about alterations in Part 3, S2.11 a)
xiv. Item 19-24 - slight wording change in Part 3, S6.16.4 b) 1)
xv. Item 19-43 – updating ISO/IEC-17025 references in Part 3, 1.6.6.2 m), 1.6.7.2 m), and 1.6.8.2 m)
xvi. Item 19-50 – revising Part 3, 3.3.4.3 e) 3) l. to match ASME PCC-2
xvii. Item 19-52 – alternative NDE requirements (Part 3, 4.2 a))
xviii. Item 19-53 – historical boiler record retention (Part 3, S2.12)

d. Part 4

i. Item NB17-1401 – requirements to remove shipping caps/plugs from pressure relief devices prior to installation (Part 4, S4.4 b) 2))
ii. Item 17-121 – changes to installation and discharge requirements for pressure relief valves (Part 4, 2.2.10)
iii. Item 17-125 – changes to inlet opening diameter requirements for steam heating boiler pressure relief valves (Part 4, 2.4.2)
iv. Item 17-130 – simplified definition of where pressure relief devices will discharge pressure (Part 4, 2.5.6 f))
v. Item 17-131 – adding language about potable hot water storage tanks (Part 4, 2.5.7)

10. Report of Subcommittees

a. Subcommittee Repairs & Alterations

i. Interpretations

Item Number: 19-5	**NBIC Location: Part 3, 3.2.6**	**Attachment Page 1**

General Description: Reference to Other Codes and Standards

Subgroup: Repairs and Alterations

Task Group: B. Morelock (PM)

Explanation of Need: Repair Methodology proposed by user is rejected by AI as there are no codes, standards, and practices available to support repair method.

January Meeting Action: Mr. Brian Morelock presented a proposal for the item, along with negative comments from a previous Main Committee letter ballot. Discussion was held on the revisions made to the proposal to address the ballot comments. After discussion, a motion was made, seconded, and unanimously approved to accept the proposed interpretation.

Item Number: 19-10	**NBIC Location: Part 3, 8.1**	**Attachment Page 4**

General Description: Allow interpretations to be used in any edition, provide the same wording

Subgroup: Repairs and Alterations
Task Group: K. Moore (PM)

Explanation of Need: NBIC currently limits each interpretation to the edition it was issued for. However often time the words in question do not change from one edition to another. At present a new interpretation would be needed for each edition of the NBIC to address the same issues, this is a delay to field work and a drain on NBIC committee time.

January Meeting Action: Ms. Kathy Moore presented the proposal for this item, and announced that the proposed interpretation would apply to Part 3, 8.1 instead of the introduction. A motion was made and seconded to approve the proposed interpretation as presented. The motion was approved unanimously.

Item Number: 19-25	**NBIC Location: Part 3, 4.4.2 c)**	**Attachment Page 6**

General Description: NDE methods to do in lieu of Hydro test

Subgroup: Repairs and Alterations
Task Group: J. Siefert (PM)

Explanation of Need: For ASME BPV Section VIII Division 2 Vessel is under Alteration with Re-rate of lowering MAWP & increasing of Design Temperature & there is no physical alteration in the Vessel but only change is in the Alteration design report because of different design stress intensity value at higher design temperature.

January Meeting Action: Mr. George Galanes presented the proposal for this item. A motion was made and seconded to approve the proposed interpretation. Mr. Wielgoszinski asked why the question was expanded to include Div. 3 pressure vessels; Mr. Galanes replied that it was done to address potential future questions about Div. 3 vessels. After discussion, the motion to accept the proposed interpretation was approved unanimously.

Item Number: 19-26	NBIC Location: Part 3, 3.3.2	Attachment Page 11

General Description: Clarification on welding repairs on appendages

Subgroup: Repairs and Alterations
Task Group: P. Shanks (PM)

Explanation of Need: The original submitter of this item will sometimes need to perform a welding repair on an appendage (not on the tank itself) in order for the complete process of refurbishment to be done for their customers' expectations. There appears to be no direct reference to these types of minor welding repairs for the refurbishment process in the NBIC code.

January Meeting Action: Mr. Paul Shanks presented and explained the proposal for this item, an also discussed negative votes from the Subcommittee R&A meeting earlier in the week. After the proposal was presented, a motion was made and seconded to approve the proposed interpretation as presented. Mr. Wielgoszinski asked for those who submitted negative votes at the Subcommittee R&A meeting to elaborate on their reasons. Ms. Patricia Becker spoke on having the wording specify welding on non-pressure to non-pressure parts toad further clarification. Mr. Marty Toth agreed with this wording. Mr. Wayne Jones was okay with the wording as presented. Further discussion was held on if the proposed interpretation should apply to Part 3, section 3.3.2, section 1.4, or the introduction. Mr. Gary Scribner suggested the reply be altered to say that the questions are beyond the scope of the code, and Mr. Pat Jennings suggested changing the reference to section 1.1 (Scope) since the questions are related to the scope of the NBIC. The original motion was withdrawn and the task group will continue work on the proposal to address these comments.

Item Number: 19-34	NBIC Location: Part 3, 3.2.2 e)	Attachment Page 13

General Description: Is it the intent of Part 3, 3.2.2 e) that the reference to the original code of construction is for determining the hydrostatic test pressure?

Subgroup: Repairs and Alterations

Task Group: P. Edwards – PM

Explanation of Need: NBIC Part 3 Section 3 paragraph 3.2.2 e) (shown below) states that replacement parts shall receive a pressure test as required by the original code of construction. The original submitter is concerned that this clause is not being interpreted consistently by all users of the NBIC. The words in question are "…as required by the original code of construction." ASME issued interpretation I-16-1 (shown below) and revised PW-54 to clarify that Section I does not contain requirements for the hydrostatic testing of replacement parts provided for an existing unit. Based on this, the words "… as required by the original code of construction." Could be interpreted to mean that pressure testing of the parts is not required because Section I does not require testing of replacement parts. The submitter does not think that was the Committee's intent when clause e) was added to 3.2.2. Linking the words "original code of construction" to the test pressure would eliminate the potential interpretation that testing is only required when the original code of construction specifically requires testing of replacement parts.

January Meeting Action: Mr. Paul Edwards presented and explained the proposal for this item. This item is an intent interpretation for action item 19-59. Mr. Wielgoszinski suggested the Committee address item 19-59 first since this interpretation relies on item 19-59 being approved for the next NBIC edition. Mr, Edwards explained the changes being made by the proposal for item 19-59. A motion was made and seconded to approve this proposal for item 19-59. This motion passed unanimously. The Committee then returned to the proposal for item 19-34. A motion was made and seconded to approve the proposed intent interpretation. The motion passed unanimously.

Item Number: 19-36	NBIC Location: Part 3, 3.3.2 & 3.3.5	Attachment Page 17

General Description: Routine Repairs of VIII Div 2 and Div 3 PV

Subgroup: Repairs and Alterations

Task Group: J. Pillow (PM)

Explanation of Need: Para 3.3.2 talks about requirements for and examples of routine repairs. It does not specify any restrictions on pressure retaining items construction Code. It states that Routine repairs are repairs for which the requirements for in-process involvement by the Inspector and stamping by the "R" Certificate Holder may be waived as determined appropriate by the Jurisdiction and the Inspector. It states that all other applicable requirements of this code (NBIC) shall be met. Para 3.3.5.1 of NBIC states that the following requirements shall apply for the repair of pressure vessels constructed to the requirements of Section VIII, Division 2 or 3, of the ASME Code. This calls for properly Certified repair plan to be submitted to the Inspector who will make acceptance inspection and sign R-1 Form.

January Meeting Action: Mr. Edwards explained the proposal for this item and the negative votes from a previous Main Committee letter ballot. He announced the no changes were made to the proposal as a result of the comments from the ballot. A motion was made and seconded to approve the proposal as presented. This motion passed unanimously.

Item Number: 19-42	NBIC Location: Part 3, 3.3.3 s) & 3.4.4 g)	Attachment Page 20

General Description: 3.3.3 s design intent clarification vs 3.4.3 g

Subgroup: Repairs and Alterations

Task Group: P. Shanks (PM)

Explanation of Need: The design requirement in 3.3.3 s) is not well defined and is allowing potentially unsafe material changes to be conducted as repairs without adequate assessment.

January Meeting Action: Mr. Shanks made a motion to close the item with no action, which was seconded by a Committee member. Mr. Shanks explained that he was the original inquirer and that he wanted to withdraw his question. The motion to close the item with no action was approved unanimously.

ii. New Interpretation Requests:

Item Number: 19-62	NBIC Location: Part 3, 2.5.3.6	Attachment Page 21

General Description: Interpretation for using NBIC Part 3, 2.5.3.6 Welding Method 6 on Grade 92

Subgroup: Repairs and Alterations

Task Group: J. Siefert (PM)

Explanation of Need: End-users are experience failures in SA-213 T92 Code Case 2179 material and would like the option to invoke Welding Method 6 for repairs internal to the boiler setting.

January Meeting Action: Mr. Galanes presented the proposal for this item and gave background information. A motion was made and seconded to approve as presented. Mr. Wielgoszinski asked for clarification on the paragraph reference for this interpretation, and Mr. Galanes confirmed the original reference. Mr. Wielgoszinski asked that a few clarifying changes be made to the proposal (spelling out CSEF and specifying ASME code cases). The proposed changes were accepted by the motioner and the updated proposal was approved unanimously.

Item Number: 19-66	NBIC Location: Part 3, 3.4	Attachment Page 22

General Description: Shell Side Heat Exchanger PWHT

Subgroup: Repairs and Alterations

Task Group: K. Moore (PM)

Explanation of Need: An R Certificate Holder is Doing Repair Work on the Shell Side of Heat Exchanger, which was not PWHT Earlier. As per Client Request, Welded Joints are Post weld Heat Treated and Consider as Alteration, Client wants Shell Side to Under Go Full Post weld Heat Treatment Including areas not repaired. NDE is being Carried out for Complete Equipment and Client wants PWHT for Welds which are in Services and without any repairs.

January Meeting Action: Ms. Moore presented the proposal for this item and provided background information. She explained that this item can be addressed by interpretation 13-06. A motion was made and seconded to have the NBIC Secretary send interpretation 13-06 to inquirer to see if it answers their question and to close item 19-66. This motion was approved unanimously.

Item Number: 19-67	NBIC Location: Part 3, 3.4	Attachment Page 23

General Description: Clarification of Part 3, 1.5.1 d) 1)

Subgroup: Repairs and Alterations

Task Group: K. Moore (PM)

Explanation of Need: The original submitter interprets the above statement to mean a stamp holder must do repairs or alterations to the NBIC. Clarification is requested as the statement "as applicable" is ambiguous.

January Meeting Action: Ms. Moore presented the proposal for this item. A motion was made and seconded to approve the proposal as presented. Some discussion was held on question 1 about “R” Certificate Holders making repairs without using the NBIC. After discussion was concluded, a vote was taken and the motion was approved unanimously.

Item Number: 19-86	NBIC Location: Part 3, 2.2 & 2.2.1	Attachment Page 25

General Description: National Certified Pipe Welding Bureau (NCPWB) welding procedure specs

Subgroup: Repairs and Alterations
Task Group: K. Moore (PM)

Explanation of Need: Some ASME and National Board Certificate Holders have presented NCPWB procedures to Team Leaders (designees) at joint reviews as part of their welding demonstrations, and those companies may not understand the limited scope in which the procedures may be used.

January Meeting Action: Ms. Moore presented the proposal for this item. A motion was made and seconded to approve the proposal as presented. The motion was approved unanimously.

Item Number: 19-87	NBIC Location: Part 3, 5.6	Attachment Page 27

General Description: Form Registration Log

Subgroup: Repairs and Alterations
Task Group: Tim McBee (PM), Robert Underwood

Explanation of Need: Many "R" Certificate Holders now use the National Board EDT System to register "R" Forms. All of the required log information in paragraph 5.6 of Part 3 is available in EDT, therefore it is unnecessary and redundant for "R" Certificate Holders to maintain a separate log outside the EDT system.

January Meeting Action: Mr. Tim McBee presented the proposal for this item. After the proposal was presented, a motion was made and seconded to approve it. Mr. Wielgoszinski asked if there was a revision item associated with this interpretation that should be addressed first. Mr. Bob Underwood confirmed that there was an associated code revision item, 19-91. Mr. Underwood explained the proposal for item 19-91. The motion to approve item 19-87 was tabled to take a motion and second to approve item 19-91. The proposal for item 19-91 was approved unanimously. The motion and second to approve 19-87 was brought back for a vote, and it passed unanimously.

Item Number: 20-1	NBIC Location: Part 3, 3.3.2	Attachment Page 28

General Description: ASME B31.3 Normal Fluid Service and Severe Cyclic have mandatory requirements for radiography.

Subgroup: Repairs and Alterations

Task Group: G. Galanes (PM)

Explanation of Need:
Q1 - Are “Routine Repairs” permitted for ASME B31.3 Normal Fluid Service and Severe Cyclic piping?
Proposed Answer: No
Q2 - Are “Routine Repairs” permitted for ASME B31.3 Category D Service piping?
Proposed Answer: Yes

January Meeting Action: Mr. Galanes presented the proposal for this item. A motion was made and seconded to approve the proposal as presented. Discussion was held to clarify the reasoning for the committee question and reply. After discussion, the motion was approved unanimously.

Item Number: 20-2	NBIC Location: Part 3, Table 2.3	Attachment Page 30

General Description: Use of 2018 AWS SWPS's in accordance with the 2019 NBIC

Subgroup: Repairs and Alterations

Task Group: J. Sekely (PM)

Explanation of Need: Since Item 18-102 (updating the SWPS Table 2.3 in Part 3 to the current 2018 AWS standards) was not passed by MC until after the 2019 NBIC was published, a number of SWPS's as listed in the 2019 Edition of the NBIC, Table 2.3 are not current. This Interpretation would allow Certificate Holders to utilize the 2018 SWPS's that have been approved for the 2021 Edition of the NBIC.

January Meeting Action: Mr. Jim Sekely presented the proposal for this item. A motion was made, seconded, and unanimously approved to accept the proposed interpretation.

Item Number: 20-3	NBIC Location: Part 3, Section 3 & 4	Attachment Page 32

General Description: Inspector involvement in Fitness-for Service assessments

Subgroup: Repairs and Alterations

Task Group: J. Siefert (PM), N. Carter

Explanation of Need: Which Inspector (i.e. "IS" Commissioned or "R" Endorsement) signs the FFSA Form NB-403 when an "R" Certificate Holder is involved with a repair in that region as well as determine what level of review of the Fitness-for-Service the Inspector is expected to complete?

January Meeting Action: Mr. Nathan Carter presented a progress report for this item.

iii. Action Items – Old Business

Item Number: NB15-1405	NBIC Location: Part 3, 1.2	Attachment Page 33

General Description: Impact testing of P-11B Material

Subgroup: Repairs and Alterations
Task Group: N. Carter (PM), P. Davis, G. Galanes, P. Shanks

January Meeting Action: Mr. Carter provided background on the item and shared progress on the proposal.

Item Number: NB15-2208	NBIC Location: Part 3	No Attachment

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

Subgroup: Graphite
Task Group: Greg Becherer (PM)

January Meeting Action: There was not a member from the Graphite Task Group present to report on this item.

Item Number: NB16-1403	NBIC Location: Part 3, S4	Attachment Page 35-38

General Description: Add information on repair of high pressure vessels.

Subgroup: FRP

Task Group: N. Newhouse (PM)

January Meeting Action: There was not a member from the FPR Task Group present to report on this item.

Item Number: NB16-1502	NBIC Location: Part 3	No Attachment

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

Subgroup: SG Repairs and Alterations

Task Group: International Repair Supplement Task Group, Chuck Withers (PM)

January Meeting Action: A motion was made, seconded, and unanimously approved to close this item with no action, as no work has been done on this item for some time.

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

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

Subgroup: Repairs and Alterations

Task Group: P. Shanks (PM), Rob Troutt, Joel Amato, Kathy Moore, Paul Edwards

January Meeting Action: Work continues on a proposal for this item.

Item Number: 17-137	NBIC Location: Part 3, S4.18.2	Attachment Page 39

General Description: Remove "sand" blasting and replace with "abrasive" in Part 3, S4.18.2

Subgroup: FRP

Task Group: Terry Cowley (PM)

January Meeting Action: Mr. Sansone reported that this item would be balloted to Subcommittee R&A between this meeting and the July meeting.

Item Number: 17-167	NBIC Location: Part 3, S3.2 d)	No Attachment

General Description: Clarify repair inspection requirements for machined only graphite parts.

Subgroup: Graphite

Task Group: Aaron Viet (PM)

January Meeting Action: There was not a member from the Graphite Task Group present to report on this item.

Item Number: 18-13	NBIC Location: Part 3	Attachment Page 42

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

Subgroup: SG Repairs and Alterations

Task Group: John Siefert (PM), George Galanes

January Meeting Action: Mr. Galanes provided some information on the proposal for this item and requested that it be sent out to the Main Committee for letter ballot. The NBIC Secretary will send the proposal out for ballot between this meeting and the July meeting.

Item Number: 18-65	NBIC Location: Part 3, Section 3	Attachment Page 139

General Description: Draft rules for "used" material in repairs and/or alterations.

Subgroup: SG Repairs and Alterations

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

January Meeting Action: Mr. Jamie Walker presented a proposal for this item. A motion was made and seconded to approve the proposal as presented. Mr. Wielgoszinski recommended that the item be sent out for letter ballot so that the Committee would have more time to review the proposal. The original motion was withdrawn, and the NBIC Secretary will send out the proposal for letter ballot after the meeting.

Item Number: 18-66	NBIC Location: Part 3, Section 5	Attachment Page 46

General Description: Move Report Forms to a new Supplement.

Subgroup: SG Repairs and Alterations

Task Group: Marty Toth – PM, Ben Schaefer

January Meeting Action: Mr. Ben Schaefer presented the proposal and announced it will be going to Subgroup and Subcommittee R&A letter ballot. It was also requested that the proposal be sent to Main Committee as a Review and Comment ballot.

Item Number: 18-75	NBIC Location: Part 3	Attachment Page 117

General Description: Flush patches in stayed and un-stayed areas of tubesheets

Subgroup: SG Repairs and Alterations

Task Group: Michael Quisenberry (PM), Kathy Moore, Marty Toth, Rick Sturm

January Meeting Action: Mr. Michael Quisenberry presented a new proposal that addressed Main Committee letter ballot comments. A motion was made and seconded to approve the proposal as presented. Mr. Venus Newton asked if wording should be changed to include all defective material; Mr. Galanes commented that doing so would open up the text to be interpreted to include things outside the flush patches. After discussion concluded. A vote was held, and the original motion was approved unanimously.

Item Number: 18-93	NBIC Location: Part 3, S3.2, S3.4 4.4.2 6)	No Attachment

General Description: Test Duration

Subgroup: Graphite

Task Group: J. Clements (PM)

January Meeting Action: Mr. Sansone announced that both the Graphite Task Group and Subcommittee R&A voted to close the item with no action. A motion was made, seconded, and unanimously approved to officially close the item.

Item Number: 18-94	NBIC Location: Part 3, S3.2 f), h); S3.4 a), b), c) etc.	No Attachment

General Description: G-mark Requirements for Various Repairs/Alteration to Graphite

Subgroup: Graphite

Task Group: C. Cary (PM)

January Meeting Action: There was not a member from the Graphite Task Group present to report on this item.

Item Number: 18-95	NBIC Location: Part 3, S1.1.4	Attachment Page 119

General Description: Revision to Part 3, S1.1.4 to account for new rules for riveted construction

Subgroup: Locomotive

Task Group: (L. Moedinger – PM)

January Meeting Action: Mr. Linn Moedinger presented a proposal for the item. A motion was made and seconded to approve the proposal as presented. Mr. Wielgoszinski asked if there was any value in keeping the third sentence in paragraph a) since the new paragraph points them to a new code. Mr. Moedinger answered that the sentence is there for information purposes and would not cause much confusion. After discussion, the Committee voted unanimously to approve the proposal.

Item Number: 18-100	NBIC Location: Part 3, 3.3.2	Attachment Page 120

General Description: Revision adding heat exchanger tubes with an outside diameter of ¾" or smaller to NBIC Part 3.3.2 Routine Repairs

Subgroup: Repairs and Alterations

Task Group: (Marty Toth – PM), B. Schaefer, N. Carter

January Meeting Action: Mr. Ben Schaefer announced that the task group is still working on a new proposal for the item.

Item Number: 19-11	NBIC Location: Part 3, 9.1	Attachment Page 124

General Description: Clarify Definition of Authorized Nuclear Inspection Agency (ANIA)

Subgroup: Repairs and Alterations
Task Group: P. Edwards (PM)

Explanation of Need: An ANIA cannot be an Inservice AIA since Endorsements for nuclear inspectors are issued only to new construction AIA's. The requirements for qualified Authorized Nuclear Inspectors/Supervisors are clearly specified in NB-263, RCI-1. Therefore revision to the Glossary definition is needed to clarify this requirement for the NR Accreditation Program.

January Meeting Action: Mr. Edwards introduced a proposal that addressed comments from a previous Main Committee letter ballot. He also announced that a new action item has been opened to address the glossary definition of ANIA (item 20-15). A motion was made, seconded, and unanimously approved to accept the presented proposal.

Item Number: 19-16	NBIC Location: Part 3, 3.3.2 e)	No Attachment

General Description: Reword to provide clarity; contradictory requirement Part 3; 3.2.2 e)

Subgroup: Repairs and Alterations

Task Group: T. White (PM)

January Meeting Action: Mr. Terry Hellman shared that a letter to the inquirer will be sent to see if item 19-59 satisfies his concern.

Item Number: 19-19	NBIC Location: Part 3, S4.2	Attachment Page 129

General Description: Reword to provide clarity; contradictory requirement Part 3; 3.2.2 e)

Subgroup: FRP

Task Group: None assigned

Explanation of Need: The current use of the term "inspector" in S4.2 does not mean a Commissioned Inspector as defined in Section 9. Clarification is needed.

January Meeting Action: This item was approved via letter ballot on January 12, 2020.

Item Number: 19-27	NBIC Location: Part 3, S2.13.14.3-a	Attachment Page 131

General Description: Fusible Plug Repair Using Half Coupling Figure

Subgroup: SG Historical

Task Group: R. Underwood - PM

January Meeting Action: Mr. Underwood presented an updated proposal that addressed comments from a Main Committee letter ballot. A motion was made, seconded, and unanimously approved to accept the new proposal.

Item Number: 19-55	NBIC Location: Part 3, 4.4.2 a) 1)	Attachment Page 132

General Description: Change the maximum test pressure requirement when performing liquid pressure tests of repair activities.

Subgroup: Repairs and Alterations

Task Group: Robert Underwood – PM

Explanation of Need: To change the maximum test pressure requirement when performing liquid pressure tests of repair and alteration activities. This proposal was initially part of item NB16-2603, which proposed changes to 4.4.1 a) 1) and 4.4.2 a) 1). However, only the changes to 4.4.1 a) 1) made it into the 2019 NBIC.

January Meeting Action: This item was approved via letter ballot on January 12, 2020.

iv. New Items:

Item Number: 19-59	NBIC Location: Part 3, 3.2.2 e)	Attachment Page 134

General Description: Pressure Tests for Replacement Parts

Subgroup: Repairs and Alterations

Task Group: Paul Edwards – PM

Explanation of Need: ASME has issued interpretation I-16-1 and revised PW-54 to clarify that Section I does not contain requirements for the hydrostatic testing of replacement parts. Based on this, the language in 3-3.2.2 e) "… as required by the original code of construction" could be interpreted to mean that pressure testing of parts is not required because Section I does not require testing of replacement parts. On review, this was not the Committee's intent when clause e) was added to 3.2.2. The proposed intent interpretation and a supporting text revision is provided to clarify this issue. By linking the words "original code of construction" to the test pressure, it eliminates the potential interpretation that testing is only required when the original code of construction specifically requires testing of replacement parts.

January Meeting Action: This item was voted on and unanimously approved during discussion of item 19-34.

Item Number: 19-60	NBIC Location: Part 3, 1.5.1	Attachment Page 138

General Description: Quality System For Qualification For The National Board "R" Certificate

Subgroup: Repairs and Alterations

Task Group: R. Miletti (PM), K. Moore, B. Boseo, M. Toth

Explanation of Need: Part 3, 1.5.1 provides a good outline for a Quality Systems Manual. However, the remaining elements of a Quality System, outside of the one's currently being addressed in Item 19-47 and 19-4 need to be embellished to provide a more auditable description of each element.

January Meeting Action: Work continues on the proposal for this item.

Item Number: 19-61	NBIC Location: Part 3, 3.3.4	No Attachment

General Description: Quality System For Qualification For The National Board "R" Certificate

Subgroup: Repairs and Alterations

Task Group: P. Shanks (PM), N. Carter, J. Walker, T. McBee

Explanation of Need: Threaded insert are being used to fix a bolt that has broken off on certain types of boilers (autoclaves) which hold the heating elements in the water side of the boiler. When this happens, the technician correcting the problem will simply drill out the broken bolt with an over sized bit and inset a metallic insert. NBIC does address this this type of alteration.

January Meeting Action: Work continues on the proposal for this item.

Item Number: 19-68	NBIC Location: Part 3, 1.6	No Attachment

General Description: Quality System For Qualification For The National Board "R" Certificate

Subgroup: Repairs and Alterations

Task Group: B. Wielgoszinski

Explanation of Need: Review of 1.6 for possible requirement for ANI's and ANII's to hold the (R) Endorsement for "NR" activities.

January Meeting Action: Work continues on the proposal for this item.

Item Number: 19-69	NBIC Location: Part 3, 5.12.5.1 8) & 5.12.5.1 11)	Attachment Page 141

General Description: Review verbiage in Part 3, 5.12.5.1 8) and 5.12.5.1.11)

Subgroup: Repairs and Alterations

Task Group: Ben Schaefer - PM

Explanation of Need: Review verbiage in Part 3, 5.12.5.1 8) and 5.12.5.1.11) to include "Code Case" and "Code Edition" within the text.

January Meeting Action: Mr. Schaefer presented a proposal for the item. A motion was made, seconded, and unanimously approved to accept the proposal for this item.

Item Number: 19-73	NBIC Location: Part 3, S3	No Attachment

General Description: Requirements for who can make hole plugging repairs on graphite blocks

Subgroup: Graphite
Task Group: C. Cary (PM), A. Viet, A. Stupica

Explanation of Need: Performing hole plugging repairs in graphite blocks is a common repair for graphite pressure vessels, but the NBIC currently has no formal requirements for this type of repair.

January Meeting Action: There was not a member from the Graphite Task Group present to report on this item.

Item Number: 19-74	NBIC Location: Part 3, S3.3	No Attachment

General Description: Routine repair requirements for partial nozzle replacement

Subgroup: Graphite
Task Group: A. Stupica (PM), M. Bost

Explanation of Need: Currently only nozzle replacement is addressed as a routine repair. The group is planning on defining the types of partial nozzle replacements and repairs that could be defined as routine.

January Meeting Action: There was not a member from the Graphite Task Group present to report on this item.

Item Number: 19-82	NBIC Location: Part 3, 1.5.1 j)	Attachment Page 143

General Description: Review verbiage in Part 3, 5.12.5.1 8) and 5.12.5.1.11)

Subgroup: Repairs and Alterations

Task Group: None assigned.

Explanation of Need: Safety is not addressed in Part 3. This verbiage could be added to the 1.5.1 j) Method of Performing Work paragraph so Certificate Holders can address the safety concerns specific to their scope of activities.

January Meeting Action: Work continues on the proposal for this item.

Item Number: 19-91	NBIC Location: Part 3, 5.6	Attachment Page 144

General Description: Form Registration Log

Subgroup: Repairs and Alterations
Task Group: None assigned.

Explanation of Need: Many "R" Certificate Holders now register R Forms in the National Board Electronic Data Transfer (EDT) System. The EDT system contains all of the required log information listed in paragraph 5.6 of Part 3, which makes it unnecessary and redundant for the "R" Cert. Holder to maintain a separate log.

January Meeting Action: This item was voted on and unanimously approved during discussion of item 19-87.

Item Number: 19-92	NBIC Location: Part 3, 1.5.1 j)	Attachment Page 146

General Description: Adding "Document Designation" as the second column title in Table 2.3

Subgroup: Repairs and Alterations

Task Group: Jim Sekely – PM

Explanation of Need: This change is being requested so that NBIC matches the naming used by AWS.

January Meeting Action: Mr. Sekely presented a proposal for the item. A motion was made, seconded, and unanimously approved to accept the proposal as presented.

Item Number: 20-4	NBIC Location: Part 3, Table 2.3	Attachment Page 148

General Description: Update NBIC Prat 3, Table 2.3 to add additional SWPSs

Subgroup: Repairs and Alterations

Task Group: Jim Sekely – PM

Explanation of Need: Adding revised SWPSs B2.1-1-201:2019 through B2.1-14-209:2019 to Part 3, Table 2.3.

January Meeting Action: Mr. Sekely presented a proposal for this item. A motion was made, seconded, and unanimously approved to accept the proposal as presented.

b. Subcommittee Pressure Relief Devices

i. Interpretations

ii. Action Items – Old Business

Item Number: NB12-0901	NBIC Location: Part 4	No Attachment

General Description: Prepare a guide for repair of tank vents

Task Group: B. Donalson (PM), D. DeMichael, K. Simmons, K. Beise, B. Nutter, J. Little, S. Artrip

January Meeting Action: Ms. Marianne Brodeur reported that a letter ballot for this item would be sent to Subcommittee PRD prior to the July meeting.

Item Number: NB14-0602B	NBIC Location: Part 2	No Attachment

General Description: Improve index in Part 2 relating to pressure relief devices

Task Group: D. Marek (PM), B. Donalson, D. DeMichael, B. Hart

January Meeting Action: Work continues on a proposal for this item.

Item Number: NB15-0108B	NBIC Location: Part 1	No Attachment

General Description: Address pressure relief devices in new supplement on high temperature hot water boilers

Task Group: D. Marek (PM), A. Renaldo , D. McHugh, B. Nutter, A. Cox, D. Schirmer

January Meeting Action: Work continues on a proposal for this item.

Item Number: NB15-0305	NBIC Location: Part 4	No Attachment

General Description: Create Guidelines for Installation of Overpressure Protection by System Design.

Task Group: B. Nutter, A. Renaldo, D. Marek (PM), D. DeMichael

January Meeting Action: Work continues on a proposal for this item.

Item Number: NB15-0307	NBIC Location: Part 4	No Attachment
General Description: Create Guidelines for Repair of Pin Devices. **Task Group:** D. McHugh (PM), A. Renaldo, T. Tarbay, R. McCaffrey **January Meeting Action:** Work continues on a proposal for this item.		

Item Number: NB15-0308	NBIC Location: Part 4	No Attachment
General Description: - Create Guidelines for Installation of Pressure Relief Devices for Organic Fluid Vaporizers. **Task Group:** T. Patel (PM), K. Beise, B. Nutter **January Meeting Action:** Work continues on a proposal for this item.		

Item Number: NB15-0315	NBIC Location: Part 4, 2.5.6 and 2.6.6 and Part 1, 4.5.6 and 5.3.6	No Attachment
General Description: Review isolation Valve Requirements, and reword to allow installation of pressure relief devices in upstream piping. **Task Group:** D. DeMichael (PM), B. Nutter, A. Renaldo, D. Marek **January Meeting Action:** Work continues on a proposal for this item.		

Item Number: NB15-0321	NBIC Location: Part 4, 3.2.5 a) and Part 2, 2.5.7 a)	Attachment Page 150
General Description: Review testing requirements for in-service testing of pressure relief devices **Task Group:** A. Cox, A. Renaldo (PM), D. Marek, S. Irvin, D. DeMichael, B. Nutter, J. Ball **January Meeting Action:** Ms. Brodeur requested that the proposal for this item be sent to Main Committee as a letter ballot. She also announced that the proposal for this item was approved unanimously by Subgroup and Subcommittee PRD. The NBIC Secretary will send the item out for Main Committee letter ballot prior to the July meeting.		

Item Number: NB15-0324	NBIC Location: Part 4	Attachment Page 157
General Description: Create Guidelines for Inspection and Testing Frequencies with respect to shelf life and storage of pressure relief valves. **Task Group:** A. Rendaldo (PM), B. Nutter, K. Simmons, D. Marek, J. Little **January Meeting Action:** Ms. Brodeur requested that the proposal for this item be sent to Main Committee as a letter ballot. She also announced that the proposal for this item was approved unanimously by Subgroup and Subcommittee PRD. The NBIC Secretary will send the item out for Main Committee letter ballot prior to the July meeting.		

Item Number: NB16-0805	NBIC Location: Part 4, 2.6.6 and Part 1, 5.3.6	Attachment Page 159

General Description: Temperature ratings for discharge piping and fittings

Task Group: A. Renaldo (PM), T. Patel, D. Marek

January Meeting Action: Ms. Brodeur requested that the proposal for this item be sent to Main Committee as a letter ballot. She also announced that the proposal for this item was approved unanimously by Subgroup and Subcommittee PRD. The NBIC Secretary will send the item out for Main Committee letter ballot prior to the July meeting.

Item Number: 17-115	NBIC Location: Part 4, Section 2	Attachment Page 161

General Description: Complete rewrite of Section 2 combining common requirements into a general requirements section for all pressure relief devices and look at combining with 2.4.3, 2.4.4.

Task Group: A. Renaldo (PM), D. McHugh, D. Marek

January Meeting Action: Ms. Brodeur reported that a proposal for this item will be sent to Subgroup PRD for letter ballot prior to the July meeting.

Item Number: 17-119	NBIC Location: Part 4, 2.2.5 and Part 1, 2.9.1.4	No Attachment

General Description: States pressure setting may exceed 10% range. Clarify by how much.

Task Group: T. Patel (PM), D. Marek

July Meeting Action: Ms. Brodeur reported that this item is on hold pending ASME committee action on a related item.

January Meeting Action: Ms. Brodeur announced that this item is on hold pending further ASME action on a related item.

Item Number: 17-128	NBIC Location: Part 4, 2.4.4.3 and Part 1, 3.9.4.3	Attachment Page 179

General Description: allows Y-base to be used while 2.4.1.6 a) prohibits. This appears to be a conflict.

Task Group: B. Nutter (PM), S. Irvin

January Meeting Action: Ms. Brodeur requested that the proposal for this item be sent to Main Committee as a letter ballot. She also announced that the proposal for this item was approved unanimously by Subgroup and Subcommittee PRD. The NBIC Secretary will send the item out for Main Committee letter ballot prior to the July meeting.

Item Number: 17-132	NBIC Location: Part 4, 3.2.6 and Part 2, 2.5.8	Attachment Page 181

General Description: Paragraph 3.2.6 can be put into tabular format. Review test frequencies.

Task Group: B. Nutter (PM), M. Brodeur, D. Marek, D. DeMichael, A. Cox, P. Dhobi, R. McCaffrey, T. Beirne

January Meeting Action: Ms. Brodeur requested that the proposal for this item be sent to Main Committee as a letter ballot. She also announced that the proposal for this item was approved unanimously by Subgroup and Subcommittee PRD. The NBIC Secretary will send the item out for Main Committee letter ballot prior to the July meeting.

Item Number: 18-73	NBIC Location: Part 4, 2.3 and Part 1, S5.7.6	No Attachment

General Description: Update installation requirements for Thermal Fluid Heaters

Task Group: T. Patel (PM), B. Nutter

January Meeting Action: Mr. Thakor Patel presented the proposal for this item. The item was approved unanimously by Subgroup and Subcommittee PRD. A motion was made and seconded to approve the proposal as presented. Discussion was held on the necessity on requiring that a rain cap be installed at the point of discharge. After discussion, it was decided to remove the requirement for a rain cap in the proposal. Mr. Newton asked about the phrasing of “outdoor discharge” in the proposal. Additional discussion was held on installation requirements in the proposal. The Committee requested that the proposal be taken back for further work to address the installation requirements in the proposal.

Item Number: 18-80	NBIC Location: NBIC Location: Part 4, S3.1, S4.1, S6.1	Attachment Page 185

General Description: Addition of a "Scope" section to Part 4, S3.1, S4.1, and S6.1 to stay consistent with other sections

Task Group: T. Patel (PM), A. Renaldo, K. Simmons, P. Dhobi

January Meeting Action: Ms. Brodeur requested that the proposal for this item be sent to Main Committee as a letter ballot. She also announced that the proposal for this item was approved unanimously by Subgroup and Subcommittee PRD. The NBIC Secretary will send the item out for Main Committee letter ballot prior to the July meeting.

Item Number: 19-1	NBIC Location: Part 4, 4.8.5.4 & 4.8.6.1	No Attachment

General Description: Develop specific content and scope of annual field audits.

Task Group: A. Donaldson (PM), D. Marek, A. Cox, P. Dhobi, M. Brodeur, T. Patel

January Meeting Action: Work continues on the proposal for this item.

Item Number: 19-2	NBIC Location: Part 4, 4.9.1	No Attachment

General Description: Additional Training Requirements for VR and T/O programs

Task Group: A. Donaldson (PM), A. Cox, B. Donaldson, D. Marek, J. Simms

Explanation of Need: This was discussed at the July 2018 meetings and the SG and SC both agreed that we should look to expand the training program requirements. During the Development of the T/O code language in Part 4, the task group identified a lack of training requirements included in the new section. Upon further investigation, it was determined that the T/O requirements were copied directly from the V/R requirements.

January Meeting Action: Work continues on the proposal for this item.

Item Number: 19-18	NBIC Location: Part 4, 4.8.5.4 n) 5)	Attachment 187

General Description: Implementation of QC Manual Revisions

Task Group: A. Donaldson (PM)

Explanation of Need: Current wording allows for implementation of the revision once the change is merely submitted to the National Board for approval. When changes are made to a QC Manual at times other than reviews, they may be done so by submission to NB via mail, email etc. But implementation of the change should not take place until after NB acceptance of the change is received.

July Meeting Action: Ms. Brodeur reported that this is a newly received item and a TG has just been formed. A proposal is in development for this item.

January Meeting Action: Ms. Broduer introduced the proposal for this item. A motion was made and seconded to approve the proposal as presented. Discussion was held on the need for this change, and Mr. Tom Beirne clarified that original wording only requires that the revised manual be submitted to the National Board, not actually accepted/approved. After discussion, the motion to approve the proposal passed unanimously.

Item Number: 19-37	NBIC Location: Part 4, 4.3.1 c) 4)	No Attachment

General Description: Origin of Replacement Parts for Pressure Relief Devices

Task Group: A. Cox (PM), T. Patel, P. Dhobi, J. Simms
Explanation of Need: VR Holders are required to obtain a Certificate of Compliance when they purchase Replacement Critical Parts from longtime PRV Manufacturer's Representatives. This is prevalent in the Midstream Oil & Gas Sector. Several small VR Holders in this Sector of the Energy Industry have expressed their desire to make this issue less cumbersome because the Manufacturers of the majority of PRVs they repair do not have Assemblers.

January Meeting Action: Work continues on the proposal for this item.

Item Number: 19-40	NBIC Location: Part 4, Figure 4.7.2-b	Attachment Page 188

General Description: Move Fig. 4.7.2-b to Part 4 Supplement 6.

Task Group: T. Beirne (PM)

Explanation of Need: Figure 4.7.2-b should be relocated to Supplement 6. Requirement for marking repairs of Nuclear Valves in accordance with figure 4.7.2-b also does not exist. A statement should be added to Supplement 6 regarding the requirement to mark the repaired nuclear valve in accordance with the relocated Figure 4.7.2-b.

January Meeting Action: Ms. Brodeur requested that the proposal for this item be sent to Main Committee as a letter ballot. She also announced that the proposal for this item was approved unanimously by Subgroup and Subcommittee PRD. The NBIC Secretary will send the item out for Main Committee letter ballot prior to the July meeting.

Item Number: 19-41	NBIC Location: Part 4, 4.7.5	Attachment Page 193

General Description: Review Part 4, Paragraph 4.7.5 and simplify

Task Group: T. Beirne (PM), A. Cox, D. Schirmer
Explanation of Need: The requirements of adding a duplicate nameplate are the same whether the original nameplate is illegible or missing. 4.7.5 could be simplified with the three sub-paragraphs being combined into one paragraph.

January Meeting Action: Ms. Brodeur requested that the proposal for this item be sent to Main Committee as a letter ballot. She also announced that the proposal for this item was approved unanimously by Subgroup and Subcommittee PRD. The NBIC Secretary will send the item out for Main Committee letter ballot prior to the July meeting.

iii. New Items:

Item Number: 19-9	NBIC Location: Part 4, 3.2.3 and Part 2, 2.5.4 &2.5.6	Attachments Pages 205

General Description: Inspect shipping plug removal for PRD's.

Task Group: None

January Meeting Action: Ms. Brodeur presented the proposal for this item. A motion was made, seconded, and unanimously approved to accept the proposal.

Item Number: 19-49	NBIC Location: Part 4, 2.2.1 & 2.4.1, Part 1, 2.9.1 & 3.9.1	Attachments Pages 207

General Description: Ensure shipping plugs for PRD's are removed during the installation process.

Task Group: None

January Meeting Action: Ms. Brodeur presented the proposal for this item. A motion was made, seconded, and unanimously approved to accept the proposal.

Item Number: 19-54	NBIC Location: Part 4, 3.3.4 c) & S7.2 f) 1)	Attachment Page 209

General Description: Reconcile Conflict regarding Sealing Adjustments of PRVs in T/O Program

Task Group: None assigned.

Explanation of Need: S7 is needed to give T/O Organizations procedural guidance for implementation of T/O requirements in Part 4, Section 3. Such guidance needs to agree with the requirements of Part 4, Section 3. The Term "all external adjustments" is taken from ASME Original Code of Construction where is most certainly applies. However, in implementation of T/O, only one of several possible external adjustments may need to be made. The T/O Seals indicate which of the possible adjustments was made.

January Meeting Action: Ms. Brodeur presented the proposal for this item. A motion was made, seconded, and unanimously approved to accept the proposal.

Item Number: 19-70	NBIC Location: Part 4, 2.6.3	Attachment Page 210

General Description: Part 4, 2.6.3 references 2.1 through 2.2. Should be 2.2 through 2.4

Task Group: T. Beirne (PM),

Explanation of Need: Paragraph 2.6 and sub-paragraphs apply to pressure relief valves installed in piping. Paragraph 2.6.3 references 2.1 through 2.2 as the exceptions. However it should reference 2.2 through 2.4. This would match the exceptions in the duplicated paragraph in Part 1 (Part 1 paragraph 5.3.3).

January Meeting Action: Ms. Brodeur presented the proposal for this item. A motion was made, seconded, and unanimously approved to accept the proposal.

Item Number: 19-71	NBIC Location: Part 4, 4.9.2 & 4.9.3	No Attachment

General Description: Use of Personnel from another VR Certificate Holder to perform VR Repairs

Task Group: A. Donaldson (PM), A. Cox, B. Donaldson, D. Marek, J. Simms

Explanation of Need: NBIC SCPRD needs to address the practice of sub-contracted personnel between VR Holders. In order to maintain Quality Standards, the responsible VR Holder must verify the qualifications all personnel and maintain records per NBIC Part 4, Table 4.8.5.4 s)

January Meeting Action: Ms. Brodeur reported that work is still being done to develop a proposal for this item.

Item Number: 19-72	NBIC Location: Part 4, 4.6.2	Attachment Page 211

General Description: Documentation of Steam tested on Air Correction Factor

Task Group: B. Nutter (PM), S. Artrip, A. Cox, D. Marek

Explanation of Need: An ASME Code change in the 2019 Edition of Sec VIII-1 has made it impossible for an Owner/User VR Holder to use the CDTP Field of the VR Nameplate to document the Manufacturer's Correction Factor for a Steam Service PRV tested on Air as permitted by NBIC Part 4, Sec 4.6.2. When an Owner/User applies the aforementioned factor, it needs to be documented for the repair history of the PRV to ensure an accurately set PRV.

January Meeting Action: Ms. Brodeur requested that the proposal for this item be sent to Main Committee as a letter ballot. She also announced that the proposal for this item was approved unanimously by Subgroup and Subcommittee PRD. The NBIC Secretary will send the item out for Main Committee letter ballot prior to the July meeting.

Item Number: 19-75	NBIC Location: Part 4, 2.2.2	Attachment Page 212

General Description: Add PRD requirements for boilers up to 4000lb/hr to Part 4

Task Group: T. Beirne (PM)

Explanation of Need: Item 19-51 makes this proposed change to Part 1, 2.9.1.1, but the proposal never included changes to the duplicate section in Part 4. This item will ensure that the approved language for Part 1 gets reflected in Part 4.

January Meeting Action: Mr. Beirne presented the proposal for this item. A motion was made and seconded to approve the proposal as presented. Mr. Craig Hopkins asked about where the 4,000 lb/hr requirement came from, and it was confirmed that the requirement is in ASME Section I. Discussion was held on including “bare tube water” to sentence 2 of Part 4, 2.2.2, and the Committee decided it should be included. It was also determined that the Part 1 language needs to be updated as well. The original motion was rescinded, and the revised proposal will be sent to Subgroup and Subcommittee Installation for letter ballot. If both groups approve the proposal, it will be balloted to Main Committee prior to the July meeting.

Item Number: 19-76	NBIC Location: Part 4, 3.3.3.4 p)	Attachment Page 213

General Description: Paragraph 3.3.3.4 p) Incorrect Certificate of Authorization Reference

Task Group: T. Beirne (PM)

Explanation of Need: Referenced paragraph refers to "VR" Certificate of Authorization for record retention. It should refer to "T/O" Certificate of Authorization since this is in the T/O quality elements section.

January Meeting Action: Ms. Brodeur presented the proposal for this item. A motion was made, seconded, and unanimously approved to accept the proposal.

Item Number: 19-83	NBIC Location: Part 4, 4.7.5	No Attachment

General Description: Address Alternate Pressure Relief Valve Mounting Permitted by ASME CC2887-1

Task Group: D. Marek (PM), T. Patel, J. Ball

Explanation of Need: ASME Code Case 2887-1 permits the installation of pressure relief valves below a low mass water tube boiler or water heater under certain conditions. This set of conditions and alternate location should be addressed in the NBIC as the use of low mass water tube boilers and water heaters becomes more widespread.

January Meeting Action: Work continues to develop a proposal for this item.

Item Number: 19-85	NBIC Location: Part 4, 2.3.6 j)	No Attachment

General Description: Thermal Fluid Heaters

Task Group: T. Patel (PM), B. Nutter

Explanation of Need: Thermal Fluid heaters with no change of phase are not specifically addressed in 2.3.6 j).

January Meeting Action: Work continues to develop a proposal for this item.

c. Subcommittee Installation

i. Interpretations

ii. Action Items – Old Business

Item Number: NB11-1901	NBIC Location: Part 1	No Attachment

General Description: Add guidance for the safe installation of high pressure composite pressure vessels operating in close proximity to the public

Subgroup: FRP

Task Group: R. Smith (PM), M. Richards, S. Konopacki, D. Patten and E. Wiggins

January Meeting Action: Ms. Melissa Wadkinson gave a progress report for the item.

Item Number: NB16-0102	NBIC Location: Part 1	Attachment Page 214

General Description: Address post installation pressure testing

Subgroup: Installation

Task Group: S. Konopacki (PM), E. Wiggins, P. Cole, R. Smith, M. Wadkinson, D. Patten

January Meeting Action: Ms. Wadkinson introduced the proposal and discussed comments from a previous letter ballot. A motion was made and seconded to approve the proposal as presented. Discussion on including language about the removal of debris was held, and it was decided that an additional clause about removing debris would be added. The amended proposal was approved unanimously by Main Committee.

Item Number: 18-2	NBIC Location: Part 1	Attachment Page 218

General Description: Result of NB16-0101, add verbiage regarding commissioning fired boilers & fired pressure vessels with a calibrated combustion analyzer.

Subgroup: SG Installation

Task Group: E. Wiggins (PM), D. Patten, M. Wadkinson, and G. Halley, G. Thompkins, M. Washington

January Meeting Action: Mr. Eddie Wiggins presented the proposal for this item. A motion was made and seconded to approve the proposal as presented. Discussion was held on the jurisdiction in charge of monitoring emission requirements and if a boiler inspector would be involved in that process. After discussion, the original motion was rescinded in favor of sending the proposal out for Main Committee letter ballot.

Item Number: 18-57	NBIC Location: Part 1	No Attachment

General Description: address the use & definition of the word inspector

Subgroup: SG Installation

Task Group: - P. Jennings (PM), R. Smith, -, T. Creacy, R. Spiker, M. Washington, and R. Adams

January Meeting Action: Ms. Wadkinson gave a progress report for the item.

Item Number: 19-45	NBIC Location: Part 1, S1	No Attachment

General Description: Revisions to Yankee Dryer Supplement Wording in Part 1

Subgroup: SG Installation

Task Group: R. Spiker (PM), J. Jessick, and D. Patten

January Meeting Action: Ms. Wadkinson gave a progress report for the item.

iii. Action Items – New Business

Item Number: 19-77	NBIC Location: Part 1, 1.4.5.1.1	Attachment Page 219

General Description: NBIC Part 1, 1.4.5.1.1 Guide for installation report, items 6, 10, and 20

Subgroup: SG Installation

Task Group: M. Downs (PM), M. Washington, R. Spiker, J. Brockman

Explanation of Need: Cast aluminum boilers have been incorporated in ASME Section IV for a number of years now and it's time they be recognized in the NBIC. The installation report and guide were developed prior to cast aluminum boilers becoming an official part of ASME Section IV. It's suggested the guide item numbers and associated areas of the installation report be revised to incorporate cast aluminum boilers.

January Meeting Action: Mr. Wiggins presented a proposal for this item. A motion was made, seconded, and unanimously approved to accept the presented proposal.

Item Number: 19-80	NBIC Location: Part 1, 2.8.4	Attachment Page 221

General Description: Conflicting statements in Part 1 and Part 2 about boiler controls. An IC Course student challenged an exam question that was written from Part 1 but the student found another possible answer in Part 2 with the "may be" language. Part 1 has a "shall be" requirement.

Subgroup: SG Installation

Task Group: None

Explanation of Need: Requirements need to be consistent in Parts 1 and 2 to avoid confusion

January Meeting Action: Ms. Wadkinson announced that this item was closed with no action by Subgroup and Subcommittee Installation because the change is not needed**.** A motion was made, seconded, and unanimously approved to officially close the item with no action.

Item Number: 19-81	NBIC Location: Part 1, Table 3.7.9.1-b	No Attachment

General Description: Correction to value in TABLE 3.7.9.1-b
The table in question is generated using the equation in 3.7.9.1 a) 2). The values in the table are all based on the same temperatures and pressures. The only thing that changes is the volume. The ratio of the Non-pressurized Type column value to the System Volume is 0.15 in all cases except the 100 gallon case which ends up being 0.18. Thus multiplying any system volume by 0.15 should give the third column value.

Subgroup: SG Installation

Task Group: R. Smith (PM), M. Washington, T. Creacy, and R. Austin

Explanation of Need: There is only one incorrect value in the NBIC table and the rationale is in the background information. In addition, ASME Section IV, Table HG-709.2 has the correct value.

January Meeting Action: Ms. Wadkinson announced that a task group was formed to begin work on a proposal.

d. Subcommittee Inspection

i. Interpretations

ii. Action Items – Old Business

Item Number: NB16-1401	NBIC Location: Part 2, S10	Attachment Page 222

General Description: Revise and update Supplement 10 on Inspection of CRPVs

Subgroup: FRP

Task Group: N. Newhouse (PM)

January Meeting Action: Mr. Jim Getter announced that the proposal for this item was approved by Subcommittee Inspection, and requested that it be sent to Main Committee for letter ballot. The NBIC Secretary will send the proposal out for ballot prior to the July meeting.

Item Number: NB16-1402	NBIC Location: Part 2, New Supplement	Attachment Page 242

General Description: Life extension for high pressure FRP vessels above 20 years

Subgroup: FRP
Task Group: M. Gorman (PM)

Background:
In 2016, when this item was first opened, it was assigned as an item for Part 3. Recent discussions with SC R&A and the FRP Task Group have revealed that this item is better suited for Part 2. This item has been approved by the FRP Task Group.

Scope: The goal of this proposal is to provide a method to evaluate whether the service life of high pressure fiber reinforced plastic pressure vessels can be extended for an additional lifetime.

January Meeting Action: Mr. Getter announced that the proposal for this item will be sent out for letter ballot to Subcommittee Inspection.

Item Number: 18-6	NBIC Location: Part 2, S1.4.2.9	No Attachment

General Description: Riveted stay bolt dimensions

Subgroup: Locomotive

Task Group: M. Janssen (PM)

January Meeting Action: Mr. Getter gave a progress report for the item.

Item Number: 18-43	NBIC Location: Part 2, Section 5	No Attachment

General Description: Permanent nameplate removal from pressure vessel being removed from service

Subgroup: Inspection

Task Group: J. Roberts (PM), J. Burgess, J. Calvert, , J. Clark, M. Sansone

January Meeting Action: Mr. Getter presented a proposal for this item. Discussion was held on the new form and procedures for its use. The proposal will be sent out for letter ballot to Main Committee to allow for more time to review the proposal. Clarification was made that this form would only be sent to the National Board if the boiler was registered with the National Board.

Item Number: 18-62	NBIC Location: Part 2, S12.5	No Attachment

General Description: Remote Visual Inspection Requirements

Subgroup: Inspection

Task Group: V. Newton (PM), M. Horbaczewski, B. Wilson, J. Calvert, J. Castle, D. Graf, B. Ray

January Meeting Action: Mr. Getter gave a progress report for the item.

Item Number: 18-63	NBIC Location: Part 2	No Attachment

General Description: Review inspection requirements for pressure vessels designed for high pressures

Subgroup: Inspection

Task Group: V. Scarcella(PM), J. Mangas, J. Peterson, and J. Castle

January Meeting Action: Mr. Getter gave a progress report for the item.

Item Number: 19-6	NBIC Location: Part 2, 2.3.6.8	No Attachment

General Description: PVHO 2.3.6.8 Add other types of PVHO's

Subgroup: Inspection

Task Group: D. Buechel (PM), R. Smith, D.LeSage, M. Sansone

Explanation of Need: Currently part 2 only covers medical PVHO's.

January Meeting Action: Mr. Getter gave a progress report for the item.

Item Number: 19-7	NBIC Location: Part 2	No Attachment

General Description: Pressure Gage Graduation

Subgroup: Inspection

Task Group: V. Newton (PM), D. Buechel, D. Rose, D. Graff, & J. Clark

Explanation of Need: This item was opened after discussion of the pressure gage for PVHO's. The SG Inspection decided they needed to look into the pressure gage graduation for other pressure retaining items beyond PVHO's.

January Meeting Action: Mr. Getter gave a progress report for the item.

Item Number: 19-8	NBIC Location: Part 2, 2.3.6.8	No Attachment

General Description: Clarification of gage requirements for PVHO

Subgroup: Inspection

Task Group: D. Buechel (PM) & R. Smith , V. Newton

Explanation of Need: Existing PVHO gages do not conform to current NBIC and ASME Standards as written.

January Meeting Action: A motion was made, seconded, and unanimously approved to close this item with no action, as its scope is covered by item 19-7.

Item Number: 19-22	NBIC Location: Part 2, S2	Attachment Page 248

General Description: Review of MAWP on Return Flue Boilers.

Subgroup: SG Historical
Task Group: M. Wahl (PM), J. Amato, R. Bryce & D. Rose

Explanation of Need: From the Presentation, by Robert Bryce, the subcommittee feels this needs to be reviewed more in-depth. Continue the research and documentation on the MAWP of Return Flue Boiler. This was started with the documentation presented by Robert Bryce which is located in the NBIC cloud under January 2019 Historical Subcommittee.

January Meeting Action: Mr. Getter gave a progress report for the item.

Item Number: 19-46	NBIC Location: Part 2, S5	No Attachment

General Description: Revisions to Yankee dryer supplement in Part 2 (Scope)

Subgroup: Inspection

Task Group: V. Newton (PM), T. Barker, D. Lesage, J. Jessick

Explanation of Need: Various parts of supplement 5 do not match their counterparts in Part 1, Supplement 1.

January Meeting Action: Mr. Getter gave a progress report for the item.

Item Number: 19-63	NBIC Location: Part 2, S5.2	No Attachment

General Description: Changes to the Yankee Dryer Supplement (ASSESSMENT OF INSTALLATION)

Subgroup: Inspection
Task Group: V. Newton (PM), T. Barker, D. Lesage, J. Jessick

Explanation of Need: Ensure that wording in Part 2, S5.2, is identical to that found in Part 1, S1.2. Note that wording will be the same, but paragraph numberings will be different.

January Meeting Action: Mr. Getter gave a progress report for the item.

Item Number: 19-64	NBIC Location: Part 2, S5.2.1	No Attachment

General Description: Changes to the Yankee Dryer Supplement (DETERMINATION OF ALLOWABLE
OPERATING PARAMETERS)

Subgroup: Inspection

Task Group: V. Newton (PM), T. Barker, D. Lesage

Explanation of Need: Ensure that wording in Part 2, S5.2.1, is identical to that found in Part 1, S1.3. Note that wording will be the same, but paragraph numberings will be different.

January Meeting Action: Mr. Getter gave a progress report for the item.

iii. New Items:

Item Number: 19-78	**NBIC Location: Part 2, 2.2.12.1 a)**	**Attachment Page 254**

General Description: Detailed Requirements for Inservice Inspection of Cast Iron Boilers.

Subgroup: Inspection

Task Group: None assigned

Explanation of Need: The only reference to cast iron material in ASME Section I is PMB-5.4 that allows heads or parts of miniature boilers, when not exposed to direct action of the fire, may be made of cast iron or malleable iron provided it complies with a specification permitted by Section I. Heads and parts do not make up the complete boiler. ASME Section VIII Div. 1, UCI-2 states that cast iron boilers shall not be used in direct firing applications or in unfired steam boilers.

January Meeting Action: Mr. Getter presented the proposal for this item. A motion was made and seconded to approve the proposal as presented. This motion passed unanimously.

Item Number: 19-80	**NBIC Location: Part 2, 2.2.10.6 l) 1)**	**Attachment Page 221**

General Description: Conflicting statements in Part 1 and Part 2 about boiler controls

Subgroup: Inspection

Task Group: None assigned

Explanation of Need: Requirements in this section need to be consistent with Part 1, 2.8.4 a) to avoid confusion.

January Meeting Action: Mr. Getter announced that this item was closed with no action by the subgroup and subcommittee because the proposed change is not necessary. A motion was made, seconded, and unanimously approved to officially close the item with no action.

Item Number: 19-84	**NBIC Location: Part 2, S2.10.7**	**No Attachment**

General Description: Inspecting riveted joints for failure

Subgroup: SG Historical

Task Group: None assigned

Explanation of Need: The text covers cracks parallel to a longitudinal joint, but there is no text covering inspection of plate material around a rivet.

January Meeting Action: Mr. Getter gave a progress report for the item.

Item Number: 19-88	NBIC Location: Part 2, 2.2.12.7 c) 2)	No Attachment

General Description: At NBIC Part II propose the following be added to Thermal Fluid Heater

Subgroup: Inspection

Task Group: None assigned

Explanation of Need: These items are essential to preventing catastrophic loss and are low cost items.

January Meeting Action: Mr. Getter gave a progress report for the item.

Item Number: 19-89	NBIC Location: Part 2, S2.7.3.2	No Attachment

General Description: Longer NDE cycle for historic boilers

Subgroup: SG Historical
Task Group: None assigned

Explanation of Need: The National Historic Boiler Association (NHBA) of Canada is the association of Canadian historical boiler associations.
The NHBA is submitting a request for change to the National Board Subgroup, Historical Boilers, to review and extend the current NDE cycle for historical boilers that is defined in Part 2, S2.7.3.2. The duration is currently shorter than other jurisdictions.

- TSSA of Ontario, Canada enforced a 10-year cycle on ultrasonic thickness testing on historical boilers after careful review of recurring NDE results and operating logs from various historical boilers in that province.
- England is reportedly also on a 10-year cycle.

Extending the NBIC NDE cycle to 10 years would reduce costs for owners in jurisdictions where NBIC is being strictly followed. If granted the opportunity, the NHBA has data to support this request.

January Meeting Action: Mr. Getter announced that a proposal for this item will be letter balloted to Subcommittee Inspection.

Item Number: 19-90	NBIC Location: Part 2	No Attachment

General Description: Request NBIC Part II add guidance for inspection for high pressure vessels

Subgroup: Inspection

Task Group: None assigned

Explanation of Need: No guidance currently exists and the vessels are becoming more prevalent. Guidance is needed on how to inspect and NDE. A general review of cyclical designs and required documentation and relief protection also needed.

January Meeting Action: A motion was made, seconded, and unanimously approved to close this item with no action, as its scope is covered by item 18-63.

Item Number: 19-93	NBIC Location: Part 2, 5.3.2	Attachment Page 255
General Description: NBIC Forms have the wrong pages identified for reference **Subgroup:** Inspection **Task Group:** None assigned **January Meeting Action:** Mr. Getter presented the proposal for this item. A motion was made, seconded, and unanimously approved to accept the proposal as presented.		

11. Liaison Activities

a. American Society of Mechanical Engineers BPV Code (ASME BPV)

i. Mr. Edwards gave his report to the committee. The full report can be seen on Attachment Page 256.

b. American Welding Society (AWS)

i. Mr. Sekely gave his report to the committee. The full report can be seen on Attachment Page 260.

12. Future Meetings

- July 13th-16th, 2020 – Louisville, KY
- January 11th -14th, 2021 – New Orleans, LA

13. Adjournment

Mr. Wielgoszinski gave his thanks to the National Board staff for the work they put in to helping the meetings run smoothly. He also thanked the committee members and visitors for attending and participating in the meeting.

At 3:00 PM local time, a motion was made, seconded, and unanimously approved to adjourn the meeting.

Respectfully submitted,

Jonathan Ellis

Jonathan Ellis
NBIC Secretary

Contents

Interpretation IN19-5

Proposed Interpretation

Inquiry:	IN19-5
Source:	
Subject:	NBIC Part 3 Section Part 3, 3.2.6
Edition:	2017
General Description:	
Question 1:	Can user's opinion, categorization and proposed Repair methods be considered under NBIC Part 3, 3.2.6?
Reply 1:	No
Committee's Question 1:	~~Can~~ May a bolt hole in a SA350-LF2 flange be considered a repair~~ed~~ using SA-105 material that is welded using a Welding Procedure Specification (WPS) that was qualified without postweld heat treatment (PWHT) and without impact testing?
Committee's Reply 1:	~~This is consulting~~No. This cannot be completed as a Repair.
Question 2:	Does AI have final authority to take decision under Part 3, 3.2.6 when jurisdiction does not exist?
Reply 2:	Yes
Committee's Question 2:	Does the Inspector have final authority for review and acceptance of a repair by a repair organization that has an "R" Certificate of Authorization under Part 3, 3.2.6 when ~~jurisdiction~~ a Jurisdiction does not exist?
Committee's Reply 2:	Yes.
Rationale:	NBIC Part 3, Section 3.2.6
SC Vote	
NBIC Vote	

Rationale:

3.2.6 REFERENCE TO OTHER CODES AND STANDARDS

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

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

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

ASME Section IIA, SA-350/SA-350M, 2017 ED, SPECIFICATION FOR CARBON AND LOW-ALLOY STEEL FORGINGS, REQUIRING NOTCH TOUGHNESS TESTING FOR PIPING COMPONENTS

4. General Requirements

4.1 Product furnished to this specification shall conform to the requirements of Specification A 961, including any supplementary requirements that are indicated in the purchase order. Failure to comply with the general requirements of Specification A 961 constitutes nonconformance with this specification. In case of conflict between the requirements of this specification and Specification A 961, this specification shall prevail.

7.2 Impact Test:

7.2.1 Requirements — The material shall conform to the requirements for impact properties in Table 3 when tested at the applicable standard temperature in Table 4 within the limits of 7.2.4.2 and 7.2.4.3.

11. Rework and Retreatment

11.3.1 Repair by welding shall be made using welding procedures and welders qualified in accordance with ASME Section IX of the Code. The weld procedure qualification test shall also include impact tests of the weld metal and heat-affected zone. All impact test specimens shall have the longitudinal axis transverse to the weld and the base of the notch normal to the weld surface.

ASTM A 961: Standard Specification for Common Requirements for Steel Flanges, Forged Fittings, Valves, and Parts for Piping Applications

12. Impact Requirements

12.1 The part shall conform to the impact requirements prescribed in the product specification.

Background Information IN19-5 from the Inquirer:

Saudi Aramco Hawiyah Gas Plant (User) requested Repair to one of their Floating tube sheet Heat Exchanger (UHX-14.1(a)). The user requested repair organization to plug all bolt holes of floating tube sheet using Plug material SA-105 and close by welding. New holes were drilled at center of the ligament of previously drilled bolt holes as required by original drawing of the heat exchanger. No design has been performed and method classified as "Repair".

It is informed that the floating tube sheet has shrunk during service and due to which after dismantling it was difficult to reassemble the Floating tube sheet.

Tube Sheet Material is SA350 LF2 Class-1. WPS used to close holes is without PWHT and without impact.

National Board Inspector rejected the repair method with the following understanding:

1. Welding on SA-350 forging shall meet requirement for Repair of Base Material in accordance with SA 350 and Section 11.8.
2. Integrity of this Flange is compromised as it is Plugged with SA 105 Material and welded for 5 mm with Groove on both Side. This methodology of Repairing Base material is not approved as per Code

AIS Concurred and provided his Opinion to AI question as follows:

1. Welding on SA-350 forging shall meet requirement for Repair of Base Material in accordance with SA-350 and Section 11.8

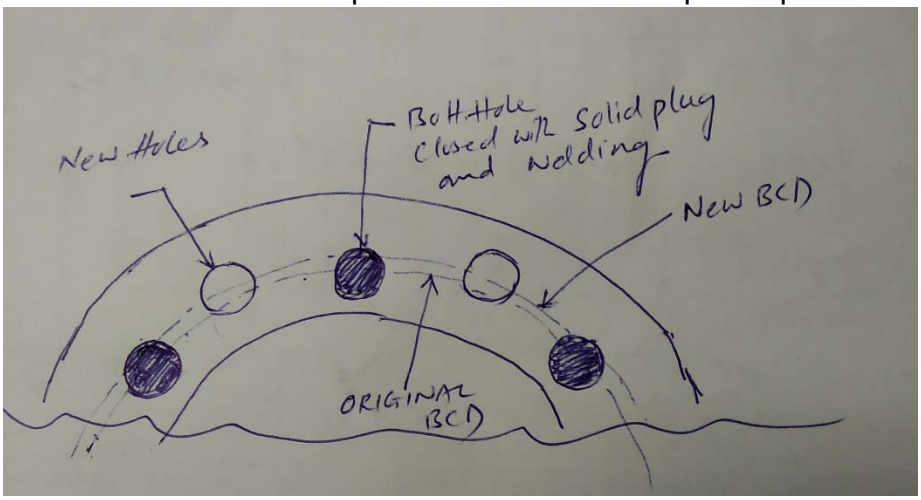
AIS Opinion: All types of repairs are not addressed in NBIC however para 3.2.6 shall be applicable and to be complied.

2. Integrity of this Flange is now compromised as it is Plugged with SA 105 Material and welded for 5 mm with Groove on both Side. This methodology of Repairing Base material is not approved as per Code

AIS Opinion: Refer my comments above, the user is cautioned in para 3.2.6 that the referenced codes, standards and practices may address methods categorized as repairs. These methods/Practices must be accepted by AI.

Questions:

1. Can user opinion, categorization and acceptance of Repair methods be considered under NBIC Para 3.2.6, Part 3?
2. Does NB consider this repair method as an acceptable practice?



PROPOSED INTERPRETATION

Inquiry No.	19-10
Source	Paul Shanks
Subject	Interpretations
Edition	2017, Part 3, 8.1 b)
Question	May an interpretation issued to a past NBIC edition be used in any other NBIC edition when the words in the NBIC paragraph are the same? (See Part 3, Introduction, Interpretations for text reference)
Reply	Yes if the NBIC has not changed the requirements pertaining to the interpretation
Committee's Question	May an interpretation issued to ~~a~~an ~~past~~ earlier NBIC Edition be used for any other NBIC Edition when the requirements of the NBIC are the same?
Committee's Reply	Yes.
Rationale	NBIC currently limits each interpretation to the edition it was issued for. However, often time the words in question do not change from one edition to another. At present a new interpretation would be needed for each edition of the NBIC to address the same issues, this is a delay to field work and a drain on NBIC committee time. **Background Information:** Understandably each request for interpretation does not require a change to the words in the NBIC, but given the same NBIC words and consistent committee approach to resolving interpretations the same answer should be provided from one edition to the next. But this would cause a delay in working to a standard accepted practice and would consume time for the committee answering the same base question each year. Further the proposed approach is that which ASME currently employs and whilst NBIC and ASME are different they do operate within the same industrial sphere so the proposed interpretation is not unusual.
SC Vote	
NBIC Vote	

Negative Vote Comments	

PROPOSED INTERPRETATION

Inquiry No.	Item 19-25
Source	M.A. Shah abmindustrialservices@gmail.com
Subject	This inquiry seeks an interpretation of NBIC Part 3, 4.4.2 c), which states the following: c) Nondestructive Examination NDE may be conducted when contamination of the pressure-retaining item by liquids is possible or when pressure testing is not practicable. Concurrence of the owner shall be obtained in addition to the Inspector, and where required, the Jurisdiction. Exclusive use of Visual Examination (VT) shall not be permitted. In all cases NDE methods or combination of methods used shall be suitable for providing meaningful results to verify the integrity of the alteration.
Edition	2017
Explanation of Need	For ASME BPV Section VIII Division 2 Vessel is under Alteration with Re-rate of lowering MAWP & increasing of Design Temperature & there is no physical alteration in the Vessel but only change is in the Alteration design report because of different design stress intensity value at higher design temperature.
Question	In lieu of a liquid pressure test, what kind of NDE methods or combination of methods used shall be suitable for providing meaningful results to verify the integrity of the alteration?
Reply	No further NDE shall be required as there is no Physical Alteration for the Vessel.
Committee's Question 1	An alteration to a Section VIII Div. 2 ~~and~~or Div. 3 vessel is performed by lowering the MAWP and increasing the design temperature. No physical work was performed on the vessel. Calculations confirm that the hydrostatic test pressure for the new MAWP and design temperature would be higher than that of the original hydrostatic test pressure. Is a new hydrostatic test required after the alteration is completed?
Committee's Reply 1	Yes, except as provided in Part 3, 4.4.2.c.
Committee's Question 2	The NBIC Part 3, 4.4.2.c provides rules for performing NDE in lieu of a hydrostatic test of an alteration. Is it required that concurrence of the owner, the Inspector, the Certifying Engineer if applicable, and when required, the Jurisdiction be obtained regarding the NDE methods, or combination of methods, to be used to verify the integrity of the alteration?
Committee's Reply 2	Yes, in accordance with Part 3, 3.4.5.
Rationale	NBIC Part 3, Section 3.3.4, Section 4.4.2. and Section 9.1
SC Vote	
NBIC Vote	

Negative Vote Comments	

Relevant Background

NBIC Section 3.4.4 clearly states that an example of an alteration is an increase in the design temperature for the pressure retaining item. Furthermore, the definitions section 9.1 states that nonphysical changes such as an increase in the design temperature shall be considered an alteration. Thus, in the background information provided by the requestor, it is clear that this scenario describes a vessel which has been altered.

Page 68, Section 3, Part 3

3.4.4 EXAMPLES OF ALTERATIONS (17)

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

Page 237, Section 9, Part 3

Alteration — A change in the item described on the original Manufacturer's Data Report which affects the pressure containing capability of the pressure-retaining item. (See NBIC Part 3, 3.4.3, *Examples of Alteration*) Nonphysical changes such as an increase in the maximum allowable working pressure (internal or external), increase in design temperature, or a reduction in minimum temperature of a pressure-retaining item shall be considered an alteration.

The 'explanation of need' now links to the relevant Section 4.4.2 which requires that one of the following shall be applied to an activity considered to be an alteration: liquid pressure test; pneumatic test; or nondestructive examination. The NBIC does not describe which NDE methods are acceptable, merely that: *concurrence of the owner and inspector and possibly the jurisdiction shall be obtained; that visual examination is not sufficient; and the selected method shall be suitable to provide meaningful results verifying the integrity of the vessel*.

Page 73, Section 4, Part 3

4.4.2 TEST OR EXAMINATION METHODS APPLICABLE TO ALTERATIONS

Based on the nature and scope of the alterations activity, one or a combination of the following examination and test methods shall be applied to alterations and replacement parts used in alterations.

a) Liquid Pressure Test

b) Pneumatic Test

c) Nondestructive Examination

Relevant Interpretations

INTERPRETATION 93-5

Subject: Chapter III, R-503(d)

1992 edition

Question: If a pressure test required for a re-rated vessel is less than or equal to the hydrostatic test performed during construction, is a new pressure test required after the re-rating is completed?

Reply: No, provided no physical work is performed.

INTERPRETATION 98-15

Subject: RC-3022 & RC-3030(h) Pressure Testing Requirements Related to Re-rating Activities

1995 Edition with the 1996 Addendum

Question 1: If calculations and current thickness measurements indicate that a pressure retaining item may be altered by re-rating only (no physical work being done), may the original pressure test as recorded on the Manufacturer's Data Report be used to satisfy RC-3022(d), if the pressure test is at least equal to the calculated test pressure required to verify the integrity of said alteration, subject to the approval of the Inspector and the requirements of the jurisdiction?

Reply 1: Yes.

Question 2: If the maximum allowable working pressure (MAWP) of a pressure-retaining item must be reduced, due to wall thinning below the minimum wall thickness required to contain the MAWP stated on the manufacturer's data report and on the ASME stamped nameplate, but the maximum allowable temperature is increased, is it the intent of the NBIC that this be considered a re-rate?

Reply 2: Yes. Any increase in pressure or temperature is considered a re-rate in accordance with RC-3022.

Question 3: If the maximum allowable working pressure (MAWP) of a pressure-retaining item must be reduced, due to wall thinning below the minimum wall thickness required to contain the MAWP stated on the manufacturer's data report and on the ASME stamped nameplate, but the maximum allowable temperature is increased, is it the intent of the NBIC that this is, in effect, a derate and outside the scope of the NBIC?

Reply 3: No. Any increase in pressure or temperature is considered a re-rate in accordance with RC-3022.

INTERPRETATION 98-34

Subject: RC-3030 Examination and Testing

1995 Edition with the 1996 Addendum

Question: When the design rated capacity of a boiler is increased without physical work such that the design pressure and temperature are unaffected, is it required to perform a pressure test in accordance with the NBIC?

Reply: No.

Interpretation IN19-26

Proposed Interpretation

Inquiry:	IN19-26
Source:	Doug Biggar
Subject:	NBIC Part 3 Section Part 3, 3.3.2
Edition:	[Current/all]
General Description:	Repair of none pressure boundary parts
Question 1:	If a welding repair is done to an appendage of a horizontal ASME LPG pressure vessel such as a faulty leg or the raised data plate holder, is this considered routine and are we exempt to have an inspector present to witness it and/or fill out a specialized form?
Reply 1:	No inspector needs to be present as the welding is not performed on any part of the pressure vessel directly related to its performance under pressure.
Question 2:	What is the minimum length of an appendage we can weld onto without being an ASME/NBIC certified welder (only a standard welding ticket)?
Reply 2:	1/4”
Committee’s Question 1:	Are refurbishment activities such as shot blasting, thread cleaning and painting considered within the scope of the NBIC?
Committee’s Reply 1:	No
Rationale 1:	These activities should not affect the pressure retaining integrity of the item, per the introduction to the NBIC that (maintenance) is the function of the NBIC. Reasonably these activities fall outside the scope of the NBIC
Committee’s Question 2:	Do welding activities on items which have neither a pressure retaining or load bearing function fall within the scope of the NBIC
Committee’s Reply 2:	No.
Rationale:2	These welds are such that typical ASME BPV construction codes would not dictate the qualification of the welders or welding operators.
NBIC Vote	

Include in response letter: NA

Rationale:

Having emailed the enquirer to determine the scope of their typical operations it was clear that there was a general misunderstanding about the purpose of the NBIC, the proposed questions are overly specific and as sure fail to grasp the crux of the issue hence the question re-write. Q3 was added to ensure that no misunderstand occurs. With the exception of a very hardline reading on Section 3.3.2 a) the NBIC addresses in the main body and the introduction the pressure retaining capability of the item and not work conducted elsewhere.

Sections 3.3.2 e), 3.3.3 & 3.4.4 address working (welding / replacing) on components which have a pressure retaining function. Pipes, tubes, heads, shell, and tube sheet are mentioned, integral parts without pressure retaining function such as legs and davit arms are not addressed.

Section 3.3.3 a) can be read as "Weld repairs ~~or replacement of pressure parts or~~ of (sic) attachments that have failed in a weld or in the base material;"

19-34 – Edwards – 12-23-19

Background – This Item is a proposed Intent Interpretation to Part 3, 3.2.2 e). The original request and supporting information by the Inquirer are attached. The proposed interpretation was unanimously approved by SC-R/A in July 2019 but withdrawn at Main Committee pending action on a corresponding code revision.

Proposed Action – Reaffirm the attached Interpretation to Part 3, 3.2.2 e), without change, in conjunction with the proposed revision under Item 19-59.

PROPOSED INTERPRETATION

Inquiry No.	**19-34**
Source	GE Power
Subject	NBIC Part 3, paragraph 3.2.2 e), Pressure Testing of Replacement Parts
Edition	2017
Question	NBIC Part 3 paragraph 3.2.2 e) states that the replacement part shall receive a pressure test as required by the original code of construction. ASME has issued an interpretation (I-16-6) clarifying that Section I does not provide rules for hydrostatic testing of parts supplied for repair or alteration of existing boilers. Is it the intent of 3.2.2 e) that the reference to the original code of construction is for determining the hydrostatic test pressure?
Reply	Yes
Committee's Question	NBIC Part 3 paragraph 3.2.2 e) states that the replacement part shall receive a pressure test as required by the original code of construction. Is it the intent of 3.2.2 e) that the reference to the original code of construction is for determining the pressure used for the hydrostatic test?
Committee's Reply	Yes
Rationale	ASME has issued interpretation I-16-1 and revised PW-54 to clarify that Section I does not contain requirements for the hydrostatic testing of replacement parts. Based on this, the language in 3-3.2.2 e) *"... as required by the original code of construction"* could be interpreted to mean that pressure testing of parts is not required because Section I does not require testing of replacement parts. On review, this was not the Committee's intent when clause e) was added to 3.2.2. The proposed intent interpretation and a supporting text revision is provided to clarify this issue. By linking the words *"original code of construction"* to the test pressure, it eliminates the potential interpretation that testing is only required when the original code of construction specifically requires testing of replacement parts.
SC Vote	
NBIC Vote	
Negative Vote Comments	

INFORMATION ONLY

Background Materials Submi

NBIC Part 3 Section 3 paragrap
test as required by the original
consistently by all users of the
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not contain requirements for th
this, the words "… *as required*
testing of the parts is not requir
think that was the Committee's
interpretation and proposed rev
"original code of construction" t
required when the original code

Proposed Intent Interpretation:
Question: NBIC Part 3 paragra
required by the original code of
does not provide rules for hydr
intent of 3.2.2 e) that the refere
pressure?
Reply: Yes.

Associated Revision:
e) Replacement parts addresse
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original code of construction. I
~~the original code of constructio~~
~~construction~~ pressure test provi
one or a combination of the exa
or 4.4.2 (for alterations). The R
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Background Information:

NBIC Part 3 Section 3 paragrap

e) Replacement parts addresse
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code of construction.

ASME Interpretation I-16-6

Standard Designation:	BPV I
Edition/Addenda:	2015
Para./Fig./Table No:	PW-54
Subject Description:	Section I Intent Interpre
Date Issued:	08/16/2016
Record Number:	13-942
Interpretation Number :	BPV I-16-6
Question(s) and Reply(ies):	Question: Is it the inten regarding hydrostatic t or alteration of existing Reply: No. Section I d to Existing Boilers.

INFORMATION ONLY

2017 Addition to PW-54

PW-54.4 Refer to A-64 as guidance for welded pressure parts supplied to the user of an existing boiler as replacement or repair parts. (17)

A-64

A-64 REPAIRS TO EXISTING BOILERS

Where repairs are necessary that in any way affect the working pressure or safety of a boiler, a state inspector, municipal inspector, or an inspector employed regularly by an insurance company, which is authorized to do a boiler insurance business in the state in which the boiler is used, shall be called for consultation and advice as to the best method of making such repairs; after such repairs are made they shall be subject to the approval of a state inspector, municipal inspector, or an inspector regularly employed by an insurance company that is authorized to do a boiler insurance business in the state in which the boiler is used.

19-36, Edwards, 12-23-19

Background – This item is an inquiry on Part 3, 3.3.2 and 3.3.5, regarding the application of routine repairs on ASME VIII-2 and ASME VIII-3 vessels. The proposed Interpretation (see attached) was voted unanimously by SC-R/A and submitted for Main Committee letter ballot. The MC ballot failed with 1 negative and 1 approved with comment.

Committee Member:	Donald Cook	Vote Date:	2019-09-27	Vote:	Disapproved	Uploads:
Member Comment:	Wouldn't it be clearer to answer the inquirers question #1 with a "No". Everything else becomes unnecessary with a simple question and response.					
PM Reply:	Because I am familiar with the NBIC requirements relating to routine repairs I am personally willing to make the suggested changes if the Committee prefers. My reason for adding the other questions and replies is because the rational explaining why a particular answer is given is for use by the Committee and is not published with the interpretation for use by the public. I thought it prudent to walk the inquirer through the "rational" via additional questions and replies.					

Committee Member:	Robby Troutt	Vote Date:	2019-09-27	Vote:	Approved	Uploads:
Member Comment:	I approve this interpretation; however recommend a change to the first sentence of the rationale to say the same as the first sentence of NBIC Part 3, 3.3.2.a). Recommend the following for the rationale: Routine repairs are repairs for which the requirements for in-process involvement by the inspector and stamping by the "R" Certificate Holder may be waived as determined appropriate by the Jurisdiction and the Inspector. The rules described in Part 3, 3.3.5.2(b) are clear that the Inspector must make an acceptance inspection of the repair.					
PM Reply:	Thank you for approving the item and for the comment. Providing the rational is for the benefit of the Committee when considering the proposed interpretation. Because of the Committee members' general familiarity with the NBIC rules, I think the rational provided is sufficient and prefer not to make the suggested changes.					

Proposed Action – On review, the ballot comments are noted as suggested clarifications of the proposed action, rather than objection to the basis of the questions and replies. In consideration of the PM responses, the proposed action is to reaffirm the previous proposal, without change, for reconsideration by the Main Committee.

PROPOSED INTERPRETATION

Inquiry No. **19-36**	Part 3, Section 3, 3.3.2 and 3.3.5, Routine Repairs of Section VIII Div.2 and Div.3 Pressure Vessels
Source	Inquirer: Narayanan Murugappan NBIC Committee PM: Jim Pillow
Subject	Part 3, Section 3, 3.3.2 Routine Repairs and 3.3.5 Repair of Section VIII Div.2 and Div.3 Pressure Vessels
Edition	2017
Question	**Inquirer's Proposed Q and R** **Question 1:** Is Routine Repairs defined para 3.3.2 applicable to pressure vessels constructed to ASME Section VIII Division-2 and 3? **Proposed Reply 1:** Yes. **Question 2:** If the answer to the above question is Yes, are requirements specified in Para 3.3.5 to be followed for routine repairs to pressure vessels constructed to ASME Section VIII Division-2 and 3? **Proposed Reply 2:** Yes.
Reply	
Committee's Question	Q1; Is a repair plan required for all repairs of an ASME Section VIII Div. 2 or Div. 3 pressure vessel? Q2: May the repair plan for an ASME Section VIII Div.2 or Div.3 pressure vessel be accepted by the Inspector in lieu of the Authorized Inspection Agency or the Owner-User Inspection Organization? Q3: Must the Authorized Inspection Agency's or the Owner-User Inspection Organization's Inspector make an acceptance inspection of the repair of an ASME Section VIII Div.2 or Div.3 pressure vessel? Q4: Are routine repairs defined in Part 3, Section 3, 3.3.2, applicable to pressure vessels constructed to ASME Section VIII Div.2 or Div.3?

Committee's Reply	R1: Yes. See Part 3, 3.3.5.2. R2: No. See Part 3, 3.3.5.2(b). R3: Yes. See Part 3, 3.3.5.2(b). R4: No. Inspection of the repair by the Inspector is required.
Rationale	The rules for routine repairs do not require in process involvement by the Inspector to inspect and accept the repair. The rules described in Part 3, 3.3.5.2(b) are clear that the Inspector must make an acceptance inspection of the repair.
SC Vote	
NBIC Vote	
Negative Vote Comments	

BACKGROUND/INQUIRER'S REQUEST

Explanation of Need: Para 3.3.2 talks about requirements for and examples of routine repairs. It does not specify any restrictions on pressure retaining items construction Code. It states that Routine repairs are repairs for which the requirements for in-process involvement by the Inspector and stamping by the "R" Certificate Holder may be waived as determined appropriate by the Jurisdiction and the Inspector. It states that all other applicable requirements of this code (NBIC) shall be met. Para 3.3.5.1 of NBIC states that the following requirements shall apply for the repair of pressure vessels constructed to the requirements of Section VIII, Division 2 or 3, of the ASME Code. This calls for properly certified repair plan to be submitted to the Inspector who will make acceptance inspection and sign R-1 Form.

Background Information: The recent interpretations issued by NBIC are reproduced below.

INTERPRETATION 17-17

Subject: Repair and alteration of Section VIII Division 2 items

Edition: 2017

Question: Is it permissible to perform a repair or alteration on an ASME Section VIII, Division 2 pressure vessel in accordance with the NBIC when the original User's Design Specification (UDS) and/or the Manufacturer's Design Report (MDR) is not available?

Reply: No. The Repair/Alteration Plan is required to be compatible with the UDS and MDR per the NBIC Part 3, Sections 3.3.5 and 3.4.5.

Item 19-42 – Interpretation Request
Submitted by: Paul Shanks paul.shanks@onecis.com

NBIC Location: Part 3, 3.3.3 s) and 3.4.4 g)

Explanation of Need: The design requirement in 3.3.3 s) is not well defined and is allowing potentially unsafe material changes to be conducted as repairs without adequate assessment.

Background Information: Most pressure vessel parts are design in isolation from those around them or connected to them, heads and shell for example. There are however some components which take strength from or are subject to stresses imposed form adjacent components. For example, body flanges and bolting or tube sheets and the tubes. 3.3.3 s) allows materials of high strength than originally used to be implemented in a repair, under the condition that they "satisfy the material and design requirements of the original code" it is intuitively obvious what is meant by the material requirements but the design requirements are unclear and a great many people thing stronger is more better. But in the case of tubes in a fixed tube sheet heat exchanger or bolting on a custom body flange this is not necessarily the case, upgrading the bolts or tubes could introduce an unsafe overstressed condition in the adjacent materials unless calculations are conducted this will not be known. 3.4.4 g) could be used to indicate that the some material 'upgrades' need to be an alteration but as it refers back to 3.3.3 s) and the design requirement is not well defined it becomes hard to justify a material 'upgrade' as an alteration.

Question 1: 3.3.3 s) includes the following "provided the replacement material satisfies the material and design requirements of the original code of construction" it is clear that the material must be one permitted by the original code of construction but in referring to the "design requirements" is it the intent of the NBIC that when higher strength material are use the new material must not introduce an overstress situation?

Reply 1: Yes.

Question 2: If the above answer is no please remove 3.4.4 g) as it is superfluous or reword it to address changing to materials with lower allowable stresses specifically.

PROPOSED INTERPRETATION

Inquiry No.	**19-62**
Source	John Siefert, EPRI
Subject	Interpretation for using NBIC Part 3, 2.5.3.6 Welding Method 6 on Grade 92 **Background:** Most creep strength enhanced ferritic (CSEF) steels exist as Code Case materials. One such example is Grade 92 steel. This material still exists as a Code Case (2179), and it appears in some SA-specs, for example: SA-213 T92, SA-335 P92, SA-336 F92, and so forth. ASME B&PV Code does not yet have a strategy or plan for the formal adoption of Code Case materials into the main body of the Code. In Code Case 2179-8 it states: "(c) For the purposes of procedure and performance qualifications, the material shall be considered P-No. 15E Group 1. The procedure and performance qualifications shall be conducted in accordance with Section IX." There exist applications of Code Case 2179 in boiler tubing where the alternative weld repair methodology would be identical to that which is described in Welding Method 6. However, because of its Code Case status, it is not clear how to handle repairs for Code Case 2179 although the material is recognized as having similar welding characteristics and qualification rules in ASME Section IX. **Explanation of Need:** End-users are experience failures in SA-213 T92 Code Case 2179 material and would like the option to invoke Welding Method 6 for repairs internal to the boiler setting.
Edition	2019
Question	May Welding Method 6 also be used on CSEF steel which has been manufactured to the requirements in Code Case 2179, and otherwise classified as P No 15E Group 1?
Reply	~~Yes~~No.
Committee's Question	
Committee's Reply	
Rationale	

PROPOSED INTERPRETATION

Inquiry No.	**19-66**
Source	Jagadheesan Vellingiri Muthukumaraswamy, ABS Consulting
Subject	Shell Side Heat Exchanger PWHT **Background:** An R Certificate Holder is Doing Repair Work on the Shell Side of Heat Exchanger, which was not PWHT Earlier. As per Client Request, Welded Joints are Post weld Heat Treated and Consider as Alteration, Client wants Shell Side to Under Go Full Post weld Heat Treatment Including areas not repaired. NDE is being Carried out for Complete Equipment and Client wants PWHT for Welds which are in Services and without any repairs.
Edition	2019; Part 3, 3.4 & 2.5.2
Question	1. An R Certificate Holder is Doing Repair Work on the Shell Side of Heat Exchanger, which was not Post Welded Heat treated Earlier. As per Client Request, Repair Welded Joints are Post weld Heat Treated and Consider as Alteration as per 3.4, For Welded Joints not repaired Can Post weld Heat treatment be done and Responsibility can be Taken by R Certification and Considered Alteration? ~~2. If R Stamp Holder Holds WPS for The Vessel with PWHT can that Post Weld Heat Treatment be carried out as per as per Approved WPS in order to meet Alteration requirement?~~
Reply	1. ~~No.~~ This has been addressed in Interpretation 13-06. ~~2. Yes~~
Committee's Question	
Committee's Reply	Letter of Response to be sent to Inquirer to see if Interp. 13-06 addresses this question.
Rationale	

PROPOSED INTERPRETATION – 19-67

Inquiry No.	**19-67**
Source	Doug Fowler, TUV AIA Services
Subject	Clarification of Part 3, 1.5.1 d) 1) **Background:** Manufacturers in non-jurisdictional states are making API-510 repairs or "non" code repairs to Code vessels when an NBIC rule is not convenient to an owner/customer. This should stop in my opinion. I interpret the statement in Part 3, 1.5.1 d) 1) to mean a stamp holder must do repairs or alterations to the NBIC. Clarification would be appreciated as the statement "as applicable" is ambiguous. .
Edition	2019; Part: Repairs and Alterations; Section: 1; Paragraph: 1.5.1 (d) (1)
Question	In Part 3 Section 1 Paragraph 1.5.1 (d) (1) it states: A statement that all repairs or alterations carried out by the organization shall meet the requirements of the NBIC and the Jurisdiction, as applicable. Does the statement mean an organization holding an "R" stamp must do all repairs and organizations to the NBIC?
Reply	Yes
Committee's Question	1. If an R-Certificate holder makes repairs or alterations to a pressure retaining item installed in a location where there is no Jurisdiction or where the NBIC is not adopted, are the repairs/alterations required to be made in accordance with the NBIC? 2. If a Form "R" Report is completed and/or a Nameplate affixed/stamped for a repair or alteration to a pressure retaining item located where there is no Jurisdiction or where the NBIC is not adopted, is the R-Certificate holder required to make the repairs/alterations in accordance with the NBIC?
Committee's Reply	1. No. 2. Yes.

Rationale	Question 1: d) Statement of Authority and Responsibility A dated *Statement of Authority and Responsibility*, signed by a senior management official of the organization, shall be included in the manual. Further, the *Statement* 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; The NBIC states “the NBIC and Jurisdiction, as applicable. Since there are no Jurisdictional requirements, therefore, there are no NBIC requirements Question 2: The R Certificate Holder sign the R Form attesting that the repairs conform to the NBIC ,_____ certify that to the best of my knowledge and belief the statements made in this report are correct and that all material, construction, and workmanship on this Repair conforms to the *National Board Inspection Code*. National Board

PROPOSED INTERPRETATION

Inquiry No.	**19-86**
Source	Luis Ponce, National Board
Subject	National Certified Pipe Welding Bureau (NCPWB) welding procedure specs **Background:** Some ASME and National Board Certificate Holders have presented NCPWB procedures to Team Leaders (designees) at joint reviews as part of their welding demonstrations, and those companies may not understand the limited scope in which the procedures may be used. ASME Sect I, PW-28.5 used to read like B31.1, para 127.5.3. which states, "Each employer shall be responsible for qualifying any WPS that he/she intends to have used by personnel of his/her organization. However, to avoid duplication of effort, and subject to approval of the owner, a WPS qualified by a technically competent group or agency may be used if: (A.1) the group or agency qualifying the WPS meets all of the procedure qualification requirements of this Code, (A.2) the fabricator accepts the WPS thus qualified, (A.3) the user of the WPS has qualified at least one welder using the WPS, and (A.4) the user of the WPS assumes specific responsibility for the procedure qualification work done for him/her by signing the records required by para. 127.6. However, PW-38.5 was removed in the 2009 Addenda to Section I and no longer exists in the Code, therefore the interpretation is no longer valid. Section VIII Div. 1 is silent on procedures "qualified by a technically competent group or agency." Both Section I and VIII Div 1 require welding procedures to be qualified in accordance with Section IX. In conclusion, NCPWB WPSs may only be used for Code work on ASME B31.1 power piping and under no other ASME construction Code.
Edition	2019; Part: Repairs and Alterations; Section: 2; Paragraph: 2.2 & 2.2.1
Question	1. May an "R" certificate holder use a National Certified Pipe Welding Bureau (NCPWB) welding procedure for repairs and alterations of pressure retaining items consisting of pipe where ASME B31.1 is the construction Code? 2. May an "R" certificate holder use a National Certified Pipe Welding Bureau (NCPWB) welding procedure for repairs and alterations of pressure retaining items consisting of pipe (as the shell or nozzles) where ASME Section I or Section VIII Div 1 is the construction Code?
Reply	1. Yes. 2. No, because the NCPWB itself states the bureau operates exclusively under the scope of the ASME B31 Code for Pressure Piping, including B31.1 power piping.
Committee's Question	1. May an "R" certificate holder use a National Certified Pipe Welding Bureau (NCPWB) welding procedure for repairs and alterations of pressure retaining items consisting of pipe where ASME B31.1 is the construction Code? 2. May an "R" certificate holder use a National Certified Pipe Welding Bureau (NCPWB) welding procedure for repairs and alterations of pressure retaining items consisting of pipe (as the shell or nozzles) where ASME Section I or Section VIII Div 1 is the construction Code?

Committee's Reply	1. Yes. 2. No.

PROPOSED INTERPRETATION

Inquiry No.	**19-87** **NBIC Location: Part 3, 5.6**
Source	Robert Underwood
Subject	Form Registration Log • Background: Many "R" (or "NR"?) Certificate Holders now use the National Board EDT system to register "R" Forms. All of the required log information in Paragraph 5.6 of Part 3 is available in EDT, therefore it is unnecessary and redundant for "R" Certificate Holders to maintain a separate log outside the EDT system.
Edition	2019
Question	1. If an "R" Certificate Holder uses the EDT system to register repairs and alterations may the Form Registration Log requirement be waived?
Reply	1. Yes.
Committee's Question	1. Does an "R" or "NR" Certificate Holder exclusively using National Board Electronic Data Transfer system (EDT) for registration of Form "R" Reports meet the Form Registration Log requirements of Part 3, 5.6 of the NBIC? ~~2. Must the Certificate Holder address the method of Form Registration Log documentation in their Quality Control Manual?~~
Committee's Reply	1. Yes, provided the Certificate Holder addresses the method of Form Registration Log documentation, access, and control in their Quality System ~~Manual~~. ~~2. Yes.~~
	The National Board EDT system has all of the NBIC Part 3, 5.6 Form Registration Log requirement's and can be accessed for review by all users. The EDT Home page states: the capability to meet the log requirements of NB-264, *Criteria for Registration* for manufacturing organizations, and the requirements of the NBIC for Form Registration Logs for **R** Certificate Holders.
SC Vote	
NBIC Vote	
Negative Vote Comments	

PROPOSED INTERPRETATION

Inquiry No.	**20-1**
Source	**Michael Coggan,** Boiler Inspector, Technical Inspection Services , *Justice and Public Safety,* Phone: 506-343-0327, E-mail: michael.coggan@gnb.ca
Subject	NBIC Part 3, paragraph 3.3.2 **Backgound:** ASME B31.3 Normal Fluid Service and Severe Cyclic have mandatory requirements for radiography.
Edition	2019
Question 1	Are "Routine Repairs" permitted for ASME B31.3 Normal Fluid Service and Severe Cyclic piping?
Proposed Reply 1	No.
Committee's Question 1	For process piping classified as Normal Fluid Service and under Severe ~~Cycling~~Cyclic conditions ~~service~~ in accordance with ASME B31.3 Process Piping, may routine weld repairs be performed in accordance with Part 3 of the NBIC?
Committee's Reply 1	~~Yes, provided routine weld repairs have been described in the R-Certificate holders Quality System program and routine weld repairs have been accepted by the Inspector, and when required, by the Jurisdiction.~~ Yes, provided the requirements of Part 3, 3.3.2 are met and routine weld repairs have been accepted by the Inspector, and when required, by the Jurisdiction.
Rationale 1	
Question 2	Are "Routine Repairs" permitted for ASME B31.3 Category D Service piping?
Proposed Reply 2	Yes.
Committee's Question 2	Are "Routine Repairs" permitted for ASME B31.3 Category D Service piping?
Committee's Reply 2	Yes, provided the requirements of Part 3, 3.3.2 are met and routine weld repairs have been accepted by the Inspector, and when required, by the Jurisdiction.
Rationale 2	
SC Vote	
NBIC Vote	

Negative Vote Comments	

PROPOSED INTERPRETATION

Inquiry No.	**20-2**
Source	**Michael Ferry,** Curran International, Field Project Supervisor (Re-tube & Liners), +1 281 339 9993 Phone, "Mike Ferry" <mferry@curranintl.com>
Subject	NBIC Part 3, Table 2.3 – Latest 2018 AWS SWPS to be used in accordance with the 2019 NBIC for Repairs/Alterations **Background**: Since Item 18-102 (updating the SWPS Table 2.3 in Part 3 to the current 2018 AWS standards – **Attachment 1**) was not passed by MC until after the 2019 was published, a number of SWPS's as listed in the 2019 Edition of the NBIC, Table 2.3 are not current.
Edition	2019
Question	Is it the intent of the NBIC to accept the use of the following Standard Welding Procedure Specifications for repairs and/or alterations in accordance with the 2019 NBIC? B2.1-1-016: 2018 B2.1-1-017: 2018 B2.1-1-019: 2018 B2.1-1-020: 2018 B2.1-1-021: 2018 B2.1-1-022: 2018 B2.1-8-023: 2018 B2.1-2-026: 2018 B2.1-1-027: 2018
Proposed Reply	Yes.
Committee's Question	
Committee's Reply	
Rationale	**Item 18-102 was approved by Main Committee for use of these 2018 SWPS's in the 2021 Edition of the NBIC. This Intent Interpretation Item would allow use of these SWPS's once approved.**
SC Vote	
NBIC Vote	
Negative Vote Comments	

ATTACHMENT 1 – Item 18-102 approved by Main Committee – To be published in 2021 Edition of the NBIC

NB Item # 18-102 Update NBIC Part 3, Table 2.3 (01-16-2019)

Revise Table 2.3 adding the listed SWPSs that were revised by the AWS B2 Committee in 2018.

PROPOSED REVISION

TABLE 2.3

Standard Welding Procedure Specification (SWPS) for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1, Group 1 or 2) 1/8 inch [3 mm] through 1-1/2 inch [38 mm] Thick, E7018, in the As-Welded or PWHT Condition, Primarily Plate and Structural Applications.	B2.1-1-016: 2018
Standard Welding Procedure Specification (SWPS) for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1, Group 1 or 2) 1/8 inch [3 mm] through 1-1/2 inch [38 mm] Thick, E6010, in the As-Welded or PWHT Condition, Primarily Plate and Structural Applications.	B2.1-1-017: 2018
Standard Welding Procedure Specification (SWPS) for CO_2 Shielded Flux Cored Arc Welding of Carbon Steel (M-1/P-1, Group 1 or 2) 1/8 inch [3 mm] through 1-1/2 inch [38 mm] Thick, E70T-1C and E71T-1C, in the As- Welded, Primarily Plate and Structural Applications.	B2.1-1-019: 2018
Standard Welding Procedure Specification (SWPS) for 75% Ar/25%CO_2 Shielded Flux Cored Arc Welding of Carbon Steel (M-1/P-1, Group 1 or 2) 1/8 inch [3 mm] through 1-1/2 inch [38 mm] Thick, E70T-1M and E71T-1M, in the As-Welded or PWHT Condition, Primarily Plate and Structural Applications.	B2.1-1-020: 2018
Standard Welding Procedure Specification (SWPS) for Gas Tungsten Followed by Shielded Metal Arc Welding of Carbon Steel (M-1/P-1, Group 1 or 2) 1/8 inch [3 mm] through 1-1/2 inch [38 mm] Thick, ER70S-2 and E7018, in the As-Welded or PWHT Condition, Primarily Plate and Structural Applications.	B2.1-1-021: 2018
Standard Welding Procedure Specification (SWPS) for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1, Group 1 or 2) 1/8 inch [3 mm] through 1-1/2 inch [38 mm] Thick, E6010 (Vertical Uphill) Followed by E7018, in the As-Welded or PWHT Condition, Primarily Plate and Structural Applications.	B2.1-1-022: 2018
Standard Welding Procedure Specification (SWPS) for Shielded Metal Arc Welding of Austenitic Stainless Steel (M-8/P-8, Group 1) 1/8 inch [3 mm] through 1-1/2 inch [38 mm] Thick, in the As-Welded Condition, Primarily Plate and Structural Applications.	B2.1-8-023: 2018
Standard Welding Procedure Specification (SWPS) for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1, Group 1 or 2) 1/8 inch [3 mm] through 1-1/2 inch [38 mm] Thick, E6010 (Vertical Downhill) Followed by E7018, in the As-Welded or PWHT Condition, Primarily Plate and Structural Applications.	B2.1-2-026: 2018
Standard Welding Procedure Specification (SWPS) for Self-Shielded Flux Cored Arc Welding of Carbon Steel (M-1 or P-1, Groups 1 and 2), 1/8 inch [3 mm] through 1/2 inch [13 mm] Thick, E71T-11, in the As-Welded Condition, Primarily Plate and Structural Applications	B2.1-1-027:2018

PROPOSED INTERPRETATION

Inquiry No.	**20-3**
Source	Nathan Carter, Hartford Steam Boiler
Subject	Inspector Involvement for Fitness-for-Service Assessments **Background:** The below questions are intended to gain clarity as to first which Inspector (i.e. "IS" Commissioned or "R" Endorsement) signs the FFSA Form NB-403 when an "R" Certificate Holder is involved with a repair in that region as well as determine what level of review of the Fitness-for-Service the Inspector is expected to complete. If it is an Inspector holding a "R" Endorsement with an AI Commission (not tested on NBIC Part 2), shouldn't the relevant pages in NBIC Part 2 concerning Fitness for Service be included in their tested body of knowledge, so they are aware of the detailed rules?
Edition	2019; Part: Inspection & Repairs and Alterations; Section: 4 & 3; Paragraph: 4.4; Form NB-403; & 3.3.4.8
Question	Question 1: In accordance with NBIC Part 3, 3.3.4.8, a fitness-for-service condition assessment as described in NBIC Part 2, 4.4 shall be completed and adequately documented on the FFSA Form NB-403. Once Form NB-403 is completed, is it required that the Inspector signing this Form hold a National Board "R" Endorsement as described in RCI-1/NB-263? Question 2: NBIC Part 2 4.4.1 d) states that the Inspector shall indicate acceptance of the Report of FFSA by signing. Paragraph 4.4.3 b) states that the Inspector shall review the condition assessment methodology and ensure that the inspection data and documentation are in accordance with Part 2. Is the Inspector's signature on Form NB-403 an indication that the condition assessment and recommendations completed by the Engineer have been fully reviewed for appropriateness and accuracy by the Inspector? Question 3: If the answer to Question 2 is No, is the Inspector's signature on Form NB-403 an indication of acceptance solely on the basis of review of the Form for completeness and verification that the requirements outlined in 4.4 were addressed?
Reply	Proposed Reply 1: Yes Proposed Reply 2: No Proposed Reply 3: Yes
Committee's Question	
Committee's Reply	
Rationale	

Item #: NB15-1405
Revision: 1
Date: January 14, 2020
Subject: Clarification of Impact Testing Rules for Repairs

Justification:
This revision was generated to address an interpretation asking whether production impact test plates were required for repair of vessels made from P-No 11B materials, when no extra material from one of the heats exist. Where extra material does not exist from one of the heats, the original code of construction would require existing material from the vessel to be used. This would require the vessel to be further damaged with material being cut out to serve as a test plate.

Initially this interpretation was meant to address only P-No 11B material; however, this same problem exists for all vessel materials. As a result, the following proposal was generated.

INSERT NEW PARAGRAPHS:

3.3.6 Pressure Vessel Impact Testing

3.3.6.1 Welding procedures used for repairs shall be qualified with impact testing when required by the original code of construction. The requirements for impact testing shall be in accordance with the rules of the original code of construction.

3.3.6.2 When the original code of construction requires the welding and testing of production impact test plates, the welding of production impact test plates shall be in accordance with the rules of the original code of construction. ~~The production impact test plates shall be from the material in the vessel. When this is not practicable, the material may be from the same P-No and Group Number as the material being repaired.~~

3.3.6.3 The test material for the welding procedure qualification and for the production impact test plate shall be of the same material specification (including specification type, grade, class, and condition of heat treatment) as the material being repaired. In the event that the notch toughness of the material to be repaired is unknown, evidence from tests of that material or from another acceptable source (see NBIC Part 3, 2.5.3) may be

used for the base metal notch toughness when qualifying the WPS as required in NBIC Part 3, 2.5.3.2 h).
In the event that the original material specification is obsolete, the test material used should conform as closely as possible to the original material used for construction based on nominal composition and carbon equivalent (IIW Formula CE = C + Mn/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15; elements are expressed in Weight Percent Amounts), but in no case shall the material be lower in strength.

NB16-1403 adds information on repair of high pressure vessels to Supplement 4 of Part 3. Due to the greater pressure, and resulting increased wall thicknesses, additional guidance was appropriate for pressure vessels with high design pressures, i.e. 1500 psi to 15000 psi, compared with vessels with design pressures from 200 psi to 1500 psi. Changes include identification of additional inspection tools, identifying minor defects and how to repair them so defects are mitigated and do not grow, how to confirm the repair is satisfactory, and identifying defects that are not repairable. A final hydrostatic proof test is required, and there shall be no delamination of the repaired area.

PART 3
SUPPLEMENT 4
REPAIR AND ALTERATION OF FIBER-REINFORCED THERMOSETTING PLASTIC PRESSURE EQUIPMENT

S4.1 SCOPE

…

S4.2 INSPECTOR QUALIFICATIONS

…

S4.3 TOOLS

The following tools may be required by the Inspector:
a) adequate lighting including overall lighting and a portable lamp for close inspections;
b) handheld magnifying glass;
c) Barcol hardness tester;
d) small pick or pen knife;
e) small quantity of acetone and cotton swabs;
f) camera with flash capability; ~~and~~
g) liquid penetrant testing kit;
h) depth and length gages; and
i) metallic tap tester (e.g. quarter dollar).

S4.4 LIMITATIONS

…

S4.5 REPAIR LIMITATIONS FOR FILAMENT WOUND VESSELS

When the MAWP is greater than 200 psig (1.38 MPa), and less than 1500 psi (10.34 MPa) field repair of filament wound ASME Code Section X, Class I vessels shall be limited to corrosion barrier or liner repairs only, provided there is access to the vessel interior. ~~No s~~Structural repairs~~, re-rating, or alterations~~ are allowed for filament wound ASME Code Section X, Class 1 vessels that have an MAWP equal to or greater than ~~200 psig (1.38 MPa)~~ 1500 psi (10.34 MPa) and Class III vessels in accordance with the requirements of S4.19.

S4.6 VESSELS FABRICATED USING ELEVATED TEMPERATURE CURED RESIN SYSTEMS

…
…
…

S4.18 REPAIR AND ALTERATION METHODS

…

S4.19 REPAIR OF HIGH PRESSURE FILAMENT WOUND VESSELS

S4.19.1 Scope

Types of damage that are addressed in this section include abrasion, cuts and scratches, impact, chemical, fire and heat, and weathering.

S4.19.2 Level of damage

- Level 1 damage, up to 0.010 inch, is repairable any time
- Level 2 damage, defined by the manufacturer (or up to 0.050 if not defined), is repairable with the manufacturer's concurrence

- Level 3 damage, defined by the manufacturer (or 0.050 or greater if not defined), is not repairable

Softening of the resin due to chemical attack, or charring due to exposure to fire, ~~are considered to be~~shall be defined as Level 3 damage.

The manufacturer's guidance for assessing damage depth and levels shall be followed if it conflicts with general guidelines in this document.

Table S4.19.2-1 Damage Levels and Assessment

Type of damage	**Definition**				**Comment**
		Level 1 — accept	**Level 2**	**Level 3 — reject**	
Cuts/scratches	A sharp impression where material has been removed or redistributed	When depth is less than 0.010 in	Depth from 0.010 in to the limit defined by the manufacturer, or 0.050 if not defined.	Greater than the limit defined by the manufacturer, or greater than 0.050 if not defined	
Abrasion	An area that is scuffed or worn thinner by rubbing or scraping	When depth is less than 0.010 in	Depth from 0.010 in to the limit defined by the manufacturer, or 0.050 if not defined.	Greater than the limit defined by the manufacturer, or greater than 0.050 if not defined	
Charring/soot	Blackening or browning of an area, burning of an area	Soot only, which washes off	Minor discolouration; manufacturer's recommendation	Charring	
Chemical attack, including stress corrosion cracking	Vessel is subjected to a chemical that softens or dissolves the composite	Residue may be cleaned off, no evidence of softening or dissolving.	Permanent discoloration.	Softening or dissolving of the material, cracking of the composite due to stress and chemical exposure	
Impact	Composite material was struck or hit; the resin has a frosted or smashed appearance	Damaged area is less than 0.20 in^2 and no other damage is apparent	Damage is uncertain, requiring the manufacturer's advice	Permanent deformation of cylinder or liner, evidence of underlying delamination	
Weathering	Composite affected by UV exposure and general weather	Minor gloss loss or chalking, only non-structural materials affected.	Structural laminate affected to a level less than defined by the manufacturer, or 0.050 inch.	Structural laminate affected to a level greater than defined by the manufacturer, or 0.050 inch	

S4.19.3 Thickness considerations

Damage to a depth greater than 5% of the structural laminate thickness is not repairable, and the vessel shall be removed from service. Depth of damage does not include paint thickness, or material designated by the manufacturer as protective (non-structural) rather than structural.

S4.19.4 Impact damage considerations

Impact damage may result in rejection, without possibility of repair, regardless of the measurable depth due to risk of internal fracture or delamination. Impact damage may be characterized by noting permanent deformation, softness or deflection of the surface, or localized surface crazing.

S4.19.5 Assessment of damage depth

All loose fibers and affected resin ~~are to~~shall be removed. This includes material that is softened by actions of chemicals or heat. Confirmation that the material remaining is sound shall be determined by a tap test, Barcol hardness measurement, and/or visual inspection.

S4.19.6 Repair procedure

a) Non-structural material, including paint, shall be removed from any area involved in the repair.
b) Resin used in structural repairs shall be compatible with the resin used to fabricate the vessel.
c) Cloth patches made of glass or carbon fiber may be used in the repair and to cover the repaired area.
    1) Cloth patches shall extend at least 0.5 inches beyond the edge of the repair area, and subsequent layers ~~must~~shall extend at least 0.25 inch beyond the edge of the previous patch.
    2) Total patch thickness shall not be more than 5% of the structural thickness of the original laminate.
d) A layer of fiber wound continuously in the hoop direction may be applied over the repair.
e) Non-structural material may be applied to the repaired area for protection if originally used in the vessel design.
f) The repaired area may be covered with epoxy, polyurethane, or other compatible paint.
g) The repaired area shall be cured at a temperature that will not degrade the resin in the vessel. It may be cured prior to applying any non-structural material or paint.
h) The repair shall be confirmed by either:
    1) A tap test or Barcol hardness measurement conducted on the structural material after cure and prior to applying any non-structural material or paint, or
    2) A Modal Acoustic Emission test, in accordance with Part 2 S10.10, conducted after cure of the structural material
i) A hydrostatic proof test shall be conducted following confirmation of the repair.

S4.19.7 Acceptance of the vessel for return to service

The repair shall meet the repair confirmation requirement (i.e. confirmation of soundness using the tap test or Barcol hardness measurement, or confirmation using MAE). There shall be no delamination of the repaired area resulting from ~~thea~~ hydrostatic proof test in accordance with the Design Specification. A vessel that does not meet the requirements of the repair confirmation or hydrostatic proof test shall not be returned to service.

Item 17-137
Part 3, S4.18.2.1 2) d. 2. and 4.

1) …

2) Applying Test Patches to Verify Adequate Surface Preparation

a. Test patches should be applied to any substrate that will require a secondary bond to determine the integrity of the primer bond prior to the application of the laminate.

b. The subsequent steps shall be followed:

1. Apply the primer (0,003 -0.005 in. (0.08 to 0.13 mm)) to the prepared surface, and allow primer to cure.

2. Coat the primed surface with the same resin to be used in the laminate repair. Apply 4 in. (100 mm) x 14 in. (360 mm) piece of polyester, such as Mylar®, strip to one edge of primed area. Allow the polyester film to protrude from beneath the patch.

3. Apply two layers of 1-1/2 oz/sq. ft (0.46 kg/sq. m) chopped strand mat saturated with the same resin that will be used for the repair. Mat shall be 12 in. (305 mm) x 12 in. (305 mm) square.

4. Allow the mat layers to cure completely, this may be verified by checking the hardness of the laminate.

5. Pry patch from surface using a screwdriver, chisel, or pry bar.

6. A clean separation indicates a poor bond.

7. Torn patch laminate or pulled substrate indicates that the bond is acceptable.

c. If the bond is not adequate, go back to step a) and repeat the procedure.

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

d. As a last resort, if the previous procedure does not provide an adequate bond, the permeated laminate must be handled differently using the following procedure:

1. Hot water wash the equipment.

2. Abrasive blast ~~with #3 sand, or equal~~ to achieve a 0.003 to 0.005 in. (0.08 to 0.12 mm) anchor pattern, and allow to completely dry.

3. Prime with the recommended primer, an area 12 in. (305 mm) x 12 in. (305 mm) and apply a test patch.

4. Prime a second spot 12 in. (305 mm) x 12 in. (305 mm) and prime with a recommended ~~epoxy resin~~ alternate primer.

5. Allow this primer to cure.

Part 3, S4.18.2.2 2)

1) …

2) Note that any cracks, delaminations, or permeated surfaces must be removed. If the damage is deeper than the corrosion barrier and the material removed reaches the structural laminate, the vessel is not repairable. An adequate size abrasive or proper sanding disc must be used to obtain a ~~0.003 to 0.005~~ 0.002 to 0.003 in (0.05 to 0.08 mm) anchor pattern to the area that requires the repair.

3) Preparation of any surface requires that basic rules, common to all substrates, be followed. These rules are as outlined below:

   a. Surface must be free of contaminants;

   b. Surface must be structurally sound;

   c. Surface must have adequate anchor pattern;

   d. Surface must be dry;

   e. Surface must be primed with recommended primer.

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

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1.) Remove the word sand in the abrasive blasting procedure. The NBIC should not be recommending a procedure that can give the blast operator silicosis. The phase Abrasive blasting should be sufficient. That stills leaves the blasting company the option of using sand or whatever material desired.

2.) Make the thickness measures the same where they were supposed to be.

3.) Not to recommend a specific type primer with the removal of the word epoxy. There are multiple types of primers that can be tried. By removing epoxy it doesn't mean you can't use an epoxy primer.

NBIC Subcommittee R&A Action Block

Subject Code Revision to Part 3, 2.5.3.6

File Number NB18-13 **Prop. on Pg.** 2

Proposed Revision Statement of Need The revision is to add a new Welding Method 7 to allow for dissimilar metal welding of Grade 91 to austenitic steels and low alloy steels in a boiler setting and limited to butt welds, in accordance with approved welding method 6.

Project Manager John Siefert/G. Galanes

SubGroup Negatives **SG Meeting Date**

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

Update for January 14, 2020. The item was letter balloted at the subcommittee level and revew+comment balloted at the main committee level. At the subcommittee level, the item passed with 11 approve and 1 disapprove. There were three separate editorial comments which are described below. At the main committee level there were 10 approve, 1 abstention and no comments.

The comments received at the subcommittee are addressed in the following ‘rev 4’ document. The comments were as follows:

1. Brian Boseo provided suggested a very minor edit to clarify ‘and nickel alloys’ in one of the subheadings. This has not been incorporated, but his suggestion to clarify the materials was taken into account and clarified in the rev 4 document by listing relevant P-Nos. A similar comment was raised by Ben Schaeffer.
2. Kathy Moore made two suggestions, all of which were addressed:
    a. Consistent wording – tube material or tubing?
    b. The values listed for the preheat and interpass temperatures in Fahrenheit and Celsius were different.
3. Ben Schaeffer made several suggestions, all of which were addressed:
    a. I would very much like to see "nonpressure attachments" added to the list of acceptable uses
    b. For the second arrangement 91 to P5A we may use GTAW (root and fill) or GTAW (root) with SMAW (fill). I don't believe we can us either of the

SMAW electrodes listed to root these welds. May I suggest rewording paragraph 2 to try and clarify this?

c. In the very first paragraph you use the terminology "low alloy ferritic steel tubing" which I believe is intended to mean P5A, can we match up this specific reference to the second arrangement where we are talking about P5A tubing to kind of close the loop.

In addition to these comments, the redundancy has been removed and consolidated to make the requirements and verbiage mirror Welding Method 5 or Welding Method 6 where appropriate.

Update for January 15, 2020. It was suggested to clarify verbiage in proposed 2.5.3.7 d) "…and to non-pressure part welds…"

NBIC Subcommittee R&A Action Block

NB Item 18-13

2.5.3.7 WELDING METHOD 7

When using this welding method, the following applies:

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

b) The materials shall be limited to ASME P-No. 15E, Group 1 joined to either P-No. 5A or P-No. 8, P-No. 42, P-No. 43 or P-No. 45, as permitted for welded construction by the applicable rules of the original code of construction.

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

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

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

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

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

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

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

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

minimum preheat temperature is maintained during welding and until welding is completed.

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

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

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

5) For the joining of ASME P-No. 15E, Group 1 to P-No. 8, P-No. 42, P-No. 43 or P-No. 45, the filler metal shall be limited to an austenitic, nickel-base filler metal to those assigned to F-No. 43 in ASME Section IX, QW-432 and limited to the following consumables: ERNiCr-3, ENiCrFe-3, ENiCrFe-2, ASME B&PV Code Cases 2733 and 2734.

(19) **TABLE 1.5.1**

Form "R" Reports, Records, or Documents	Instructions	Minimum Retention Period
a) Form "R" Reports and supporting records and documentation	The organization performing repairs and alterations shall retain a copy of the completed "R" Form report on file, and all records substantiating the summary of work described in NBIC Part 3, ~~5.12.4.1~~ Tables S9.2 and S9.3 of Supplement 9, Item ~~12~~19, for a minimum of 5 years. When the method of repair described in NBIC Part 3, 3.3.4.8 is used, the record retention period shall be described in b).	5 years
b) Form "R" Report with REPORT OF FITNESS FOR SERVICE ASSESSMENT FORM (NB-403) attached.	When the method of repair described in NBIC Part 3,3.3.4.8 is used, the record retention period shall be for the duration described on the FITNESS FOR SERVICE ASSESSMENT (FFSA) Form required by the repair method and as described in NBIC Part 2, 4.4. Notes: 1. The "R" Certificate Holder should be aware that when used, some of the referenced codes and standards identified in NBIC Part 2,, 1.3 describe requirements for permanent record retention throughout the service life of each equipment item. 2. When the "R" Certificate Holder is not the owner or user of the equipment, the record retention period is limited to the FFSA-results described on line 8 of the Report of Fitness for Service Assessment Form (NB-403).	5 years or as described on line 8 as reported on Form NB-403; whichever period is longer.
c) Continuity records for a welder, welding operator, bonder, or cementing technician.	Minimally, continuity records for a welder, bonder, or cementing technician within the Certificate Holder's quality system shall be described and established at the time of the applicant's initial certificate review and demonstrated at each triennial review required thereafter.	As applicable to the scope of work identified on the *Certificate of Authorization*, the continuity records are subject to review during each National Board triennial certificate review. Continuity records shall be maintained for a minimum of 5 years.

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

5.1 SCOPE

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

(19) 5.2 DOCUMENTATION

a) Repairs that have been performed in accordance with the NBIC shall be documented on a Form R-1, *Report of Repair*, as shown in Supplement S9.2~~this section~~. A Form R-4, *Report Supplement Sheet*, as shown in Supplement S9.5, shall be used as needed to record additional data when the space provided on Form R-1 is not sufficient.

b) Alterations performed in accordance with the NBIC shall be documented on a Form R-2, *Report of Alteration*, as shown in Supplement S9.3~~this section~~. A Form R-4, *Report Supplement Sheet*, as shown in Supplement S9.5, shall be used as needed to record additional data when the space provided on Form R-2 is not sufficient.

c) The organization performing repairs and alterations shall retain a copy of the completed Form "R" Report on file and all records and documentation substantiating the summary of work as described throughout Section 5, and as identified in the "R" Certificate Holder's Quality System Manual. (19)

5.2.1 PREPARATION OF FORM R-1 REPORT OF REPAIR

a) Using the instructions found ~~at NBIC Part 3, 5.12.4.1~~ in Table S9.2 of Supplement 9, preparation of Form R-1 shall be the responsibility of the "R" Certificate Holder performing the repair.

b) Information describing the scope of work used to repair a pressure-retaining item (PRI) shall be documented on a Form R-1 and extended to a Form R-4 as needed to fully describe the repair activities completed per the instructions ~~at NBIC Part 3, 5.12.4.1~~ in Table S9.2 of Supplement 9.

c) An Inspector shall indicate acceptance by signing Form R-1, and Form R-4, if attached.

d) The Form R-3, *Report of Parts Fabricated by Welding,* Manufacturer's Data Reports, and Certificates of Compliance described in this section shall be a part of the completed Form R-1 and shall be attached thereto. (19)

5.2.2 PREPARATION OF FORM R-2 REPORT OF ALTERATION

a) Using the instructions found ~~at NBIC Part 3, 5.12.4.2, Initial~~ in Table S9.3 of Supplement 9, initial preparation of Form R-2 shall be the responsibility of the "R" Certificate Holder responsible for the design portion of the alteration. The design organization shall complete and sign the "Design Certification" section of the Form R-2. An Inspector shall indicate acceptance of the design by signing the "Certificate of Design Change Review" section of the Form R-2.

b) The information describing an alteration to a pressure-retaining item shall be identified on Form R-2 with a complete description of the scope of work for physical or non-physical changes. When the scope of work represents a change that will increase the Minimum Required Relieving Capacity (MRRC) of a pressure-retaining item, such as a change in heating surface, Maximum Designed Steaming Capacity (MDSC), or BTU/hr (W) heating capacity, the new MRRC shall be documented on Form R-2 and indicated on the appropriate nameplate of NBIC Part 3, Figure 5.7.5-b or NBIC Part 3, Figure 5.7.5-c.

c) Final preparation of Form R-2, including gathering and attaching supporting reports, shall be the responsibility of the “R” Certificate Holder that performed the construction portion of the alteration. The construction organization shall complete the Form R-2 provided by the design organization, including the “Construction Certification” section of the form. An Inspector shall indicate that the work complies with the applicable requirements of this code by completing and signing the “Certificate of Inspection” section of the form. When no construction work is performed (e.g., a re-rating with no physical changes), the “R” Certificate Holder responsible for the design shall prepare the Form R-2, including gathering and attaching of supporting documentation.

d) The following shall be attached to and become a part of completed Form R-2:

1) For ASME boilers and pressure vessels, a copy of the original Manufacturer’s Data Report, when available;

2) Form R-3, Report of Parts Fabricated by Welding, Manufacturer’s Partial Data Reports, or Certificates of Compliance, if applicable; and

3) For other than ASME, the manufacturer’s reports (i.e., reports required by the original code of construction, etc.), when available.

5.2.3 PREPARATION OF FORM R-3 REPORT OF PARTS FABRICATED BY WELDING (19)

Using the instructions found ~~at NBIC Part 3, 5.12.4.3~~ in Table S9.4 of Supplement 9, preparation of Form R-3 shall be the responsibility of the “R” Certificate Holder responsible for performing the work.

5.2.4 PREPARATION OF FORM R-4 REPORT SUPPLEMENT SHEET (19)

Using the instructions found ~~at NBIC Part 3, 5.12.4.4~~ in Table S9.5 of Supplement 9, preparation of Form R-4 shall be the responsibility of the “R” Certificate Holder responsible for performing the work.

5.3 DISTRIBUTION OF FORM R-1

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

b) Distribution of Form R-1 and attachments shall be the responsibility of the organization performing the repair.

5.4 DISTRIBUTION OF FORM R-2

a) Distribution of completed Form R-2 shall be the responsibility of the “R” Certificate Holder who performed the construction portion of the alteration. When no construction work is performed (e.g., a re-rating with no physical changes), the “R” Certificate Holder responsible for the design shall distribute the form.

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

5.5 REGISTRATION OF FORMS — GENERAL

a) When registration of the forms are required, the Certificate Holder performing a repair or alteration shall submit the completed form, meeting the requirements of the NBIC, to the National Board.

b) When registration of the forms is not required, the Certificate Holder may register the completed form, meeting the requirements of the NBIC, with the National Board.

c) The “R” or “NR” Certificate Holder should be aware that some Jurisdictions may require registration of repairs and alterations with the National Board.

5.5.1 REGISTRATION FOR REPAIRS

Form R-1 may be registered with the National Board as noted in NBIC Part 3, 5.5.

5.5.2 REGISTRATION FOR ALTERATIONS

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 registered with the National Board, one original Form R-2, together with attachments, may be registered with the National Board or retained as required by the Quality System Manual.

5.5.3 REGISTRATION FOR FIBER-REINFORCED VESSELS

Organizations performing repairs or alterations under an “R” stamp program shall register such repairs or alterations with the National Board.

5.5.4 REGISTRATION FOR NUCLEAR REPAIR/REPLACEMENT ACTIVITIES

Organizations performing repair/replacement activities under the “NR” or “NVR” stamp program shall register forms with the National Board.

5.5.5 REGISTRATION FOR GRAPHITE VESSELS

Organizations performing repair/replacement activities under the “R” stamp program shall register such repairs or alterations with the National Board.

(19) 5.6 FORM REGISTRATION LOG

“R” or “NR” Certificate Holders shall maintain a log or multiple logs documenting unique and sequentially numbered Form “R” Reports that are registered with the National Board. The logs shall include, as a minimum, each form’s unique registration number, type (R-1, R-2, NR-1, etc.), description of work performed, date of acceptance by the Authorized Inspection Agency, and date the report was submitted to the National Board.

5.7 STAMPING REQUIREMENTS FOR REPAIRS AND ALTERATIONS

5.7.1 GENERAL

The stamping of or attachment of a nameplate to a pressure-retaining item shall indicate that the work was performed in accordance with the requirements of this code. Such stamping or attaching of a nameplate shall be done only with the knowledge and authorization of the Inspector. The “R” Certificate Holder responsible for repair or the construction portion of the alteration shall apply stamping. For a re-rating where no physical changes are made to the pressure-retaining item, the “R” Certificate Holder responsible for design shall apply stamping.

5.7.2 STAMPING REQUIREMENTS FOR REPAIRS

a) Pressure-retaining items repaired in accordance with the NBIC shall be stamped as required by this section.

b) Subject to the acceptance of the Jurisdiction and the concurrence of the Inspector, nameplates and stamping may not be required for routine repairs (see NBIC Part 3, 3.3.2). In all cases, the type and extent of repairs necessary shall be considered prior to waiving the requirement.

c) Stamping or nameplate shall be applied adjacent to the original manufacturer's stamping or nameplate. A single repair nameplate or stamping may be used for more than one repair to a pressure-retaining item, provided each is carried out by the same certificate holder. The date of each repair, corresponding with the date on associated Form R-1, shall be stamped on the nameplate.

5.7.3 STAMPING REQUIREMENTS FOR ALTERATIONS

Pressure-retaining items altered in accordance with this code shall have a nameplate or stamping applied adjacent to the original manufacturer's stamping or nameplate in accordance with this section. For an alteration where physical changes are made to the pressure-retaining item, the "R" Certificate Holder responsible for the construction portion of the alteration shall apply the stamping or nameplate. For an alteration where no physical changes are made to the pressure-retaining item (e.g., a re-rating) the "R" Certificate Holder, assuming responsibility for the design, shall apply the stamping or nameplate.

5.7.4 STAMPING REQUIREMENTS FOR PARTS

Stamping or nameplate shall be applied in a conspicuous location on the part.

5.7.5 SPECIFIC REQUIREMENTS FOR STAMPING AND NAMEPLATES

a) Required data shall be in characters of at least 5/32 in. (4 mm) high, except that characters for pressure relief valve repair nameplates may be smaller. Markings may be produced by casting, etching, embossing, debossing, stamping, or engraving. The selected method shall not result in any harmful contamination, or sharp discontinuities to, the pressure-retaining item. See NBIC Part 3, Figures 5.7.5–a through 5.7.5-e.

b) The National Board Code Symbols ("R","VR", and "NR") are to be stamped; do not emboss.

c) Stamping directly on items, when used, shall be done with blunt-nose continuous or blunt-nose interrupted dot die stamps. If direct stamping would be detrimental to the item, required markings may appear on a nameplate affixed to the item.

d) The certificate holder shall use its full name as shown on the *Certificate of Authorization* or an abbreviation acceptable to the National Board.

e) The letters "RP" shall be stamped below the "R" Symbol Stamp to indicate organizations accredited for performing repairs or alterations to fiber-reinforced plastic items.

f) The letter "G" shall be stamped below the "R" Symbol Stamp to indicate organizations accredited for performing repairs or alterations to graphite pressure equipment.

g) The subject nameplate shall be securely attached using a method compatible with the structure or stand-off bracket supporting the nameplate, in a manner that will impede easy removal. The method of attaching this nameplate, as permitted by the original code of construction, may include, but is not limited to:

    1) Welding

2) Adhesive, bonding or cementing

3) Tamper-resistant mechanical fasteners of suitable metal construction

FIGURE 5.7.5-a

REQUIRED MARKINGS FOR REPAIRS, WITH USE OF NATIONAL BOARD FORM R-1

REPAIRED BY

CERTIFICATE HOLDER

NATIONAL BOARD "R" CERTIFICATE NUMBER

DATE REPAIRED

FIGURE 5.7.5-b

REQUIRED MARKINGS FOR ALTERATIONS, WITH USE OF NATIONAL BOARD FORM R-2

ALTERED BY

CERTIFICATE HOLDER

M.A.W.P. P.S.I.

AT °F

NATIONAL BOARD "R" CERTIFICATE NUMBER

DATE ALTERED

FIGURE 5.7.5-c

REQUIRED MARKINGS FOR RE-RATINGS, WITH USE OF NATIONAL BOARD FORM R-2

RE-RATED BY

CERTIFICATE HOLDER

M.A.W.P. P.S.I.

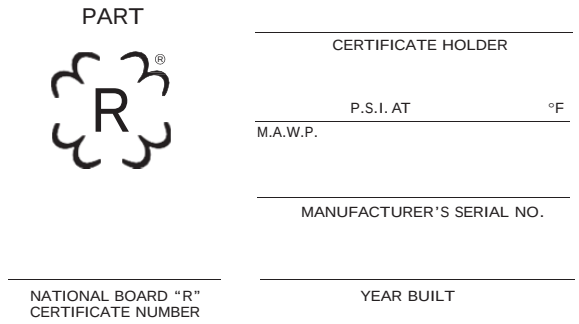
AT °F

NATIONAL BOARD "R" CERTIFICATE NUMBER

DATE ALTERED

FIGURE 5.7.5-d

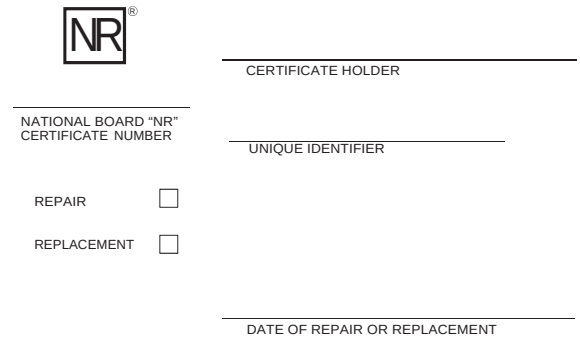
REQUIRED MARKINGS FOR PARTS FABRICATED BY WELDING, WITH USE OF NATIONAL BOARD FORM R-3



Note 1: To be indicated only when changed.

FIGURE 5.7.5-e

REQUIRED MARKINGS FOR NUCLEAR REPAIRS OR REPLACEMENTS



5.8 STAMPING FOR FIBER-REINFORCED VESSELS

The attachment of a nameplate to a repaired or altered vessel or tank shall indicate that work was performed in accordance with requirements of this code. The attachment of a nameplate shall be done only with knowledge and authorization of the Inspector. The certificate holder responsible for repair or alteration shall apply the stamping nameplate. Required stamping and nameplate information are shown in NBIC Part 3, 5.7.

5.8.1 STAMPING FOR REPAIRS

Pressure-retaining items repaired in accordance with the NBIC shall have a nameplate as required by NBIC Part 3, 5.7. Subject to the acceptance of the Jurisdiction and the concurrence of the Inspector, nameplates may not be required for routine repairs (See NBIC Part 3, 5.7.2 b). In all cases, the type and extent of repairs necessary shall be considered prior to waiving the requirement.

5.8.2 STAMPING FOR ALTERATIONS

The nameplate shall be applied in accordance with NBIC Part 3, 5.7. Location of nameplate shall be documented under "Remarks" on NBIC Form R-2 line 9.

5.9 STAMPING REQUIREMENTS FOR YANKEE DRYERS

a) Stamping is not required for repairs that do not affect pressure-retaining capability of the Yankee shell, as indicated on the De-rate Curve, or other pressure-retaining parts, as indicated on the original Manufacturer's Data Report.

b) Stamping is required for repairs that affect pressure-retaining capability of the Yankee Dryer shell, as indicated on the De-rate Curve, or other pressure-retaining parts as indicated on the original Manufacturer's Data Report.

c) Stamping is required for alterations as listed in NBIC Part 3, S5.7.2.

d) Stamping, when required, shall meet the requirements for stamping in NBIC Part 3, 5.7.2. The location of stamping shall be described in the "Remarks" section of Form R-2.

5.10 ALTERNATIVE MARKING AND STAMPING FOR GRAPHITE PRESSURE EQUIPMENT

a) General Requirements

1) This procedure may be used in lieu of the stamping and nameplate requirements defined in this section.

2) The required data as defined in this section shall be 5/32 in. (4 mm) high, minimum.

3) The National Board Code Symbol "R" shall be used to make the impression in the cement.

b) Application of the "R" Code Symbol

1) The graphite surface shall be clean and smooth.

2) Apply a thin coating of cement onto the code part. The cement should have the consistency of toothpaste.

3) Apply sufficient heat to the cement so that it begins to form a skin.

4) Apply a coating of a thinned release agent, such as "anti-seize," to the tip of the "R" stamp with a brush.

5) Press the coated stamp all the way to the bottom of the cement and remove by pulling straight out before the cement hardens.

6) Cure or heat the impression as required.

7) When cured, the part may be washed to remove any excess release agent.

c) Application of characters directly to graphite

1) Use a very thin template of a flexible material (stainless steel; flexible and easily cleaned).

2) Place the template over a clean smooth surface.

3) Hold the template securely and trowel over with approved cement to fill all of the template area.

4) Carefully lift the template from the graphite part and examine the detail of the characters.

5) If acceptable, cure the cement.

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

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

5.11 REMOVAL OF ORIGINAL STAMPING OR NAMEPLATE

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

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

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

~~5.12.1 FORM R-1, *REPORT OF REPAIR*, NB-66~~

~~5.12.2 FORM R-2, REPORT OF ALTERATION, NB-229~~

~~5.12.3 FORM R-3, *REPORT OF PARTS FABRICATED BY WELDING*, NB-230~~

~~5.12.4 FORM R-4, *REPORT SUPPLEMENT SHEET*, NB-231~~

~~5.12.4.1 INSTRUCTIONS FOR COMPLETING NATIONAL BOARD FORM R-1 REPORT~~ ~~(19)~~

~~These instructions are to be used when completing the National Board Form R-1, Report of Repairs. When computer generated, the format of the form shall replicate the type and relative location of the information depicted on the Form R-1 shown in NBIC Part 3, 5.12.1. The numbers below correspond to the "circled" numbers shown on the Form R-1. Note that a fillable version of the Form R-1 (NB-66,) is available on the National Board website, www.nationalboard.org.~~

~~1) Initials of the authorized representative of the "R" Certificate Holder.~~

~~2) Initials of the Inspector reviewing the "R" Certificate Holders work.~~

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

~~4) If applicable, document the unique purchase order, job, or tracking number assigned by the organization performing the work.~~

~~5) The name and address of the National Board "R" Certificate Holder performing the work as it appears on the "*Certificate of Authorization*".~~

~~6) Name and address of the owner of the pressure-retaining item.~~

7) Name and address of plant or facility where the pressure-retaining item is installed.

8) Description of the pressure-retaining item, such as boiler or pressure vessel, or piping. Include the applicable unit identification.

9) Name of the original manufacturer of the pressure-retaining item. If the original manufacturer is unknown, indicate by, “unknown.”

10) Document the serial number of the pressure retaining item if assigned by the original manufacturer. If there is no serial number assigned or is unknown, indicate “unknown.”

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

12) Indicate the jurisdiction number assigned to the pressure retaining item, if available.

13) Indicate any other unique identifying nomenclature assigned to the pressure retaining item by the owner or user.

14) Identify the year in which fabrication/construction of the pressure retaining item was completed.

15) Indicate edition and addenda of the NBIC under which this work is being performed.

16) Indicate the name, section, division, edition, and addenda (if applicable) of the original code of construction for the pressure-retaining item.

17) Indicate the name, section, division, edition, and addenda (if applicable) of the construction code used for the work being performed. If code cases are used, they shall be identified in the “Remarks” section.

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

19) Provide a detailed summary describing the scope of work that was completed to a pressure retaining item (PRI). The information to be considered when describing the scope of work should include such items as, the nature of the repair (i.e. welding, bonding, cementing), the specific location of the work performed to the PRI, the steps taken to remove a defect or as allowed by 3.3.4.8 to remain in place, the method of repair described as listed in the examples of Part 3, Section 3 or supplemental section if applicable, and the acceptance testing and or examination method used in accordance with the NBIC. When additional space is required to describe the scope of work, a Form R-4 shall be used and attached (check box). If a FITNESS FOR SERVICE Form (NB-403) is part of the Form R-1 repair package, check box and attach the form. Information determined to be of a proprietary nature need not be included, but shall be stated on the form.

20) Indicate type of pressure test applied (Liquid, Pneumatic, Vacuum, Leak). If no pressure test applied, indicate “none.”

21) Indicate test pressure applied.

22) Indicate maximum allowable working pressure (MAWP) for the pressure retaining item, if known.

23) As applicable, identify what Replacement Parts manufactured by welding or bonding were introduced as needed to complete the scope of work. Indicate part, item number, manufacturer’s name, stamped identification, and data report type or Certificate of Compliance.

24) Indicate any additional information pertaining to the work involved (e.g., routine repairs, code cases).

25) When registering a Form R-1 Report with the National Board, this line is solely designated for a unique sequential number assigned by the “R” Certificate Holder. When the “R” Form is not to be registered,

indicate so by “N/A”. As described in NBIC Part 3, 5.6, a log shall be maintained identifying sequentially, any Form “R” registered with the National Board.

26) If applicable, document the unique purchase order, job, or tracking number assigned by organization performing work.

27) Type or print name of authorized representative of the “R” Certificate Holder attesting to accuracy of the work described.

28) Indicate National Board “R” *Certificate of Authorization* number.

29) Indicate month, day, and year that the “R” *Certificate of Authorization* expires.

30) Record name of “R” Certificate Holder who performed the described work, using full name as shown on the *Certificate of Authorization* or an abbreviation acceptable to the National Board.

31) Signature of “R” Certificate Holder authorized representative.

32) Enter month, day, and year repair certified.

33) Type or print name of Inspector.

34) Indicate Inspector’s Jurisdiction.

35) Indicate Inspector’s employer.

36) Indicate address of Inspector’s employer (city and state or province).

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

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

39) Signature of Inspector.

40) Indicate month, day, and year of Inspector signature

5.12.4.2 INSTRUCTIONS FOR COMPLETING NATIONAL BOARD FORM R-2 REPORT

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

1) Initials of the National Board “R” Certificate of Authorization authorized representative who registers the Form R-2.

2) Initials of the Inspector who certified the completed Form R-2 for registration.

3) When registering a Form R-2 with the National Board, this line is solely designated for a unique sequential number assigned by the “R” Certificate Holder. As described in NBIC Part 3, Paragraph 5.6, a log shall be maintained identifying unique and sequentially numbered Form “R” reports that are registered with the National Board. For rerating only, the Design Organization registers the Form R-2.

4) If applicable, document the unique purchase order, job, or tracking number assigned by the organization performing the work.

5) The name and address of the National Board "R" *Certificate of Authorization* holder performing the design as it appears on the "Certificate of Authorization".

6) The name and address of the National Board "R" *Certificate of Authorization* holder performing the construction activity as it appears on the "Certificate of Authorization."

7) Name and address of the owner of the pressure retaining item.

8) Name and address of the plant or facility where the pressure retaining item is installed.

9) Description of the pressure retaining item, such as boiler or pressure vessel, or piping. Include the applicable unit identification.

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

11) Document the serial number of the pressure-retaining item if assigned by the original manufacturer. If there is no serial number assigned or it is unknown, indicate "unknown."

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

13) Indicate the jurisdiction number assigned to the pressure retaining item, if available.

14) Indicate any other unique identifying nomenclature assigned to the pressure retaining item by the owner or user.

15) Identify the year in which fabrication/construction of the pressure retaining item was completed.

16) Indicate edition and addenda of the NBIC under which this work is being performed, as applicable.

17) Indicate the name, section, division, edition, and addenda (if applicable) of the original code of construction for the pressure retaining item.

18) Indicate the name, section, division, edition, and addenda (if applicable) of the construction code used for the work being performed. If code cases are used, they shall be identified in the "Remarks" section.

19) Provide a detailed summary of the scope of design that was performed. When additional space is required to describe the design scope, a Form R-4 shall be used and attached (check box if needed).

20) The information to be considered when describing the construction scope of work should include such items as, the nature of the alteration (i.e. welding, bonding, cementing), the specific location of the work performed to the pressure retaining item, the steps taken to remove a defect or as allowed by NBIC Part 3, Paragraph 3.3.4.8 to remain in place, and the method of alteration described as listed in the examples of NBIC Part 3, Paragraph 3.4.4 or applicable supplement. When additional space is required to describe the construction scope, a Form R-4 shall be used and attached (check box if needed).

21) Indicate type of pressure test applied (liquid, pneumatic, vacuum, leak). If no pressure test applied, indicate "none."

22) Indicate test pressure applied.

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

24) When registering a Form R-2 with the National Board, this line is solely designated for a unique sequential number assigned by the "R" Certificate Holder. As described in NBIC Part 3, Paragraph 5.6,

a log shall be maintained identifying unique and sequentially numbered Form "R" reports that are registered with the National Board. For rerating only, the Design Organization registers the Form R-2.

25) If applicable, document the unique purchase order, job, or tracking number assigned by organization performing work.

26) As applicable, identify what parts manufactured by welding or bonding were introduced as needed to complete the scope of work. Indicate part, item number, manufacturer's name, stamped identification, and data report type or Certificate of Compliance.

27) Indicate any additional information pertaining to the work involved (e.g. code cases, interpretations used).

28) Type or print name of the National Board "R" *Certificate of Authorization* authorized representative responsible for design certification.

29) Indicate National Board "R" *Certificate of Authorization* number.

30) Indicate month, day, and year that the "R" *Certificate of Authorization* expires.

31) Indicate month, day, and year the alteration was certified.

32) Record the name of National Board "R" *Certificate of Authorization* holder who performed the design portion of the work, using full name as shown on the "*Certificate of Authorization*" or an abbreviation acceptable to the National Board.

33) Signature of National Board "R" *Certificate of Authorization* authorized representative for the design change.

34) Type or print the name of Inspector certifying the design review.

35) Indicate Inspector's Jurisdiction.

36) Indicate Inspector's employer.

37) Indicate address of Inspector's employer (city and state or province).

38) Indicate the month, day and year of the design certification by the Inspector.

39) Signature of the Inspector certifying the design review.

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

41) Type or print name of the National Board "R" *Certificate of Authorization* authorized representative responsible for any construction.

42) Indicate the National Board "R" *Certificate or Authorization* number.

43) Indicate month, day, and year the National Board "R" *Certificate of Authorization* expires.

44) Indicate the date the alteration was certified.

45) Record the name of National Board "R" *Certificate of Authorization* holder who performed the construction portion of the described work, using full name as shown on the *Certificate of Authorization* or an abbreviation acceptable to the National Board.

46) Signature of National Board "R" *Certificate of Authorization* authorized representative.

47) Type or print the name of Inspector certifying the construction inspection.

48) Indicate the Inspector's Jurisdiction.

49) Indicate Inspector's employer.

50) Indicate address of Inspector's employer (city and state or province).

51) Indicate the month, day and year of the final inspection by the Inspector.

52) Indicate the month, day and year the completed Form R-2 was signed by the Inspector.

53) Signature of the Inspector certifying the construction inspection.

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

(19) 5.12.4.3 INSTRUCTIONS FOR COMPLETING NATIONAL BOARD FORM R-3 REPORT

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

1) Initials of the National Board "R" *Certificate of Authorization* authorized representative who registers the Form R-3.

2) Initials of the Inspector who certified the completed Form R-3 for registration.

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

4) The name and address of the National Board "R" Certificate Holder who manufactured the welded parts as it appears on the "*Certificate of Authorization.*"

5) If applicable, document the unique purchase order, job, or tracking number assigned by organization performing work.

6) Document name and address of organization that purchased the parts for incorporation into the repair or alteration. If the part's origin is unknown or the part was built for stock, so state.

7) Document name of organization responsible for specifying the code design conditions, if known. If origin of design conditions are not known, state "unknown."

8) Document name of organization responsible for performing the code design, if known. If code design organization is not known, state "unknown."

9) Name, section, and division of the design code, if known. If the design is not known, state "unknown."

10) Indicate code edition year used for fabrication.

11) Indicate code addenda date used for fabrication, if applicable.

12) Indicate the code paragraph reference for formula used to establish the MAWP, if known. If the code reference of the formula is not known, state "unknown."

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

14) Indicate quantity of named parts.

15) Match line number of part references for Identification of Parts in item 5 and the Description of Parts in item 6.

16) Indicate manufacturer's serial number or identification number for the named part.

17) Indicate drawing number for the named part.

18) Indicate maximum allowable working pressure (MAWP) for the part, if known.

19) Indicate test pressure, if applied.

20) Identify the year in which fabrication/construction of the item was completed.

21) Use inside diameter for size: indicate shape as square, round, etc.

22) Indicate the complete material specification number and grade.

23) Indicate nominal thickness of plate and minimum thickness after forming.

24) Indicate shape as flat, dished, ellipsoidal, or hemispherical.

25) Indicate minimum thickness after forming.

26) Indicate the complete material specification number and grade for the head or end.

27) Indicate outside diameter.

28) Indicate minimum thickness of tubes.

29) Indicate the complete material specification number and grade for tubes.

30) Indicate any additional information pertaining to the work involved (e.g. code cases). The part manufacturer is to indicate the extent he has performed any or all of the design function. If only a portion of the design, state which portion.

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

32) If applicable, document the unique purchase order, job, or tracking number assigned by organization performing work.

33) Type or print name of authorized representative of the "R" Certificate Holder attesting to accuracy of the work described.

34) Indicate National Board "R" *Certificate of Authorization* number.

35) Indicate month, day, and year that the "R" *Certificate of Authorization* expires.

36) Indicate the date the repair was certified.

37) Record name of "R" Certificate Holder who performed the described work, using full name as shown on the *Certificate of Authorization* or an abbreviation acceptable to the National Board.

38) Signature of National Board "R" *Certificate of Authorization* authorized representative.

39) Type or print name of Inspector.

40) Indicate Inspector's Jurisdiction.

41) Indicate Inspector's employer.

42) Indicate address of Inspector's employer (city and state or province).

43) Indicate month, day, and year of final inspection by Inspector.

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

45) Signature of Inspector.

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

(19) **5.12.4.4 INSTRUCTIONS FOR COMPLETING NATIONAL BOARD FORM R-4 REPORT**

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

1) When registering a Form "R" Report with the National Board, this line is solely designated for a unique sequential number assigned by the "R" Certificate Holder. When the "R" Form is not to be registered, indicate so by "N/A". As described in NBIC Part 3, Paragraph 5.6, a log shall be maintained identifying unique and sequentially numbered Form "R" reports that are registered with the National Board. Complete information identical to that shown on the Form "R" to which this sheet is a supplement.

2) If applicable, document the unique purchase order, job, or tracking number, assigned by the organization performing work.

3) The name and address of the Certificate Holder performing the work as it appears on the "*Certificate of Authorization.*"

4) Name and address of the owner of the pressure-retaining item.

5) Name and address of plant or facility where the pressure-retaining item is installed.

6) Indicate the Form "R" type to which this report is supplementary. Example: Form R-1, Form R-2, Form R-3.

7) Indicate the reference line number from the Form "R" to which this report is supplementary.

8) Complete information for which there was insufficient space on the reference Form "R".

9) Indicate the date certified.

10) Signature of the repair organizations authorized representative.

11) Record name of "R" Certificate Holder who performed the described work, using full name as shown on the *Certificate of Authorization* or an abbreviation acceptable to the National Board.

12) Indicate the date the form was completed by the Inspector.

13) Signature of the Inspector.

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

5.12.5 FORM NR-1, *NUCLEAR COMPONENTS AND SYSTEMS IN NUCLEAR POWER PLANTS*, SEE PG. 96

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

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

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

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

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

2) Indicate NR Form Registration Number.

3) Indicate the repair/replacement plan, job number, etc., as applicable, assigned by the organization that performed the work for traceability to documentation.

4) Name and address of the owner of the nuclear facility.

5) Name and address of the nuclear power plant and, if applicable, identification of the unit.

6) Identify the system or component (e.g., residual heat removal, reactor coolant) with which the repair/ replacement and/or re-rating activity is associated.

7) Identify the original design specification number and revision for the system or component listed in line 4.

8) Identify the original construction code, edition/addenda used for the system or component identified in line 4.

9) NBIC Edition used for performing activities specified on this form.

10) Organization having responsibility for design when there is a change from the original design specification.

11) Identify code edition/addenda used for design, when applicable.

12) Check the type of test conducted (e.g., hydrostatic, pneumatic, system leakage, exempt, or other) and indicate the pressure applied when applicable.

13) Indicate the number of components where work was performed. Each component shall be indicated on page 2 of the form NR-1.

14) Provide a detailed summary describing the scope of work completed. Information to be considered should include type of work (welding, brazing, fusing), location, steps taken for removal or acceptance of defects, examinations, testing, heat treat, and other special processes or methods utilized. If Necessary, attach additional data, sketch, drawing, Form R-4, etc. In the remarks section state if additional data is attached.

15) Indicate any additional information pertaining to the work, including manufacturer's data reports.

16) Number in sequence beginning with No. 1 to identify each component work was performed. This number may be used to correspond with the detailed description of work performed.

17) Identify the type of item. i.e. piping, pump, valve, etc.

18) Identify the manufacturer's name of component.

19) Identify the manufacturer's serial no. or other assigned number for traceability.

20) Identify the National Board registration number, if previously assigned.

21) Identify the code class criteria, as assigned for each component.

22) Identify the code section used to perform work.

23) Identify Code section year and/or addenda used to perform work.

24) Identify any code cases used for work performed.

25) Identify any revisions to be made to the design specifications or if any design reconciliations were performed.

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

27) Name of the organization that performed the identified work, using the full name as shown on the *Certificate of Authorization*, or an abbreviation acceptable to the National Board.

28) Indicate code section as applicable to the repair/replacement activity and/or re-rating activity performed.

29) Indicate National Board *Certificate of Authorization* number.

30) Indicate month, day, and year the certificate expires.

31) Signature of authorized representative from the NR certificate holder.

32) Indicate month, day and year of signature by the Authorized Representative.

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

34) Type or print name of Authorized Nuclear Inspector.

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

36) Indicate Authorized Nuclear Inspector's employer.

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

38) Signature of Authorized Nuclear Inspector.

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

40) National Board Commission number and required endorsements.

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

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

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

replicate the type and relative location of the information depicted on the Form NVR-1, Report of Repair/ Replacement Activities for Nuclear Pressure Relief Devices.

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

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

1) Name and address of the organization, as shown on the National Board "VR" and "NR" *Certificates of Authorization*, which performed the activity.

2) Indicate NVR Form Registration Number.

3) Indicate the repair/replacement plan number, job number, etc., as applicable for traceability, assigned by the organization that performed the work.

4) Name and address of the organization for which the work was performed.

5) Name and address of the owner nuclear facility.

6) Name and address of the nuclear facility and, if applicable, identification of the unit.

7) Identify the edition, addenda, and as applicable, code cases of the code used for the inservice inspection activity.

8) Identify the edition, addenda, and as applicable, code cases of the code used for the repair/replacement activity.

9) Identify the NBIC edition used for the repair/replacement activity.

10) Identify the organization responsible for design or design reconciliation, if applicable.

11) Indicate the set pressure of the valve.

12) Indicate the blowdown, if applicable, as a percentage of set pressure.

13) Indicate the location of testing.

14) Indicate medium (steam, air, etc.) used for the adjustment of the set pressure and, if applicable, blowdown.

15) Provide a detailed summary describing the scope of work completed. Information to be considered should include type of work (welding, brazing, fusing), location, steps taken for removal or acceptance of defects, examinations, testing, heat treat, and other special processes or methods utilized. If Necessary, attach additional data, sketch, drawing, Form R-4, etc. If additional data is attached, so state in the remarks section.

16) Indicate any additional information pertaining to the work, such as, additional documentation that is attached to this form to further support item 15.

17) Manufacturer's name of the affected item.

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

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

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

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

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

23) Indicate the year the affected item was manufactured.

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

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

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

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

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

29) Name of the replacement part.

30) Identifying number of the replacement part.

31) Number/quantity of each replacement part used.

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

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

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

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

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

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

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

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

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

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

42) Type or print name of Authorized Nuclear Inspector.

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

44) Indicate Authorized Nuclear Inspector's employer.

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

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

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

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

49) National Board Commission number and required endorsements.

SUPPLEMENT 9
REPAIR AND ALTERATION FORMS AND INSTRUCTIONS FOR COMPLETING FORMS

S9.1 SCOPE

a) This supplement provides requirements and guidelines for completing the following National Board Forms

   1) R-1 (Report of Repair, form NB-66)

   2) R-2 (Report of Alteration, form NB-229)

   3) R-3 (Report of Parts Fabricated by Welding, form NB-230)

   4) R-4 (Report Supplement Sheet, form NB-231)

   5) NR-1 (Report of Repair/Replacement Activities for Nuclear Facilities, form NB-81)

   6) NVR-1 (Report of Repair/Replacement Activities for Nuclear Pressure Relief Devices, form NB-160).

b) Immediately following each of the forms within this supplement is a guide for completing that form. The forms may be used for documenting specific requirements as indicated on the top of each form. The explanations included in the guides are keyed to the forms in the following manner:

   1) Circled numbers on each of the forms refer to the items listed on the applicable guide. The parenthesized numbers in the guides correspond to circled numbers on the forms.

   2) Numbers without circles appearing in the guides identify specific line or item numbers of the forms.

c) When computer generated, the format of the form shall replicate the type and relative location of the information depicted on the applicable form for the specific requirements as indicated on the top of each form. Note that a fillable version of all forms is available on the National Board website.

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

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

THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS

NB-66, Rev. 16, (01/28/19)

FORM R-1 REPORT OF REPAIR

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

(1) (Authorized Rep. initials)

(2) (Inspectors initials)

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

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

1. WORK PERFORMED BY: (5) (name of repair organization)

(address)

2. OWNER: (6) (name)

(address)

3. LOCATION OF INSTALLATION: (7) (name)

(address)

4. ITEM IDENTIFICATION: (8) (boiler, pressure vessel, or piping) NAME OF ORIGINAL MANUFACTURER: (9)

5. IDENTIFYING NOS: (10) (mfg. serial no.) (11) (National Board no.) (12) (jurisdiction no.) (13) (other) (14) (year built)

6. NBIC EDITION/ADDENDA: (15) (edition) (addenda)

Original Code of Construction for Item: (16) (name / section / division) (edition / addenda)

Construction Code Used for Repair Performed: (17) (name / section / division) (edition / addenda)

7. REPAIR TYPE: (18) ☐ welded ☐ graphite pressure equipment ☐ FRP pressure equipment ☐ DOT

8. DESCRIPTION OF WORK: (use Form R-4, if necessary) ☐ Form R-4, Report Supplementary Sheet is attached ☐ FFSA Form (NB-403) is attached

(19)

(20) (Liquid, Pneumatic, Vacuum, Leak) Pressure Test, if applied (21) psi MAWP (22) psi

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

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

(23)

10. REMARKS: (24)

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

THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS

NB-66, Rev. 16, (01/28/19)

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

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

CERTIFICATE OF COMPLIANCE

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

Repair Organization: (30) _____

Signed: (31) _____ (authorized representative)

Date: (32) _____

CERTIFICATE OF INSPECTION

I, (33) _____, holding a valid commission issued by The National Board of Boiler and Pressure Vessel Inspectors and certificate of competency, where required, issued by the Jurisdiction of (34) _____ and employed by (35) _____ of (36) _____ have inspected the work described in this report on (37) _____, _____ and state that to the best of my knowledge and belief, this work complies with the applicable requirements of the *National Board Inspection Code*. By signing this certificate, neither the undersigned nor my employer makes any warranty, expressed or implied, concerning the work described in this report. Furthermore, neither the undersigned nor my employer shall be liable in any manner for any personal injury, property damage, or loss of any kind arising from or connected with this inspection.

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

Signed: (39) _____ (Inspector)

Date: (40) _____

TABLE S9.2

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

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

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

TABLE S9.2 Cont'd

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

(34) Indicate Inspector's Jurisdiction.

(35) Indicate Inspector's employer.

(36) Indicate address of Inspector's employer (city and state or province).

TABLE S9.2 Cont'd

Reference to Circled Numbers in the Form	Description
(37)	Indicate month, day, and year of final inspection by Inspector. For routine repairs this shall be the month, day, and year the Inspector reviews the completed routine repair package.
(38)	Inspector's National Board commission number and endorsement that qualifies the Inspector to sign this report, and when required by the Jurisdiction, the applicable State or Provincial numbers.
(39)	Signature of Inspector.
(40)	Indicate month, day, and year of Inspector signature

S9.3 FORM R-2, REPORT OF ALTERATION, NB-229

FIGURE S9.3.1
FORM R-2, PAGE 1 OF 2

THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS

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

FORM R-2 REPORT OF ALTERATION

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

(1) (Authorized Rep. initials)

(2) (Inspectors initials)

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

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

1a. DESIGN PERFORMED BY: (5) (name of "R" organization responsible for design)

(address)

1b. CONSTRUCTION PERFORMED BY: (6) (name of "R" organization responsible for construction)

(address)

2. OWNER OF PRESSURE RETAINING ITEM: (7) (name)

(address)

3. LOCATION OF INSTALLATION: (8) (name)

(address)

4. ITEM IDENTIFICATION: (9) (boiler, pressure vessel, or piping) NAME OF ORIGINAL MANUFACTURER: (10)

5. IDENTIFYING NOS: (11) (mfg. serial no.) (12) (National Board no.) (13) (jurisdiction no.) (14) (other) (15) (year built)

6. NBIC EDITION/ADDENDA: (16) (edition) (16) (addenda)

Original Code of Construction for Item: (17) (name / section / division) (17) (edition / addenda)

Construction Code Used for Alteration Performed: (18) (name / section / division) (18) (edition / addenda)

7a. DESCRIPTION OF DESIGN SCOPE: ☐ Form R-4, Report Supplementary Sheet is attached

(19)

7b. DESCRIPTION OF CONSTRUCTION SCOPE: ☐ Form R-4, Report Supplementary Sheet is attached

(20)

(21) Pressure Test, if applied (22) psi MAWP (23) psi

FIGURE S9.3.2
FORM R-2, PAGE 2 OF 2

THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS

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

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

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

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

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

(26)

9. REMARKS: (27)

DESIGN CERTIFICATION

I, (28), 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. (29) expires on (30)

Date (31), (32) Signed (33)

(name of design organization) (authorized representative)

CERTIFICATE OF DESIGN CHANGE REVIEW

I, (34), holding a valid Commission issued by The National Board of Boiler and Pressure Vessel Inspector and certificate of competency, where required, issued by the jurisdiction of (35) and employed by (36) of (37) 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 (38) Signed (39) Commissions (40)

(inspector) (National Board and jurisdiction no. including endorsement)

CONSTRUCTION CERTIFICATION

I, (41), 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. (42) expires on (43)

Date (44), (45) Signed (46)

(name of alteration organization) (authorized representative)

CERTIFICATE OF INSPECTION

I, (47), holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and certificate of competency, where required, issued by the Jurisdiction of (48) and employed by (49) of (50) have inspected the work described in this report on (51), 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 (52) Signed (53) (54)

(inspector) (National Board and jurisdiction no. including endorsement)

TABLE S9.3

GUIDE FOR COMPLETING FORM R-2, REPORT OF ALTERATION, NB-226

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

	original code of construction for the pressure-retaining item.
(18)	Indicate the name, section, division, edition, and addenda (if applicable) of the construction code used for the work being performed. If code cases are used, they shall be identified in the “Remarks” section.

TABLE S9.3 Cont'd

Reference to Circled Numbers in the Form	Description
(19)	Provide a detailed summary of the scope of design that was performed. When additional space is required to describe the design scope, a Form R-4 shall be used and attached (check box if needed).
(20)	Indicate type of pressure test applied (liquid, pneumatic, vacuum, leak). If no pressure test applied, indicate "none."
(21)	Indicate test pressure applied.
(22)	Indicate maximum allowable working pressure (MAWP) for the pressure retaining item. (As altered)
(23)	When registering a Form R-2 with the National Board, this line is solely designated for a unique sequential number assigned by the "R" Certificate Holder. As described in NBIC Part 3, Paragraph 5.6, a log shall be maintained identifying unique and sequentially numbered Form "R" reports that are registered with the National Board. For rerating only, the Design Organization registers the Form R-2.
(24)	If applicable, document the unique purchase order, job, or tracking number assigned by organization performing work.
(25)	As applicable, identify what parts manufactured by welding or bonding were introduced as needed to complete the scope of work. Indicate part, item number, manufacturer's name, stamped identification, and data report type or Certificate of Compliance.
(26)	Indicate any additional information pertaining to the work involved (e.g. code cases, interpretations used).
(27)	Type or print name of the National Board "R" *Certificate of Authorization* authorized representative responsible for design certification.
(28)	Indicate National Board "R" *Certificate of Authorization* number.
(29)	Indicate month, day, and year that the "R" *Certificate of Authorization* expires.
(30)	Indicate month, day, and year the alteration was certified.
(31)	Record the name of National Board "R" *Certificate of Authorization* holder who performed the design portion of the work, using full name as shown on the "*Certificate of Authorization*" or an abbreviation acceptable to the National Board.
(32)	Signature of National Board "R" *Certificate of Authorization* authorized representative for the design change.
(33)	Type or print the name of Inspector certifying the design review.
(34)	Indicate Inspector's Jurisdiction.
(35)	Indicate Inspector's employer.
(36)	Indicate type of pressure test applied (liquid, pneumatic, vacuum, leak). If no pressure test applied, indicate "none."
(37)	Indicate address of Inspector's employer (city and state or province).

(38) Indicate the month, day and year of the design certification by the Inspector.

(39) Signature of the Inspector certifying the design review.

TABLE S9.3 Cont'd

Reference to Circled Numbers in the Form	Description
(40)	Inspectors National Board commission number and endorsement that qualifies the Inspector to sign this report, and when required by the Jurisdiction, the applicable State or Provincial numbers.
(41)	Type or print name of the National Board "R" *Certificate of Authorization* authorized representative responsible for any construction.
(42)	Indicate the National Board "R" *Certificate or Authorization* number.
(43)	Indicate month, day, and year the National Board "R" *Certificate of Authorization* expires.
(44)	Indicate the date the alteration was certified.
(45)	Record the name of National Board "R" *Certificate of Authorization* holder who performed the construction portion of the described work, using full name as shown on the *Certificate of Authorization* or an abbreviation acceptable to the National Board.
(46)	Signature of National Board "R" *Certificate of Authorization* authorized representative.
(47)	Type or print the name of Inspector certifying the construction inspection.
(48)	Indicate the Inspector's Jurisdiction.
(49)	Indicate Inspector's employer.
(50)	Indicate address of Inspector's employer (city and state or province).
(51)	Indicate the month, day and year of the final inspection by the Inspector.
(52)	Indicate the month, day and year the completed Form R-2 was signed by the Inspector.
(53)	Signature of the Inspector certifying the construction inspection.
(54)	Inspector's National Board commission number and endorsement that qualifies the Inspector to sign this report, and when required by the Jurisdiction, the applicable State or Provincial numbers.

S9.4 FORM R-3, REPORT OF PARTS FABRICATED BY WELDING, NB-230

FIGURE S9.4.1
FORM R-3, PAGE 1 OF 2

THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS

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

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

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

1. MANUFACTURED BY: (4) (name of "**R**" certificate holder)
(address)
2. MANUFACTURED FOR: (6) (name)
(address)
3. DESIGN CONDITION SPECIFIED BY: (7) CODE DESIGN BY: (8)
4. DESIGN CODE: (9) (10) (11) (12)
5. REPAIR/ALTERATION/MODIFICATION ACTIVITIES

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

6. DESCRIPTION OF PARTS

	(a) Connections other than tubes			Heads or Ends			(b) Tubes		
Line No.	Size and Shape	Material Spec. No.	Thickness (in.)	Shape	Thickness (in.)	Material Spec. No.	Diameter (in.)	Thickness (in.)	Material Spec. No.
(15)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)

7. REMARKS: (30)

FIGURE S9.4.2
FORM R-3, PAGE 2 OF 2

THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS

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

(31) _____
(Form "**R-3**" Registration no.)

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

CERTIFICATE OF COMPLIANCE

I, (33) _____, certify that to the best of my knowledge and belief the statements made in this report are correct and that all material, fabrication, construction, and workmanship of the described parts conforms to the *National Board Inspection Code* and the standards of construction cited.

National Board "**R**" *Certificate of Authorization* No. (34) _____ expires on: (35) _____, _____

Date (36) _____, _____ (37) _____ Signed (38) _____

(name of "R" Certificate holder) (Authorized Representative)

CERTIFICATE OF INSPECTION

I, (39) _____, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and certificate of competency, where required, issued by the Jurisdiction of (40) _____ and employed by (41) _____ of (42) _____ have inspected the part described in this report on (43) _____, _____ and state that to the best of my knowledge and belief the parts comply with the applicable requirements of the *National Board Inspection Code*.

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

Date (44) _____, _____ Signed (45) _____ Commissions (46) _____

(inspector) (National Board and jurisdiction No. including endorsement)

TABLE S9.4

GUIDE FOR COMPLETING FORM R-3, REPORT OF PARTS FABRICATED BY WELDING, NB-230

Reference to Circled Numbers in the Form	Description
(1)	Initials of the National Board "R" *Certificate of Authorization* authorized representative who registers the Form R-3.
(2)	Initials of the Inspector who certified the completed Form R-3 for registration.
(3)	When registering a Form R-3 Report with the National Board, this line is solely designated for a unique sequential number assigned by the "R" Certificate Holder. When the "R" Form is not to be registered, indicated so by "N/A". As described in NBIC Part 3, Paragraph 5.6, a log shall be maintained identifying unique and sequentially numbered Form "R" reports that are registered with the National Board.
(4)	The name and address of the National Board "R" Certificate Holder who manufactured the welded parts as it appears on the "*Certificate of Authorization.*"
(5)	If applicable, document the unique purchase order, job, or tracking number assigned by organization performing work.
(6)	Document name and address of organization that purchased the parts for incorporation into the repair or alteration. If the part's origin is unknown or the part was built for stock, so state.
(7)	Document name of organization responsible for specifying the code design conditions, if known. If origin of design conditions are not known, state "unknown."
(8)	Document name of organization responsible for performing the code design, if known. If code design organization is not known, state "unknown."
(9)	Name, section, and division of the design code, if known. If the design is not known, state "unknown."
(10)	Indicate code edition year used for fabrication.
(11)	Indicate code addenda date used for fabrication, if applicable.
(12)	Indicate the code paragraph reference for formula used to establish the MAWP, if known. If the code reference of the formula is not known, state "unknown."
(13)	If available, identify component by part's original name, function, or use the original equipment manufacturer's "mark or item number."
(14)	Indicate quantity of named parts.
(15)	Match line number of part references for Identification of Parts in item 5 and the Description of Parts in item 6.
(16)	Indicate manufacturer's serial number or identification number for the named part.
(17)	Indicate drawing number for the named part.
(18)	Indicate maximum allowable working pressure (MAWP) for the part, if known.
(19)	Indicate test pressure, if applied.

(20)	Identify the year in which fabrication/construction of the item was completed.
(21)	Use inside diameter for size: indicate shape as square, round, etc.
(22)	Indicate the complete material specification number and grade.

TABLE S9.4 Cont'd

Reference to Circled Numbers in the Form	Description
(23)	Indicate nominal thickness of plate and minimum thickness after forming.
(24)	Indicate shape as flat, dished, ellipsoidal, or hemispherical.
(25)	Indicate minimum thickness after forming.
(26)	Indicate the complete material specification number and grade for the head or end.
(27)	Indicate outside diameter.
(28)	Indicate minimum thickness of tubes.
(29)	Indicate the complete material specification number and grade for tubes.
(30)	Indicate any additional information pertaining to the work involved (e.g. code cases). The part manufacturer is to indicate the extent he has performed any or all of the design function. If only a portion of the design, state which portion.
(31)	When registering a Form R-3 Report with the National Board, this line is solely designated for a unique sequential number assigned by the "R" Certificate Holder. When the "R" Form is not to be registered, indicated so by "N/A". As described in NBIC Part 3, Paragraph 5.6, a log shall be maintained identifying unique and sequentially numbered Form "R" reports that are registered with the National Board.
(32)	If applicable, document the unique purchase order, job, or tracking number assigned by organization performing work.
(33)	Type or print name of authorized representative of the "R" Certificate Holder attesting to accuracy of the work described.
(34)	Indicate National Board "R" Certificate of Authorization number.
(35)	Indicate month, day, and year that the "R" Certificate of Authorization expires.
(36)	Indicate the date the repair was certified.
(37)	Record name of "R" Certificate Holder who performed the described work, using full name as shown on the Certificate of Authorization or an abbreviation acceptable to the National Board.
(38)	Signature of National Board "R" Certificate of Authorization authorized representative.
(39)	Type or print name of Inspector.
(40)	Indicate Inspector's Jurisdiction.
(41)	Indicate Inspector's employer.
(42)	Indicate address of Inspector's employer (city and state or province).
(43)	Indicate month, day, and year of final inspection by Inspector.
(44)	Indicate the month, day and year the completed Form "R" was signed by the Inspector.

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

FIGURE S9.5.1
FORM R-4, PAGE 1 OF 1

THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS

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

FORM R-4 REPORT SUPPLEMENT SHEET

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

(1) ____________ (form "R" referenced)

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

1. WORK PERFORMED BY: (3) ____________ (name)

____________ (address)

2. OWNER: (4) ____________ (name)

____________ (address)

3. LOCATION OF INSTALLATION: (5) ____________ (name)

____________ (address)

REFERENCE LINE NO. (7) ______ CONTINUED FROM FORM R- (6) ______ (8) ____________

Date (9) ______, ______ Signed (10) ____________ (authorized representative) Name (11) ____________ (Name of "R" certificate holder)

Date (12) ______, ______ Signed (13) ____________ (inspector) Commissions (14) ____________ (National Board and jurisdiction no. including endorsement)

TABLE S9.5

GUIDE FOR COMPLETING FORM R-4, REPORT SUPPLEMENT SHEET, NB-231

Reference to Circled Numbers in the Form	Description
(1)	When registering a Form "R" Report with the National Board, this line is solely designated for a unique sequential number assigned by the "R" Certificate Holder. When the "R" Form is not to be registered, indicate so by "N/A". As described in NBIC Part 3, Paragraph 5.6, a log shall be maintained identifying unique and sequentially numbered Form "R" reports that are registered with the National Board. Complete information identical to that shown on the Form "R" to which this sheet is a supplement.
(2)	If applicable, document the unique purchase order, job, or tracking number, assigned by the organization performing work.
(3)	The name and address of the Certificate Holder performing the work as it appears on the "Certificate of Authorization."
(4)	Name and address of the owner of the pressure-retaining item.
(5)	Name and address of plant or facility where the pressure-retaining item is installed.
(6)	Indicate the Form "R" type to which this report is supplementary. Example: Form R-1, Form R-2, Form R-3
(7)	Indicate the reference line number from the Form "R" to which this report is supplementary.
(8)	Complete information for which there was insufficient space on the reference Form "R".
(9)	Indicate the date certified.
(10)	Signature of the repair organizations authorized representative.
(11)	Record name of "R" Certificate Holder who performed the described work, using full name as shown on the Certificate of Authorization or an abbreviation acceptable to the National Board.
(12)	Indicate the date the form was completed by the Inspector.
(13)	Signature of the Inspector.
(14)	Inspector's National Board commission number and endorsement that qualifies the Inspector to sign this report, and when required by the Jurisdiction, the applicable State or Provincial numbers.

S9.6 FORM NR-1, REPORT OF REPAIR/REPLACEMENT ACTIVITIES FOR NUCLEAR FACILITIES, NB-81

FIGURE S9.6.1
FORM NR-1, PAGE 1 OF 3

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

CATEGORY OF ACTIVITY: 1 ☐ 2 ☐ 3 ☐

☐ REPAIR/REPLACEMENT ☐ RE-RATING

(2) (**NR** Form Registration No.)

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

1. WORK PERFORMED BY: (1)
(name of "**NR**" certificate holder)

(address)

2. OWNER: (4)
(name)

(address)

3. NAME, ADDRESS, AND IDENTIFICATION OF NUCLEAR FACILITY:
(5)
(name)

(address)

(unit identification)

4. SYSTEM/COMPONENT: (6) ORIGINAL DESIGN SPECIFICATION NO./REV.: (7)

5. CONSTRUCTION CODE, SECTION & EDITION/ADDENDA AND APPLICABLE CODE CASES USED FOR THE SYSTEM OR COMPONENT:
(8)

6. NBIC EDITION USED FOR PERFORMING REPAIRS/REPLACEMENT OR RE-RATING ACTIVITY: (9)

7. DESIGN RESPONSIBILITY: (10) CODE ED/AD: (11)

8. TESTS CONDUCTED: ☐ Hydrostatic ☐ Pneumatic ☐ System Leakage ☐ Pressure _____ psi (MPa)
(12) ☐ Exempt ☐ Other _____

9. NUMBER OF COMPONENTS REPAIRED/REPLACED AND/OR RE-RATED (refer to page 2): (13)

10. DESCRIPTION OF WORK (use of properly identified additional sheet[s] or sketch[es] is acceptable):
(14)

11. REMARKS: (15)

FIGURE S9.6.2
FORM NR-1, PAGE 2 OF 3

THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS

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

(2) (NR Form Registration No.)

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

WORK PERFORMED BY: (1)

(Name of "NR" certificate holder)

(Address of "NR" certificate holder)

COMPONENT IDENTIFICATION

No. (16)	Type of Item (17)	Mfg. Name (18)	Serial No. (19)	Nat'l Bd No. (20)	Code Class (21)	Code Section (22)	Year / Addenda (23)	Code Case (24)	Revised Design Specification No./Rev. or Design Reconciliation No./Rev. (25)

FIGURE S9.6.3
FORM NR-1, PAGE 3 OF 3

THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS

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

(**NR** Form Registration No.)

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

CERTIFICATE OF COMPLIANCE

I, (26) _____, employed by (27) _____
certify that to the best of my knowledge and belief the statements made in this report are correct and the repair/replacement activities or re-rating described above conform to (28) _____ and the *National Board Inspection Code* "**NR**" rules.

National Board *Certificate of Authorization* No. (29) _____ Expiration date: (30) _____

Signed: (31) _____ Date: (32) _____

Title: (33) _____
(authorized representative)

CERTIFICATE OF INSPECTION

I, (34) _____, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and certificate of competency, where required, issued by the Jurisdiction of (35) _____ and employed by (36) _____ have inspected the repair/replacement and/or re-rating activities described in this report on (37) _____ and state that to the best of my knowledge and belief, these activities have been completed in accordance with the Code specified and the *National Board Inspection Code* "**NR**" rules.

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.

Signed: (38) _____ Date: (39) _____ Commissions (40) _____
(inspector) (National Board and endorsement)

TABLE S9.6

GUIDE FOR COMPLETING FORM NR-1, REPORT OF REPAIR/REPLACEMENT ACTIVITIES FOR NUCLEAR FACILITIES, NB-81

Reference to Circled Numbers in the Form	Description
	Title Block: Check type of activity, repair/replacement and/or rerating, as applicable.
	Check category of activity, 1, 2, or 3, as described in Part 3, Paragraph 1.6.2.
(1)	Name and address of the organization, as shown on the National Board "NR" Certificate of Authorization, which performed the activity.
(2)	Indicate NR Form Registration Number.
(3)	Indicate the repair/replacement plan, job number, etc., as applicable, assigned by the organization that performed the work for traceability to documentation.
(4)	Name and address of the owner of the nuclear facility.
(5)	Name and address of the nuclear power plant and, if applicable, identification of the unit.
(6)	Identify the system or component (e.g., residual heat removal, reactor coolant) with which the repair/replacement and/or re-rating activity is associated.
(7)	Identify the original design specification number and revision for the system or component listed in line 4.
(8)	Identify the original construction code, edition/addenda used for the system or component identified in line 4.
(9)	NBIC Edition used for performing activities specified on this form.
(10)	Organization having responsibility for design when there is a change from the original design specification.
(11)	Identify code edition/addenda used for design, when applicable.
(12)	Check the type of test conducted (e.g., hydrostatic, pneumatic, system leakage, exempt, or other) and indicate the pressure applied when applicable.
(13)	Indicate the number of components where work was performed. Each component shall be indicated on page 2 of the form NR-1.
(14)	Provide a detailed summary describing the scope of work completed. Information to be considered should include type of work (welding, brazing, fusing), location, steps taken for removal or acceptance of defects, examinations, testing, heat treat, and other special processes or methods utilized. If Necessary, attach additional data, sketch, drawing, Form R-4, etc. In the remarks section state if additional data is attached.
(15)	Indicate any additional information pertaining to the work, including manufacturer's data reports.
(16)	Number in sequence beginning with No. 1 to identify each component work was performed. This number may be used to correspond with the detailed description of work performed.
(17)	Identify the type of item. i.e. piping, pump, valve, etc.

(18)	Identify the manufacturer's name of component.
(19)	Identify the manufacturer's serial no. or other assigned number for traceability.
(20)	Identify the National Board registration number, if previously assigned.
(21)	Identify the code class criteria, as assigned for each component.
(22)	Identify the code section used to perform work.

TABLE S9.6 Cont'd

Reference to Circled Numbers in the Form	Description
(23)	Identify Code section year and/or addenda used to perform work.
(24)	Identify any code cases used for work performed.
(25)	Identify any revisions to be made to the design specifications or if any design reconciliations were performed.
(26)	Type or print name of authorized representative from the certificate holder.
(27)	Name of the organization that performed the identified work, using the full name as shown on the Certificate of Authorization, or an abbreviation acceptable to the National Board.
(28)	Indicate code section as applicable to the repair/replacement activity and/or re-rating activity performed.
(29)	Indicate National Board Certificate of Authorization number.
(30)	Indicate month, day, and year the certificate expires.
(31)	Signature of authorized representative from the NR certificate holder.
(32)	Indicate month, day and year of signature by the Authorized Representative.
(33)	Title of authorized representative as defined in the Quality Program.
(34)	Type or print name of Authorized Nuclear Inspector.
(35)	Indicate the Jurisdiction where the activity is performed, when required.
(36)	Indicate Authorized Nuclear Inspector's employer.
(37)	Indicate month, day, and year of inspection by the Authorized Nuclear Inspector.
(38)	Signature of Authorized Nuclear Inspector.
(39)	Indicate month, day, and year of signature by the Authorized Nuclear Inspector.
(40)	National Board Commission number and required endorsements.

S9.7 FORM NVR-1, REPORT OF REPAIR/REPLACEMENT ACTIVITIES FOR NUCLEAR PRESSURE RELIEF DEVICES, NB-160

FIGURE S9.7.1
FORM NVR-1, PAGE 1 OF 3

THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS

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

FORM NVR-1, REPORT OF REPAIR/REPLACEMENT ACTIVITIES FOR NUCLEAR PRESSURE RELIEF DEVICES

(2) (NVR Form Registration No.)

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

CATEGORY OF ACTIVITY: 1 ☐ 2 ☐ 3 ☐

☐ REPAIR/REPLACEMENT ☐ RE-RATING

1. WORK PERFORMED BY: (1)
(name of "NVR" authorized organization)
(address)

2. WORK PERFORMED FOR: (4)
(name)
(address)

3. OWNER: (5)
(name)
(address)

4. NAME, ADDRESS, AND IDENTIFICATION OF NUCLEAR FACILITY: (6)
(name)
(address)/ (unit identification)

5. CODE APPLICABLE FOR INSERVICE INSPECTION: (7)
(edition) (addenda) (code case(s))

6. CODE USED FOR REPAIR/REPLACEMENT ACTIVITY: (8)
(edition) (addenda) (code case(s))

7. NBIC USED FOR REPAIR/REPLACEMENT ACTIVITY: (9)
(edition)

8. DESIGN RESPONSIBILITY: (10)

9. **REPAIRED PRESSURE RELIEF DEVICE: SEE PAGE 2**

10. OPENING PRESSURE: (11) BLOWDOWN (if applicable): (12)

11. SET PRESSURE AND BLOWDOWN ADJUSTMENT MADE AT: (13) USING: (14)

12. DESCRIPTION OF WORK: (include name and identifying number of replacement parts):
(15)

12. REMARKS: (16)

FIGURE S9.7.2
FORM NVR-1, PAGE 2 OF 3

THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS

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

(2)
(NR Form Registration No.)

(3)
(R/R Plan No., Job No., etc.)

WORK PERFORMED BY: (1)

(Name of "NR" certificate holder)

(Address of "NR" certificate holder)

PRESSURE RELIEF DEVICE

Name of Mfg.	Type	Mfg. Serial No.	Nat'l Bd No.	Service	Size	Year Built
(17)	(18)	(19)	(20)	(21)	(22)	(23)

CONSTRUCTION CODE

Section	Class	Edition	Addenda	Code Case(s)
(24)	(25)	(26)	(27)	(28)

NAME AND IDENTIFYING NUMBER OF REPLACEMENT PARTS

No.	Part Name	Part Number	Quantity	Serial Number/Traceability No.
	(29)	(30)	(31)	(32)
1.				
2.				
3.				
4.				
5.				
6.				
7.				

FIGURE S9.7.3
FORM NVR-1, PAGE 3 OF 3

THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS

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

_____
(form "**NVR**" registration no.)

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

CERTIFICATE OF COMPLIANCE

I, (33) _____, certify that to the best of my knowledge and belief the statements made in this report are correct and the repair/replacement of the pressure relief devices described above conform to (34) _____ and the *National Board Inspection Code* "**VR**" & "**NR**" rules.

National Board *Certificate of Authorization* No. (35) _____ to use the "**VR**" stamp expires (36) _____
National Board *Certificate of Authorization* No. (37) _____ to use the "**NR**" stamp expires (38) _____
Date (39) _____ Signed (40) _____ (41) _____
(authorized representative) (title)

CERTIFICATE OF INSPECTION

I, (42) _____, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and certificate of competency, where required, issued by the Jurisdiction of (43) _____ and employed by (44) _____ of (45) _____ have inspected the repair/replacement described in this report on (46) _____ and state that to the best of my knowledge and belief, this repair/replacement has been completed in accordance with the Code specified and the *National Board Inspection Code* "**VR**" & "**NR**" rules.

By signing this certificate, neither the undersigned nor my employer makes any warranty, expressed or implied, concerning the repair/replacement 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.

Signed (47) _____ Date (48) _____ (49) _____
(inspector) (National Board and endorsement)

TABLE S9.7

GUIDE FOR COMPLETING FORM NVR-1, REPORT OF REPAIR/REPLACEMENT ACTIVITIES FOR NUCLEAR PRESSURE RELIEF DEVICES, NB-160

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

(20)	National Board number, if applicable, of the affected item.
(21)	Indicate the service as steam, liquid, air/gas, etc.

TABLE S9.7 Cont'd

Reference to Circled Numbers in the Form	Description
(22)	Indicate the pressure relief device by inlet size, in inches.
(23)	Indicate the year the affected item was manufactured.
(24)	Indicate the name, section and division of the original construction code for the affected item.
(25)	Indicate the code class for the affected item as applicable, i.e. Class 1, 2 or 3.
(26)	Indicate the construction code edition for the affected item.
(27)	Indicate the construction code addenda, as applicable, for the affected item.
(28)	Indicate any applicable code cases used for manufacturing of the affected item.
(29)	Name of the replacement part.
(30)	Identifying number of the replacement part.
(31)	Number/quantity of each replacement part used.
(32)	Indicate the Serial number or other traceability used by the manufacturer of the replacement part.
(33)	Type or print name of authorized representative from the certificate holder.
(34)	Indicate code as applicable to the repair/replacement activity performed.
(35)	Indicate National Board Certificate of Authorization number, if applicable for the "VR" Stamp.
(36)	Indicate month, day, and year the certificate expires, if applicable for the "VR" Stamp.
(37)	Indicate National Board Certificate of Authorization number, if applicable for the "NR" Stamp.
(38)	Indicate month, day, and year the certificate expires, if applicable for the "NR" Stamp.
(39)	Signature of authorized representative from the certificate holder defined in item 27 above.
(40)	Indicate month, day, and year of signature by the authorized representative.
(41)	Title of authorized representative as defined in the Quality Program.
(42)	Type or print name of Authorized Nuclear Inspector.
(43)	Indicate the Jurisdiction where the activity is performed, when required.
(44)	Indicate Authorized Nuclear Inspector's employer.
(45)	Indicate address of Authorized Nuclear Inspector's employer (city and state or province).
(46)	Indicate month, day, and year of inspection by the Authorized Nuclear Inspector.
(47)	Signature of Authorized Nuclear Inspector defined in item 42 above.

(48)	Indicate month, day, and year of signature by the Authorized Nuclear Inspector.
(49)	National Board Commission number and required endorsements.

PART 3, SECTION 11
REPAIRS AND ALTERATIONS — INDEX

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3.3.4.6 PATCHES

a) Flush Patches

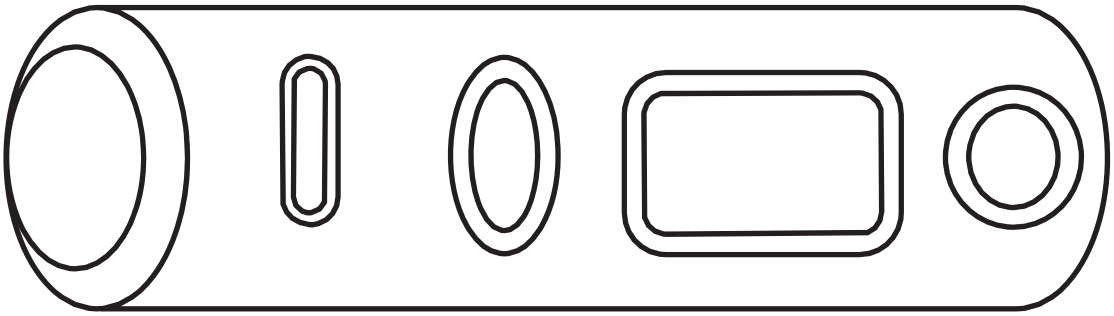
1) The weld around a flush patch shall be a full penetration weld and the accessible surfaces shall be ground flush where required by the applicable original code of construction. Examples of ~~flush welded~~ welded flush patches are shown in NBIC Part 3, Figure 3.3.4.6-a. ~~The welds shall be subjected to the nondestructive examination method used in the original code of construction or an alternative acceptable to the Inspector~~ and, where required, the Jurisdiction. Nondestructive examination ~~will~~ shall be performed in accordance with the requirements from NBIC Part 3, Section 4.2.~~.~~

2) Before installing a flush patch, ~~the the~~ defective material ~~should should~~ shall be removed until sound material is reached. The patch ~~should should~~ shall~~shall~~ be ~~rolled~~ formed to the proper shape or curvature. The edges ~~should should~~ shall~~shall~~ align without overlap. In stayed areas, the weld seams should come between staybolt rows or riveted seams. Patches shall be made from a material whose composition and thickness meet the intended service. Patches may be any shape or size. If the patch is rectangular, a minimum radius of not less than three times the material thickness shall be provided at the corners. Square corners are not permitted. The completed welds shall meet the requirements of the original code of construction.

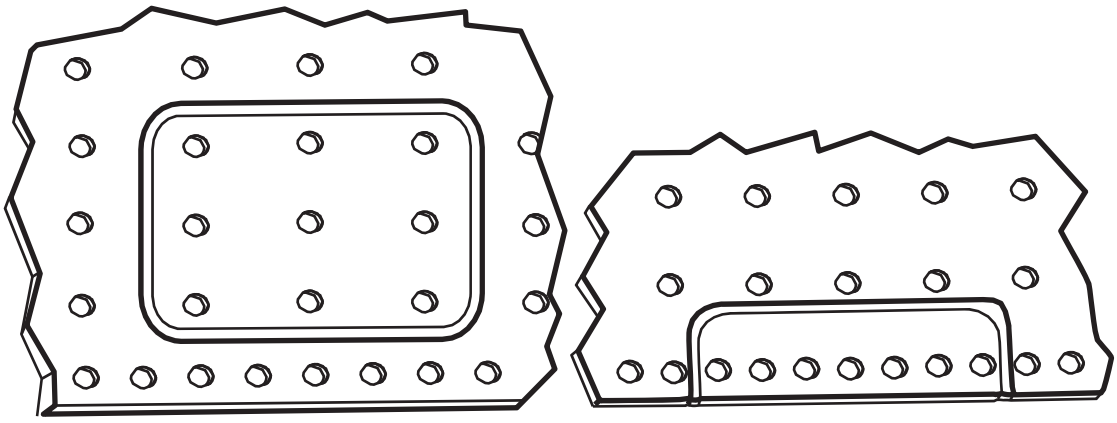
b) Tube Patches

In some situations it is necessary to weld a flush patch on a tube, such as when replacing tube sections and accessibility around the complete circumference of the tube is restricted, or when it is necessary to repair a small bulge. This is referred to as a window patch. Suggested methods for window patches are shown in NBIC Part 3, Figure 3.3.4.6-b.

FIGURE 3.3.4.6-a
FLUSH PATCH CONFIGURATIONS IN UNSTAYED AREAS



FLUSH PATCHES IN STAYED AREAS



These changes have evolved from far more extensive changes initially. These changes were made in committee at the July 2019 Subcommittee on Repairs and Alterations. Made to standardize NDE requirements across the NBIC and to reference Part 3, Section 4.2 requirements. Also changes acceptance of alternative NDE methods from being subject only to the Inspector’s approval and brings it under the jurisdiction AND the inspector.

Item 18-95

Revised after sent back from MC in July 2019

Existing wording:

S1.1.4 FORMULA AND CALCULATIONS FOR STEAM LOCOMOTIVE BOILERS

a) Most steam locomotive boilers were manufactured in the first half of the 20th century or before. The calculations, formula, and shop practices used are now distant history and quite difficult to obtain. The rules for riveted construction were last published by ASME in Section I Code, 1971 Edition.

b) This supplement herein, is based in part on the ASME Code, Section III, 1952 Edition, which was the last published edition of the Steam Locomotive Code. The railroad industry has attempted to collect the old formula and some shop practices. These have been published by The Engineering Standards Committee for Steam Locomotives, Inc. (ESC) as Compendium, Volume 1, Compilation of Calculations, which may be obtained from the Strasburg Rail Road, P.O. Box 96, Strasburg, PA 17579 (717) 687-7421.

Proposed wording:

S1.1.4 FORMULA AND CALCULATIONS FOR STEAM LOCOMOTIVE BOILERS

a) Most steam locomotive boilers were manufactured in the first half of the 20th century or before. The calculations, formula, and shop practices used are now distant history and quite difficult to obtain. The rules for riveted construction were last published by ASME in Section I Code, 1971 Edition **Currently, ASME, Section I, Part PR and Part PL, govern riveted construction and steam locomotive boiler construction, and these Parts may be referenced for repairs and alterations if appropriate for the boiler under repair/alteration.**

b) This supplement herein, is based in part on the ASME Code, Section III, 1952 Edition, which was the last published edition of the Steam Locomotive Code. The railroad industry has attempted to collect the old formula and some shop practices. These have been published by The Engineering Standards Committee for Steam Locomotives, Inc. (ESC) as Compendium, Volume 1, Compilation of Calculations, which may be obtained from the Strasburg Rail Road, P.O. Box 96, Strasburg, PA 17579 (717) 687-7421.

Background for Interpretation 18-100

Task Group PM – David Martinez;

Task Group members: Marty Russel and Nathan Carter

Item Number: 18-100 NBIC Location: Part 3, 3.3.2 Attachment Page 44

General Description: Revision adding (plugging) heat exchanger tubes with an outside diameter of ¾" or smaller to NBIC Part 3.3.2 Routine Repairs

Subgroup: Repairs and Alterations

Task Group: David Martinez (PM)

January 2019 Meeting Action: Progress Report: Mr. Martinez reported on this item and presented interpretations (98-04 and 98-29) that may satisfy the revision request, however after a presentation from TEiC regarding the use of explosive welding of tubes to be considered as a routine repair, Mr. Martinez recommend this be considered progress report to continue working to address explosive welding as a Routine Repair.

3.3.2 ROUTINE REPAIRS

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

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

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

d) Alternative welding methods without postweld heat treatment as described in NBIC Part 3, 2.5.3 shall not be used for routine repairs.

(Example of proposed additional category to examples of Routine Repairs – paragraph e)

e) The following repairs may be considered as routine repairs and shall be limited to these categories:

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

NDE other than visual is required by the original code of construction. This includes their attachments such as clips, lugs, skirts, etc., but does not include nozzles to pressure-retaining items;

2) The addition or repair of nonload bearing attachments to pressure-retaining items where postweld heat treatment is not required;

3) Weld buildup of wasted areas in heads, shells, flanges and fittings not exceeding an area of 100 in.2 (64,520 mm2) or a thickness of 25% of nominal wall thickness or 1/2 in. (13 mm), whichever is less;

4) Corrosion resistance weld overlay not exceeding 100 in.2 (64,520 mm2); ~~and~~

5) Seal welding a mechanical connection for leak tightness where by-design, the pressure retaining capability is not dependent on the weld for strength and requires no postweld heat treatment; and

6) Plugging of heat exchanger tubes ¾ in. outside diameter and smaller when explosive plugging is used as method of plugging tubes.

Background Interpretation

INTERPRETATION 15-04

Subject: Part 3, Section 3

Edition: 2015

Question: Is explosion welding of plugs into leaking heat exchanger tubes considered a repair per the NBIC Part 3?

Reply: Yes.

Support for Consideration of the Proposed Action

ASME Section IX – 2019 (Addresses Procedure and Performance Qualification for Explosion Welding heat exchanger tubes to tubesheets, but not the plug to the tube)

QW-193 TUBE-TO-TUBESHEET TESTS
When the applicable Code Section requires the use of this paragraph for tube-to-tubesheet demonstration mockup qualification, QW-193.1 through QW-193.1.3 shall apply.

QW-193.1 Procedure Qualification Specimens. Ten mockup welds are required for qualifying each tube-to tubesheet welding procedure. The mockup assembly shall essentially duplicate the tube-to-tubesheet weld joint design to be used in production, within the limits of the essential variables of QW-288. The mockup test assembly shall be prepared with the tubesheet element having a thickness not less than the lesser of the thickness of the production tubesheet or 2 in. (50 mm). For tube-to-tubesheet welds to clad tubesheets, the cladding or overlay may be represented by a base material with a chemical composition that is essentially equivalent to the cladding composition. All welds in the mockup assembly shall be subjected to the following tests and shall meet the applicable acceptance criteria.

QW-193.1.1 Visual Examination. The accessible surfaces of the welds shall be examined visually with no magnification required. The welds shall show complete fusion, be free from visual cracks or porosity indications,
and have no evidence of burning through the tube wall.

QW-193.1.2 Liquid Penetrant. The liquid penetrant examination shall meet the requirements of Section V, Article 6. The weld surfaces shall meet the requirements of QW-195.2.

QW-193.1.3 Macro-Examination. The mockup welds shall be sectioned through the center of the tube for macro-examination. The four exposed surfaces shall be smoothed and etched with a suitable etchant (see QW-470) to give a clear definition of the weld and heat-affected zone. Using a magnification of 10X to 20X, the exposed cross sections of the weld shall confirm
(a) minimum leak path dimension required by the design
(b) no cracking
(c) complete fusion of the weld deposit into the tubesheet and tube wall face

Table QW-288.2
Essential Variables for Procedure Qualification of Tube-to-Tubesheet Welding (Explosion Welding)

Paragraph		Brief of Variables
QW-403 Base Metals	.35	ϕ Tube thickness
QW-410 Technique	.82	ϕ Pressure application
	.83	ϕ Explosive
	.84	ϕ Distance charge to tubesheet
	.85	ϕ Specified clearance

Legend:
ϕ Change

QW-410.83 A change in the type of explosive or a change in the energy content greater than ±10%.

QW-410.84 A change in the distance between the explosive charge and the tubesheet face greater than ±10%.

QW-410.85 A change in the specified clearance between the tube and the tubesheet greater than ±10%.

QW-193.2 Performance Qualification Specimens.
A minimum of five mockup tube-to-tubesheet welds are required to qualify each welder or welding operator. The same rules as those applicable for procedure qualification (QW-193.1) shall be followed, with the following additional requirements and exceptions:
(a) The essential variables in QW-387 shall apply.
(b) Essential performance qualification variables applicable for each welding process listed in QW-350 or QW-360 shall also be observed in addition to the variables of Table QW-388.
(c) Postweld heat treatment may be omitted.

Only one mockup weld is required to renew a welder's or welding operator's qualification when that qualification has expired or has been revoked per the requirements of QW-322.1.

Logic to consider motion for approval:

- Explosion welding to plug leaking tubes is supported by qualified written welding procedures and welder qualification procedures compared to other mechanical tube-plugging methods that are performed with no NBIC guidance.
- Explosion welding does not rely on fusion to join the two materials. It is a pressure weld in which the explosive force joins the two materials. Unlike fusion welding that is allowed in other examples of Routine Repairs, there is no heat affected zone, and PWHT is not needed nor required.
- The majority, if not all explosion tube plugging is performed on tubes ¾" and smaller, and typically under emergency conditions. No Inspector involvement would be required if this specific category was added to the categories of Routine Repairs
- The explosion tube-plugging method for tubes ¾" and smaller would be more cost and schedule effective and is proven to be a reliable method for plugging leaking heat exchanger tubes for owners and users.

Note: The only realistic test upon completion of explosion tube-plugging is a pressure test.

Item 19-11 – Edwards – ~~01-02-20~~01-13-2020

Explanation of Need: Review the use of "Authorized Nuclear Inspection Agency" within the NBIC.

Background: An ANIA can not be an Inservice AIA since Endorsements for nuclear inspectors are issued only to new construction AIA's. The requirements for qualified Authorized Nuclear Inspectors/Supervisors are specified in NB-263, RCI-1. An NBIC revision is therefore needed to clarify reference to ANIAs in Part 3, 1.6.3 a) under the NR Accreditation Program.

This item was unanimously approved at SC-R/A but received 3 negatives on the MC ballot. There was some confusion in the original description of the proposed action in that reference was also made to revising the definition of "Authorized Nuclear Inspection Agency" in the Glossary (NBIC Parts 1, 2, 3, and 4). The MC negatives agreed with the proposal except that the action did not include a revision to the Glossary.

On further review, the current definition of "Authorized Nuclear Inspection Agency" in the Glossary is acceptable and does not require revision. The updated action for Item 19-11 is therefore to reaffirm revision to ¶1.6.3 a), to include reference to repair and alteration acceptance inspections and to delete reference to NB-369, and with no required change to the Glossary.

Upon discussion, the NR TG proposed rewording the proposed verbiage to replace "authorization" with "accreditation" to better align with the scope of the NB-360 Certificate.

Proposed Action: Revise Part 3, ¶1.6.3 a), as follows:

a) Have and maintain an inspection agreement with an Authorized Nuclear Inspection Agency accepted in accordance with NB-360, *National Board Acceptance of Authorized Inspection Agencies (AIA) Accredited by the American Society of Mechanical Engineers (ASME)*, with accreditation to perform repair and alteration acceptance inspections. ~~or accredited in accordance with NB-369, Accreditation of Authorized Inspection Agencies (AIA) Performing Inservice Inspection Activities and Qualification of Inspectors of Boilers and Pressure Vessels~~.

(Note to NBIC Secretary – The reference NBIC paragraph for Item 19-11 should be updated to reflect "NBIC Part 3, 1.6.3 a)" and the General Description revised to read "Clarify Reference to Authorized Nuclear Inspection Agencies")

Original Proposal – Information Only

Item 19-11 – Hellman – 7-15-2019

Location: Section 9 of Parts 1, 2, 3 and 4

Explanation of Need: Review the use of "Authorized Nuclear Inspection Agency" within the NBIC.

Background: An ANIA can not be an Inservice AIA since Endorsements for nuclear inspectors are issued only to new construction AIA's. The requirements for qualified Authorized Nuclear Inspectors/Supervisors are clearly specified in NB-263, RCI-1. Therefore revision to the Glossary definition is needed to clarify this requirement for the NR Accreditation Program.

Proposed Revision:

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

AUTHORIZATION

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

a) Have and maintain an inspection agreement with an Authorized Nuclear Inspection Agency accepted in accordance with NB-360, National Board Acceptance of Authorized Inspection Agencies (AIA) Accredited by the American Society of Mechanical Engineers (ASME) with authorization to perform repair and alteration acceptance inspections. ~~or accredited in accordance with NB-369, Accreditation of Authorized Inspection Agencies (AIA) Performing Inservice Inspection Activities and Qualification of Inspectors of Boilers and Pressure Vessels~~.
b) Have a written Quality Assurance Program that complies with the requirements of this section and address all controls for the intended category and scope of activities.
c) Have a current edition of the NBIC.

MC Negatives - Information Only

Committee Member:	Donnie LeSage	**Vote Date:**	2019-11-19	**Vote:**	Disapproved	**Uploads:**	
Member Comment:	I agree with Mr. Pillow. The Background stated "Therefore revision to the Glossary definition is needed". I don't see the proposed Glossary definition change.						

Committee Member:	James Pillow	**Vote Date:**	2019-10-30	**Vote:**	Disapproved	**Uploads:**	
Member Comment:	I agree with the proposed revision to 1.6.3, but the proposal does not include a revision to the Glossary as indicated in the Background.						

Committee Member:	Milton Washington	**Vote Date:**	2019-11-22	**Vote:**	Disapproved	**Uploads:**	
Member Comment:	I agree with Mr. Pillow that the proposal should include the glossary change as well.						

SUPPLEMENT 4
REPAIR AND ALTERATION OF FIBER-REINFORCED THERMOSETTING PLASTIC PRESSURE EQUIPMENT

S4.1 SCOPE

a) This supplement provides requirements and guidelines that apply to repairs and alterations to fiber-reinforced pressure-retaining items.

b) The letters “RP” shall be included on the “R” *Certificate of Authorization* for those organizations authorized to perform repairs/alterations of fiber-reinforced plastic pressure equipment.

S4.2 ~~INSPECTOR~~ QUALIFICATIONS FOR “R” ~~STAMP~~CERTIFICATE HOLDER DESIGNEE

The “R” Stamp Holder~~’s inspector shall have~~ shall designate an employee who will have the responsibility of verifying the repair and/or alteration activity meets the requirements of the NBIC. The designee shall have the following qualifications:

a) No fewer than five years of current verifiable documented experience in an occupational function that has a direct relationship to Reinforced Thermoplastic (RTP) fabrication and inspection, following customer or national standards, and be directly involved in the following activities:

1) the development of plans, drawings, procedures, inspection requirements, acceptance criteria, and personnel qualification requirements;

2) fabrication, construction, and supervision of personnel in the production of assemblies or subassemblies;

3) detection and measurement of nonconformities by application of visual or other nondestructive evaluation processes to written procedures;

4) supervision of personnel engaged in material and component examination;

5) repairs of equipment or supervision of personnel performing repairs;

6) preparation of written procedures for assembly, acceptance, nondestructive evaluation, or destructive tests;

7) qualification of secondary bonders, laminators, and welders to applicable codes, standards, or specifications;

8) operation techniques or activities used to fulfill quality control requirements for RTP fabrication or assembly; and

9) train the occupational skills of fabrication or assembly of RTP equipment.

b) The ~~Inspector~~ designee shall meet the following visual and educational requirements:

1) be able to read a Jaeger Type No. 1 standard chart at a distance of not less than 12 in. (305 mm);

2) be capable of distinguishing and differentiating contrast between colors;

3) have visual acuity checked annually to assure natural or corrected near distance vision; and

4) be a high school graduate or hold a state or military approved high school equivalency diploma.

c) The ~~employer of the inspector~~"R" Certificate Holder shall certify that the ~~employee~~ designee complies with the above qualification requirements.

S4.3 TOOLS

The following tools may be required by the ~~Inspector~~"R" Certificate~~Stamp~~ Holder's designee.:

a) adequate lighting including overall lighting and a portable lamp for close inspections;
b) handheld magnifying glass;
c) Barcol hardness tester;
d) small pick or pen knife;
e) small quantity of acetone and cotton swabs;
f) camera with flash capability; and
g) liquid penetrant testing kit.

S4.4 LIMITATIONS

All field work shall be limited to secondary bonding.

Item Number: 19-27, SG Historical
Part 3, S2.13.14.3

S2.13.14.3 REPAIR OF FUSIBLE PLUG OPENING

a) Threaded holes with damaged threads may be repaired by re-tapping or weld buildup and rethreading. ~~t~~The threads shall be removed prior to welding.

b) Threaded opening with damaged threads that ~~can not~~cannot be repaired by re-tapping or re-threading should be repaired by welding a flush patch or half coupling connection to the sheet.

c) The half coupling connection shall be such a size as to not interfere with proper operation of the fusible plug. The half coupling shall be welded flush to the fire side using a full penetration weld. The half coupling must not project higher than ½ inch (13 mm) from the water side (See Figure NBIC Part 3, S2.13.14.3-a).

d) Flush patch type repairs are to be installed in accordance with S2.13.9.3 and S2.13.10.3 (See Figure S2.13.14.3-b).

e) A fusible plug shall be of such length that when installed it shall project at least ¾ inch (19 mm) on the water side of the plate, tube, or flue. It shall extend through the plate, tube, or flue on the fire side as little as possible but not more than 1 inch (25 mm).

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add arrows to figure.

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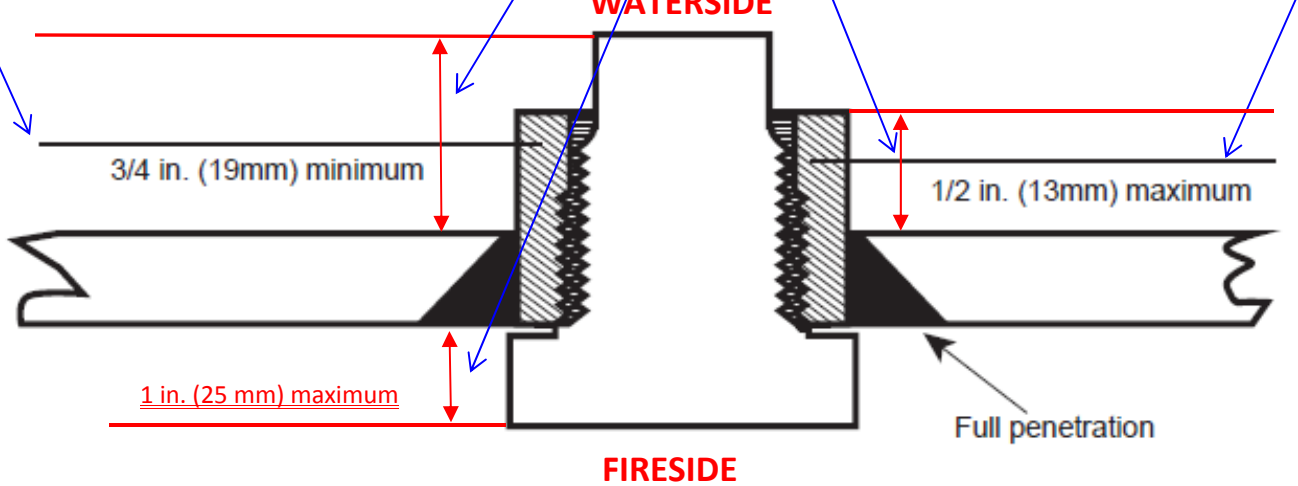
FIGURE S2.13.14.3-a
FUSIBLE PLUG REPAIR USING HALF COUPLING



Item 19-55

7/9/2019

Request for NBIC Part 3, Section 4 Revision

Purpose	To change the maximum test pressure requirement when performing liquid pressure tests of repair and alteration activities. This proposal was initially part of item NB16-2603, which proposed changes to 4.4.1 a) 1) and 4.4.2 a) 1). However, only the changes to 4.4.1 a) 1) made it into the 2019 NBIC.
Scope:	To revise paragraph 4.4.2 a) 1) of the NBIC Part 3 to require maximum liquid test pressure be in accordance with the original construction Code.
Background	For liquid pressure testing of repairs and alterations, paragraph 4.4.2(a)(1) of the NBIC Part 3 require a maximum test pressure of 150% of the maximum allowable working pressure (MAWP) stamped on the pressure retaining item, as adjusted for temperature. However, repairs and alterations of DOT vessels are required to be tested at a minimum of 150% of design pressure which makes it virtually impossible to comply with the NBIC maximum requirement. Further, repairs and alterations to DOT ammonia transport vessels made from UHT materials require a test pressure of 200% of design pressure (49CFR 180.413(b)(6) and 177.337-16). Obviously, this is in violation of the NBIC Part 3. Paragraph UG-99 of ASME Section VIII, Div. 1 does not not specify a maximum test pressure for hydrostatic tests. Therefore, it is p[proposed that paragraph 4.4.2(a)(1) be revised to remove the maximum test pressure of 150% of MAWP. The paragraph will have new wording (similar to existing paragraph 4.4.1(b) for pneumatic testing) which states test pressure shall not to exceed the maximum test pressure of the original code of construction.
Proposed Revision	See page 2 for proposed revisions.

EXISTING PARAGRAPH 4.4.2(a)(1) of NBIC Part 3

4.4.2 TEST OR EXAMINATION METHODS APPLICABLE TO ALTERATIONS

Based on the nature and scope of the alterations activity, one or a combination of the following examination and test methods shall be applied to alterations and replacement parts used in alterations.

a) Liquid Pressure Test

Pressure testing of alterations shall meet the following requirements:

1) A pressure test as required by the original code of construction shall be conducted. ~~The test pressure shall not exceed 150% of the maximum allowable working pressure (MAWP) stamped on the pressure retaining item, as adjusted for temperature.~~ When the original test pressure included consideration of corrosion allowance, the test pressure may be further adjusted based on the remaining corrosion allowance. The pressure test for replacement parts may be performed at the point of manufacture or point of installation;

PROPOSAL OF REVISION TO 4.4.2(a)(1)

1) A pressure test as required by the original code of construction shall be conducted. The test pressure shall not exceed the maximum liquid test pressure of the original code of construction. When the original test ~~t~~pressure included consideration of corrosion allowance, the test pressure may be further adjusted based on the remaining corrosion allowance. The pressure test for replacement parts may be performed at the point of manufacture or point of installation.

19-59 – Edwards – 12-23-19

Background – This Item is a proposed revision to Part 3, 3.2.2 e), as a result of an intent interpretation request under Item 19-34. The proposed interpretation was unanimously approved by SC-R/A but withdrawn at Main Committee pending action on a corresponding code revision. The original request and supporting information by the Inquirer are attached.

Proposed Action – Revise Part 3, 3.2.2 e), as follows:

e*) Replacement parts addressed by 3.2.2 c) or d) above shall receive a pressure test ~~as required by~~ at the pressure determined for the completed pressure equipment (boiler, pressure vessel, etc.) in accordance with the original code of construction. If replacement parts have not been pressure tested to this pressure ~~as required by the original code of construction~~ prior to installation they may be installed without performing the ~~original code of construction~~ pressure test provided the owner, the Inspector and, when required, the Jurisdiction accept the use of one or a combination of the examination and test methods shown in Part 3, Section 4, paragraph 4.4.1 (for repairs) or 4.4.2 (for alterations). The R Certificate Holder responsible for completing the R Form shall note in the Remarks section of the R Form the examination(s) and test(s) performed, and the reason the replacement part was not tested at the pressure determined for the completed pressure equipment in accordance with the original code of construction.*

INFORMATION ONLY

Inquiry No.	**19**
Source	GE
Subject	NE
Edition	20
Question	NE pre an hy the de
Reply	Ye
Committee's Question	NE pre 3.2 the
Committee's Reply	Ye
Rationale	AS do Ba *co* rec rev Th cla pre wh pa
SC Vote	
NBIC Vote	
Negative Vote Comments	

INFORMATION ONLY

Background Materials Submi

NBIC Part 3 Section 3 paragrap
test as required by the original
consistently by all users of the
construction." ASME issued int
not contain requirements for th
this, the words "… *as required*
testing of the parts is not requir
think that was the Committee's
interpretation and proposed rev
"original code of construction" t
required when the original code

Proposed Intent Interpretation:
Question: NBIC Part 3 paragra
required by the original code of
does not provide rules for hydr
intent of 3.2.2 e) that the refere
pressure?
Reply: Yes.

Associated Revision:
e) Replacement parts addresse
pressure determined for the co
original code of construction. I
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~~construction~~ pressure test provi
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or 4.4.2 (for alterations). The R
section of the R Form the exam
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Background Information:

NBIC Part 3 Section 3 paragrap

e) Replacement parts addresse
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ASME Interpretation I-16-6

Standard Designation:	BPV I
Edition/Addenda:	2015
Para./Fig./Table No:	PW-54
Subject Description:	Section I Intent Interpre
Date Issued:	08/16/2016
Record Number:	13-942
Interpretation Number :	BPV I-16-6
Question(s) and Reply(ies):	Question: Is it the inten regarding hydrostatic t or alteration of existing Reply: No. Section I d to Existing Boilers.

INFORMATION ONLY

2017 Addition to PW-54

PW-54.4 Refer to A-64 as guidance for welded pressure parts supplied to the user of an existing boiler as replacement or repair parts. (17)

A-64

A-64 REPAIRS TO EXISTING BOILERS

Where repairs are necessary that in any way affect the working pressure or safety of a boiler, a state inspector, municipal inspector, or an inspector employed regularly by an insurance company, which is authorized to do a boiler insurance business in the state in which the boiler is used, shall be called for consultation and advice as to the best method of making such repairs; after such repairs are made they shall be subject to the approval of a state inspector, municipal inspector, or an inspector regularly employed by an insurance company that is authorized to do a boiler insurance business in the state in which the boiler is used.

Recommendation

NBIC Part 3 - Item #: 19-48

Calibration:

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.

At a minimum it shall include:

A) A Calibration System shall include the following:

1. Examination, measuring, and test equipment, subject to calibration, shall have a unique identification number and a calibrated date as well as a specified next calibration due date.

2. The methodology of how the various equipment will be calibrated.

3. The person(s) responsible for the calibration of the equipment.

4. A statement that all calibrations will be tracible to the National Institute of Standards and Technology (NIST) or another nationally recognized Standards Organization, as much as practical.

5. A calibration record retention policy.

NBIC ACTION ITEM 18-65:

Proposed new sub-paragraphs – 1/10/19

~~3.2.1~~

~~c) Use of replacement material that has previously been in service or considered as used material may be permitted if deemed acceptable by the "R" Certificate Holder, the Inspector and, when required, the Jurisdiction. This material shall conform insofar as possible to the requirements of the original code of construction or construction standard, or code selected, and the NBIC. Material of this nature shall be given an initial visual inspection for verification of similar construction, and at a minimum meet all Code requirements of material(s) to be replaced, e.g; size, chemical, physical, minimum thickness, along with consideration of replacement material history of service, and be provided with original supporting documentation attesting to such.~~

~~d) Where original supporting documentation cannot be provided or is not available, the proposed replacement material shall be verified as being acceptable for use by the "R" Certificate Holder, along with Inspector concurrence, prior to installation. Such verification, at a minimum, shall consist of initial visual inspection along with laboratory analysis (chemical, physical, minimum thickness), and may be supplemented using one or a combination of the examination and test methods shown in Part 3 Section 4, paragraph 4.4.1 (for repairs) or 4.4.2 (for alterations).~~

Proposed Rev. 1 of new sub-paragraph – 1/14/20

3.2.1

c) Use of replacement material or Parts that ~~has~~ have previously been in service or considered as used material may be permitted if deemed acceptable by the "R" Certificate Holder, the Inspector, and if required, the Jurisdiction. This material shall conform insofar as possible to the original code of construction or construction standard, or code selected, and the NBIC. Consideration shall be given to the condition of replacement material that has previously been used, including its service history, prior to acceptance. Material/Parts that have been in time-dependent service shall not be permitted as replacement material/Parts without evaluation for exposure time.

323.1.4 Reclaimed Materials. Reclaimed pipe and other piping components may be used, provided they are properly identified as conforming to a listed or published specification (para. 323.1.1 or 323.1.2) and otherwise meet the requirements of this Code. Sufficient cleaning and inspection shall be made to determine minimum wall thickness and freedom from imperfections that would be unacceptable in the intended service.

NR Task Group "NR"
Task Group 19-69

CURRENT TEXT

5.12.5.1

8) Identify the original construction code, edition/addenda used for the system or component identified in line 4.

PROPOSED REVISION

5.12.5.1

8) Identify the original construction code, section, edition/addenda and applicable code cases used for the system or component identified in line 4.

CURRENT TEXT

5.12.5.1

11) Identify code edition/addenda used for design, when applicable.

PROPOSED REVISION

5.12.5.1

11) Identify code, section, edition/addenda and applicable code cases used for design, when applicable.

CURRENT TEXT

5.12.5.1

23) Identify Code section year and/or addenda used to perform work.

PROPOSED TEXT

5.12.5.1

23) Identify Code section ~~year~~ edition and/or addenda used to perform work.

WORK PERFORMED BY:

(1)

(Name of "NR" certificate holder)

(Address of "NR" certificate holder)

COMPONENT IDENTIFICATION

Edition/

No.	Type of Item	Mfg. Name	Serial No.	Nat'l Bd No.	Code Class	Code Section	~~Year~~/ Addenda	Code Case
(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)

Item 19-82: Request for Revision to NBIC Part 3, 1.5.1 j)

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

Purpose	Safety is not addressed in Part 3. This verbiage could be added to the 1.5.1 j) Method of Performing Work paragraph so Certificate Holders can address the safety concerns specific to their scope of activities.
Scope:	Part: Repairs and Alterations; Section: 1.5.1; Paragraph: 1.5.1 j)
Background:	Safety concerns from confined space issues, to flammable or volatile vessel contents should be addressed in Part 3 to ensure that welders, Inspectors, and other personnel are not put at unnecessary risk during Repair/Alteration activity.
Proposed Revision:	See below for the proposed revision

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

h) Repair and Alteration Methods

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

i) Materials

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

j) Method of Performing Work

The manual shall describe the methods for performing and documenting repairs and alterations in sufficient detail to permit the Inspector to determine at what stages specific inspections are to be performed. The method of repair or alteration must have prior acceptance of the Inspector. . The manual shall include provisions to ensure safe working conditions during welding, testing, and all activities related to repairs or alterations.

k) Welding, NDE and Heat Treatment

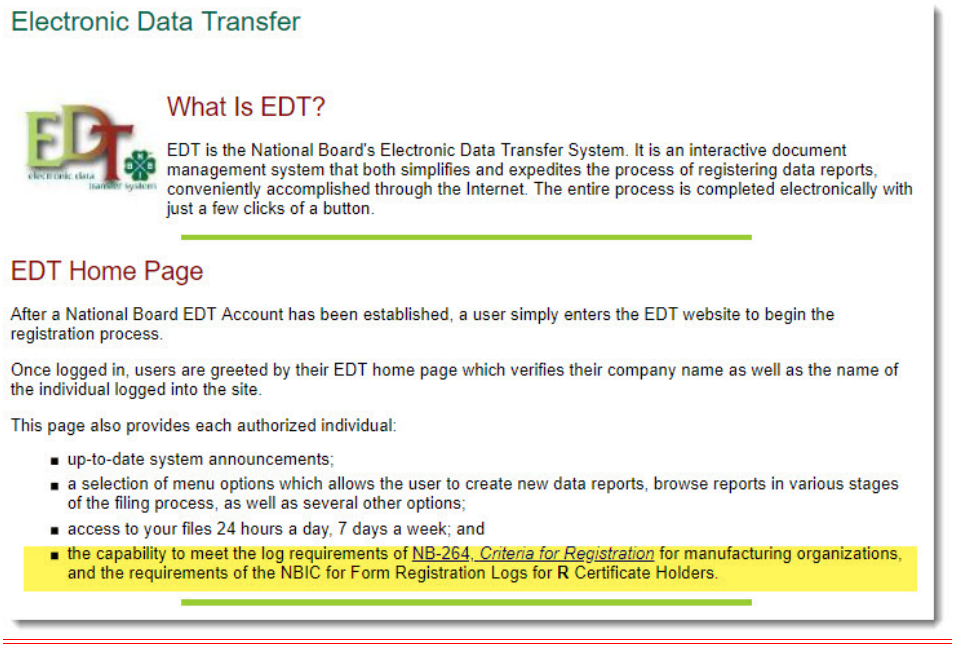
The manual shall describe controls for welding, nondestructive examination (NDE), and heat treatment. The manual is to indicate the title of the individual(s) responsible for the welding procedure specification (WPS) and its qualification, and the qualification of welders and welding

Item 19-91: Request for Revision to NBIC Part 3, 5.6

Purpose	Many "R" Certificate Holders now register R Forms in the National Board Electronic Data Transfer (EDT) System. The EDT system contains all of the required log information listed in paragraph 5.6 of Part 3, which makes it unnecessary and redundant for the "R" Cert. Holder to maintain a separate log.
Scope:	Part: Repairs and Alterations; Section: 5; Paragraph: 5.6
Background:	NBIC Part 3, paragraph 5.6 requires "R" Certificate Holders to maintain a log documenting all Forms registered with the National Board. The information required to be in the log are the the form's unique registration number, description of work performed, date of AIA acceptance, and date the report was submitted to the National Board.
Proposed Revision:	See below for the proposed revision.

5.6 FORM REGISTRATION LOG

"R" or "NR" Certificate Holders shall maintain a log or multiple logs documenting unique and sequentially numbered Form "R" Reports that are registered with the National Board. The logs shall include, as a minimum, each form's unique registration number, type (R-1, R-2, NR-1, etc.), description of work performed, date of acceptance by the Authorized Inspection Agency, and date the report was submitted to the National Board. As an alternative to the above requirement, the log may be maintained electronically in the National Board Electronic Data Transfer (EDT) System.



Electronic Data Transfer

What Is EDT?

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43 Filed Repair Report(s)

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REPAIR NO.	DATE	FORM	MFG. SERIAL NO.	DRAWING NO.
R43	7/10/2019	R2	22480	
R42	7/10/2019	R2	20687	
R41	6/5/2019	R2	19680	
R40	6/5/2019	R2	129	
R39	6/5/2019	R2	22234	
R38	5/3/2019	R2	20650	
R37	1/22/2019	R2	19475	
R36	1/22/2019	R2	107893	
R35	1/16/2019	R2	120083	
R34	11/13/2018	R2	156	
R33	2/5/2018	R2	160	
R32	2/5/2018	R2	117259	
R31	11/28/2017	R2	73821	
R30	8/9/2017	R2	117413	
R29	7/18/2017	R2	12208	
R28	10/9/2017	R2	A4516	
R27	6/22/2017	R2	A-2002	
R26	5/9/2017	R2	11006-2	
R25	1/25/2017	R2	67582	
R24	1/16/2017	R2	21250	

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Item 19-92: Request for Revision to NBIC Part 3, Table 2.3

Purpose	Add column and titles to Part 3, Table 2.3 for claritication.
Scope:	Part: Repairs and Alterations; Section: 2; Table 2.3
Background:	“Document Designation” is the name used by AWS Technical.
Proposed Revision:	See below for the proposed revision.

GMAW – Gas Metal Arc Welding	
Standard Welding Procedure Specification for Argon Plus 25% Carbon Dioxide Shielded Gas Metal Arc Welding (Short Circuiting Transfer Mode) followed by Argon Plus 2% Oxygen Shielded Gas Metal Arc Welding (Spray Transfer Mode) of Carbon Steel (M-1/P-1/S-1, Groups 1 and 2), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, ER70S-3, Flat Position Only, As-Welded or PWHT Condition, Primarily Pipe Applications.	B2.1-1-233: 2006
Standard Welding Procedure Specification for Argon Plus 2% Oxygen Shielded Gas Metal Arc Welding (Spray Transfer Mode) of Carbon Steel (M-1/P-1/S-1, Groups 1 and 2), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, ER70S-3, Flat Position Only, As-Welded or PWHT Condition, Primarily Pipe Applications.	B2.1-1-235: 2006
GTAW/SMAW Combination of Welding Processes	
Title	**Designation**
Standard Welding Procedure Specification for Gas Tungsten Arc Welding Followed by Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, ER70S-2 and E7018, As-Welded or PWHT Condition.	B2.1-1-021-94 and B2.1-1-021-94R
Standard Welding Procedure Specification for Gas Tungsten Arc Welding followed by Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Groups 1 or 2), 1/8 in. (3.2 mm) through 3/4 in. (19 mm) Thick, ER70S-2 and E7018, As-Welded or PWHT Condition, Primarily Pipe Applications.	B2.1-1-209-96
Standard Welding Procedure Specification for Gas Tungsten Arc Welding followed by Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Groups 1 or 2), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, ER70S-2 and E7018, As-Welded or PWHT Condition, Primarily Pipe Applications.	B2.1-1-209-96 (R2007)
Standard Welding Procedure Specification for Gas Tungsten Arc Welding (Consumable Insert) Followed by Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 3/4 in. (19 mm) Thick, INMs1 and E7018, As-Welded or PWHT Condition, Primarily Pipe Applications.	B2.1-1-211-96
Standard Welding Procedure Specification for Gas Tungsten Arc Welding with Consumable Insert Root Followed by Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, INMs-1, ER70S-2, and E7018 As-Welded or PWHT Condition, Primarily Pipe Applications.	B2.1-1-211:2001 R2012
GMAW/FCAW – Combination of Welding Processes	
Standard Welding Procedure Specification for Argon Plus 25% Carbon Dioxide Shielded Gas Metal Arc Welding (Short Circuiting Transfer Mode) Followed by Argon Plus 25% Carbon Dioxide Shielded Flux Cored Arc Welding of Carbon Steel (m-1/P-1/S-1, Groups 1 and 2), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, ER70S-3 and EXT-X, As-Welded or PWHT Condition, Primarily Pipe Applications.	B2.1-1-232:2006

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

SMAW — Shielded Metal Arc Welding	
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 in. (3.2 mm) through 1½ in. (38 mm) Thick, As-Welded Condition.	B2.1-8-023-94

New Item: Item # _____; Update NBIC Part 3, Table 2.3 (2019 Edition) adding the following listed SWPSs

PROPOSED REVISION

Revise Table 2.3 with the addition of the following listed Revised SWPS's.

TABLE 2.3

*Title	*Designation
Standard Welding Procedure Specification (SWPS) for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1, Group 1 or 2), 1/8" [3 mm] through 3/4 inch [19 mm] Thick, E6010 (Vertical Uphill) Followed by E7018 (Vertical Uphill), in the As-Welded Condition, Primarily Pipe Applications.	B2.1-1-201: 2019
Standard Welding Procedure Specification (SWPS) for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1, Group 1 or 2), 1/8" [3 mm] through 3/4 inch [19 mm] Thick, E6010 (Vertical Downhill) Followed by E7018 (Vertical Uphill), in the As-Welded Condition, Primarily Pipe Applications.	B2.1-1-202: 2019
Standard Welding Procedure Specification (SWPS) for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1, Group 1 or 2), 1/8" [3 mm] through 3/4 inch [19 mm] Thick, E6010 (Vertical Uphill), in the As-Welded Condition, Primarily Pipe Applications.	B2.1-1-203: 2019
Standard Welding Procedure Specification (SWPS) for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1, Group 1 or 2), 1/8" [3 mm] through 3/4 inch [19 mm] Thick, E6010 (Vertical Downhill Root with the Balance Vertical Uphill), in the As-Welded Condition, Primarily Pipe Applications.	B2.1-1-204: 2019
Standard Welding Procedure Specification (SWPS) for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1, Group 1 or 2), 1/8" [3 mm] through 1-1/2 inch [38 mm] Thick, E6010 (Vertical Uphill) Followed by E7018 (Vertical Uphill), in the As-Welded Condition or PWHT Condition, Primarily Pipe Applications.	B2.1-1-205: 2019
Standard Welding Procedure Specification (SWPS) for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1, Group 1 or 2), 1/8" [3 mm] through 1-1/2 inch [38 mm] Thick, E6010 (Vertical Downhill) Followed by E7018 (Vertical Uphill), in the As-Welded Condition or PWHT Condition, Primarily Pipe Applications.	B2.1-1-206: 2019
Standard Welding Procedure Specification (SWPS) for Gas Tungsten Arc Welding of Carbon Steel (M-1/P-1, Group 1 or 2), 1/8" [3 mm] through 1-1/2 inch [38 mm] Thick, ER70S-2, in the As-Welded Condition or PWHT Condition, Primarily Pipe Applications.	B2.1-1-207: 2019
Standard Welding Procedure Specification (SWPS) for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1, Group 1 or 2), 1/8" [3 mm] through 1-1/2 inch [38 mm] Thick, E7018, in the As-Welded Condition or PWHT Condition, Primarily Pipe Applications.	B2.1-1-208: 2019

Standard Welding Procedure Specification (SWPS) for Gas Tungsten Arc Welding Followed by Shielded Meal Arc Welding of Carbon Steel (M-1/P-1, Group 1 or 2), 1/8" [3 mm] through 1 - 1 / 2 inch [38 mm] Thick, ER70S-2 and E7018, in the As-Welded Condition or PWHT Condition, Primarily Pipe Applications.	**B2.1-1-209: 2019**

- **Info only pending adoption of Item 19-92**

NB15-0321
AMR suggested edits
1-15-20

PART 4

3.2.4.4 ~~RUPTURE DISKS~~NON-RECLOSING PRESSURE RELIEF DEVICES

g) For rupture disks and other non-reclosing devices, the following additional items should be considered during inspections.

No changes under 3.2.4.4 g)1) through g)10). New text as follows under 3.2.4.4 g)11) through g)14).

11) For non-reclosing PRDs that use pins or bars, those components should be checked for bends/deflection, cracks, or corrosion. Pin deflection may be the results of pin fasteners being overtightened.

12) For non-reclosing PRDs that use pins or bars, the markings on those components should be checked against information on the device nameplate to ensure that they are installed on the correct device. If markings are illegible or missing, the device should be taken out of service and the pin or bar should be replaced with a component specified by the manufacturer. Replacement shall not be performed while the device is pressurized.

13) For non-reclosing PRDs that use pins or bars, check that there is no foreign object present that could interfere with the bar or pin, prevent proper operation of the device, hold the device shut.

14) It is recommended that pins or bars be replaced periodically to prevent unintended failure while in service due to deterioration of the load-bearing component.

3.2.5 GENERAL CONSIDERATIONS FOR TESTING AND OPERATIONAL INSPECTION OF PRESSURE RELIEF DEVICES

a) Pressure relief ~~valves shall be tested periodically to ensure that they are free to operate and will operate~~devices shall be subject to periodic inspection and/or testing based upon the type of device. ~~in accordance with the requirements of the original code of construction. Testing should include device set or opening pressure, reclosing pressure, where applicable, and seat leakage evaluation. Tolerances specified for these operating requirements in the original code of construction shall be used to determine the acceptability of test results.~~

b) Testing may be accomplished by the owner on the unit where the valve is installed or at a qualified test facility. In many cases, testing on the unit may be impractical, especially if the service fluid is hazardous or toxic. Testing on the unit may involve the bypassing of operating controls and should only be performed
by qualified individuals under carefully controlled conditions. It is recommended that a written procedure be available to conduct this testing.

1) The Inspector should ensure that calibrated equipment has been used to perform this test and the results should be documented by the owner.

2) If the testing ~~was~~ is performed at a test facility, the record of this test should be reviewed to ensure the ~~valve~~ device meets the requirements of the original code of construction. ~~Valves~~ Devices which have been in toxic, flammable, or other hazardous services shall be carefully decontaminated before being tested. In particular, the closed bonnet of valves in these services may contain fluids that are not easily removed or neutralized. If a test cannot be safely performed, the ~~valve~~ device shall be disassembled,

cleaned, ~~and~~ decontaminated, repaired, and reset.
3) If a ~~valve~~ device has been removed for testing, the inlet and outlet connections should be checked for blockage by product buildup or corrosion.

3.2.5.1 TESTING AND OPERATIONAL INSPECTION OF PRESSURE RELIEF VALVES

In addition to 3.2.5, the following apply to testing and operational inspection of pressure relief valves.

a) Pressure relief valves shall be tested periodically to ensure that they are free to operate and will operate in accordance with the requirements of the original code of construction. Testing should include device set or opening pressure, reclosing pressure, where applicable, and seat leakage evaluation. Tolerances specified for these operating requirements in the original code of construction shall be used to determine the acceptability of test results.

b) Valves may be tested using lift assist devices when testing at full pressure may cause damage to the valve being tested, or it is impractical to test at full pressure due to system design considerations. Lift assist devices apply an auxiliary load to the valve spindle or stem, and using the measured inlet pressure, applied load and other valve data allow the set pressure to be calculated. If a lift assist device is used to determine valve set pressure, the conditions of 4.6.3 shall be met. It should be noted that false set pressure readings may be obtained for valves which are leaking excessively or otherwise damaged.

~~c~~c) If valves are not tested on the system using the system fluid, the following test mediums shall be used:

1) High pressure boiler pressure relief valves, high temperature hot-water boiler pressure relief valves, low pressure steam heating boilers: steam;

2) Hot-water heating boiler pressure relief valves: steam, air, or water;

3) Hot water heater temperature and pressure relief valves: air or water;

4) Air and gas service process pressure relief valves: air, nitrogen, or other suitable gas;

5) Liquid service process pressure relief valves: water or other suitable fluid;

6) Process steam service pressure relief valves: steam or air with manufacturer's steam to air correction factor.

Note: Valves being tested after a repair must be tested on steam except as permitted by 4.6.2.

~~d~~d) As an alternative to a pressure test, the valve may be checked by the owner for freedom of operation by activating the test or "try" lever (manual check). For high pressure boiler and process valves, this test should be performed only at a pressure greater than 75% of the stamped set pressure of the valve or the lifting device may be damaged. This test will only indicate that the valve is free to operate and does not provide any information on the actual set pressure. All manual checks should be performed with some pressure under the valve in order to flush out debris from the seat that could cause leakage.

Note: The manual check at 75% or higher is based on lift lever design requirements for ASME Section I and VIII valves. Code design requirements for lifting levers for Section IV valves require that the valve be capable of being lifted without pressure.

~~f~~e) Systems with multiple valves will require the lower set valves to be held closed to permit the higher set valves to be tested. A test clamp or "gag" should be used for this purpose. The spring compression screw shall not be tightened. It is recommended that the test clamps be applied in accordance with the valve manufacturer's instructions when the valve is at or near the test temperature, and be applied hand tight only to avoid damage to the valve stem or spindle.

~~g~~f) Upon completion of set pressure testing, all pressure relief valve gags shall be removed. Any stop valves used to isolate lower set pressure relief devices shall be reopened (and locked, if applicable).

3.2.5.2 TESTING AND OPERATIONAL INSPECTION OF NON-RECLOSING PRESSURE RELIEF DEVICES WITH PINS OR BARS

In addition to 3.2.5, the following apply to testing and operational inspection of non-reclosing PRDs with pins or bars.

a) Periodic set point testing is not required since pins or bars are single use.

b) Periodic inspection shall be per 3.2.4.4.

c) Non-reclosing PRDs shall be periodically inspected by the owner for freedom of motion. Freedom of motion inspection frequency shall be per 3.2.6.

1) Remove pressure from the PRD, or remove the PRD from service, prior to performing this check.

2) Remove the pin or bar.

3) Manually exercise the sealing mechanism to ensure it is capable of its full range of motion.

4) Reinstall the pin or bar or replace with new. Replacement pin or bar shall be per manufacturer recommendation.

5) Restore pressure to the PRD.

6) The PRD should be checked for seat leakage following restoration of pressure.

d) The owner may elect to have a non-reclosing PRD tested periodically in order to determine service life of the device. Such tests should ensure that the PRD is free to operate and will operate in accordance with the requirements of the original code of construction. Testing should include device set or opening pressure and seat leakage evaluation. Tolerances specified for these operating requirements in the original code of construction should be used to determine the acceptability of test results.

3.2.5.3 TESTING AND OPERATIONAL INSPECTION OF RUPTURE DISKS

In addition to 3.2.5, the following apply to testing and operational inspection of rupture disks.

a) Periodic testing of rupture disks is not required

b) Rupture disks shall be subject to periodic inspection per 3.2.4.4.

c) The owner may elect to have a rupture disks tested periodically in order to determine service life. Such tests should ensure that the disk is free to operate inside its holder and will operate in accordance with the requirements of the original code of construction. Testing should include an evaluation of leakage through the disk (e.g. due to cracks or porosity), followed by device opening or burst pressure at rated temperature. Tolerances specified for these operating requirements in the original code of construction should be used to determine the acceptability of test results.

d) If PRDs are not tested on the system using the system fluid, the following test mediums shall be used:

1) Air and gas service PRDs: air, nitrogen, or other suitable gas;

2) Liquid service PRDs: water or other suitable fluid.

3.2.5.~~1~~ 4 CORRECTIVE ACTION

a) If a ~~valve~~ pressure relief valve or a non-reclosing PRD that is actuated by a pin or bar is found to be stuck closed, the system should immediately be taken out of service until the condition can be corrected, unless special provisions have been made to operate on a temporary basis (such as additional relief capacity provided by another valve.) The owner shall be notified and corrective action such as repairing or replacing the inoperable ~~valve~~ device shall be taken.

b) If a pressure relief device leaks, the owner shall be notified and decide what corrective action (if any) will be taken.

PART 2

2.5.5.4 ~~RUPTURE DISKS~~NON-RECLOSING PRESSURE RELIEF DEVICES

g) For rupture disks and other non-reclosing devices, the following additional items should be considered during inspections.

No changes under 2.5.5.4 g)1) through g)10). New text as follows under 2.5.5.4 g)11) through g)14).

11) For non-reclosing PRDs that use pins or bars, those components should be checked for bends/deflection, cracks, or corrosion. Pin deflection may be the results of pin fasteners being overtightened.

12) For non-reclosing PRDs that use pins or bars, the markings on those components should be checked against information on the device nameplate to ensure that they are installed on the correct device. If markings are illegible or missing, the device should be taken out of service and the pin or bar should be replaced with a component specified by the manufacturer. Replacement shall not be performed while the device is pressurized.

13) For non-reclosing PRDs that use pins or bars, check that there is no foreign object present that could interfere with the bar or pin, prevent proper operation of the device, hold the device shut.

14) It is recommended that pins or bars be replaced periodically to prevent unintended failure while in service due to deterioration of the load-bearing component.

2.5.7 GENERAL CONSIDERATIONS FOR TESTING AND OPERATIONAL INSPECTION OF PRESSURE RELIEF DEVICES

a) Pressure relief ~~valves shall be tested periodically to ensure that they are free to operate and will operate~~devices shall be subject to periodic inspection and/or testing based upon the type of device. ~~in accordance with the requirements of the original code of construction. Testing should include device set or opening pressure, reclosing pressure, where applicable, and seat leakage evaluation. Tolerances specified for these operating requirements in the original code of construction shall be used to determine the acceptability of test results.~~

b) Testing may be accomplished by the owner on the unit where the valve is installed or at a qualified test facility. In many cases, testing on the unit may be impractical, especially if the service fluid is hazardous or toxic. Testing on the unit may involve the bypassing of operating controls and should only be performed
by qualified individuals under carefully controlled conditions. It is recommended that a written procedure be available to conduct this testing.

1) The Inspector should ensure that calibrated equipment has been used to perform this test and the results should be documented by the owner.

2) If the testing ~~was~~ is performed at a test facility, the record of this test should be reviewed to ensure the ~~valve~~ device meets the requirements of the original code of construction. ~~Valves~~ Devices which have been in toxic, flammable, or other hazardous services shall be carefully decontaminated before being tested. In particular, the closed bonnet of valves in these services may contain fluids that are not easily removed or neutralized. If a test cannot be safely performed, the ~~valve~~ device shall be disassembled, cleaned, ~~and~~ decontaminated, repaired, and reset.
3) If a ~~valve~~ device has been removed for testing, the inlet and outlet connections should be checked for blockage by product buildup or corrosion.

2.5.7.1 TESTING AND OPERATIONAL INSPECTION OF PRESSURE RELIEF VALVES

In addition to 2.5.7, the following apply to testing and operational inspection of pressure relief valves.

a) Pressure relief valves shall be tested periodically to ensure that they are free to operate and will operate in accordance with the requirements of the original code of construction. Testing should include device set or opening pressure, reclosing pressure, where applicable, and seat leakage evaluation. Tolerances specified for these operating requirements in the original code of construction shall be used to determine the acceptability of test results.

b) Valves may be tested using lift assist devices when testing at full pressure may cause damage to the valve being tested, or it is impractical to test at full pressure due to system design considerations. Lift assist devices apply an auxiliary load to the valve spindle or stem, and using the measured inlet pressure, applied load and other valve data allow the set pressure to be calculated. If a lift assist device is used to determine valve set pressure, the conditions of 4.6.3 shall be met. It should be noted that false set pressure readings may be obtained for valves which are leaking excessively or otherwise damaged.

~~c~~c) If valves are not tested on the system using the system fluid, the following test mediums shall be used:

1) High pressure boiler pressure relief valves, high temperature hot-water boiler pressure relief valves, low pressure steam heating boilers: steam;

2) Hot-water heating boiler pressure relief valves: steam, air, or water;

3) Hot water heater temperature and pressure relief valves: air or water;

4) Air and gas service process pressure relief valves: air, nitrogen, or other suitable gas;

5) Liquid service process pressure relief valves: water or other suitable fluid;

6) Process steam service pressure relief valves: steam or air with manufacturer's steam to air correction factor.

Note: Valves being tested after a repair must be tested on steam except as permitted by 4.6.2.

~~e~~d) As an alternative to a pressure test, the valve may be checked by the owner for freedom of operation by activating the test or "try" lever (manual check). For high pressure boiler and process valves, this test should be performed only at a pressure greater than 75% of the stamped set pressure of the valve or the lifting device may be damaged. This test will only indicate that the valve is free to operate and does not provide any information on the actual set pressure. All manual checks should be performed with some pressure under the valve in order to flush out debris from the seat that could cause leakage.

Note: The manual check at 75% or higher is based on lift lever design requirements for ASME Section I and VIII valves. Code design requirements for lifting levers for Section IV valves require that the valve be capable of being lifted without pressure.

~~f~~e) Systems with multiple valves will require the lower set valves to be held closed to permit the higher set valves to be tested. A test clamp or "gag" should be used for this purpose. The spring compression screw shall not be tightened. It is recommended that the test clamps be applied in accordance with the valve manufacturer's instructions when the valve is at or near the test temperature, and be applied hand tight only to avoid damage to the valve stem or spindle.

~~g~~f) Upon completion of set pressure testing, all pressure relief valve gags shall be removed. Any stop valves used to isolate lower set pressure relief devices shall be reopened (and locked, if applicable).

2.5.7.2 TESTING AND OPERATIONAL INSPECTION OF NON-RECLOSING PRESSURE RELIEF DEVICES WITH PINS OR BARS

In addition to 2.5.7, the following apply to testing and operational inspection of non-reclosing PRDs with pins or bars.

a) Periodic set point testing is not required since pins or bars are single use.

b) Periodic inspection shall be per 2.5.5.4.

c) Non-reclosing PRDs shall be periodically inspected by the owner for freedom of motion. Freedom of motion inspection frequency shall be per 2.5.8.

1) Remove pressure from the PRD, or remove the PRD from service, prior to performing this check.

2) Remove the pin or bar.

3) Manually exercise the sealing mechanism to ensure it is capable of its full range of motion.

4) Reinstall the pin or bar or replace with new. Replacement pin or bar shall be per manufacturer recommendation.

5) Restore pressure to the PRD.

6) The PRD should be checked for seat leakage following restoration of pressure.

d) The owner may elect to have a non-reclosing PRD tested periodically in order to determine service life of the device. Such tests should ensure that the PRD is free to operate and will operate in accordance with the requirements of the original code of construction. Testing should include device set or opening pressure and seat leakage evaluation. Tolerances specified for these operating requirements in the original code of construction should be used to determine the acceptability of test results.

2.5.7.3 TESTING AND OPERATIONAL INSPECTION OF RUPTURE DISKS

In addition to 2.5.7, the following apply to testing and operational inspection of rupture disks.

a) Periodic testing of rupture disks is not required

b) Rupture disks shall be subject to periodic inspection per 2.5.5.4.

c) The owner may elect to have a rupture disks tested periodically in order to determine service life. Such tests should ensure that the disk is free to operate inside its holder and will operate in accordance with the requirements of the original code of construction. Testing should include an evaluation of leakage through the disk (e.g. due to cracks or porosity), followed by device opening or burst pressure at rated temperature. Tolerances specified for these operating requirements in the original code of construction should be used to determine the acceptability of test results.

d) If PRDs are not tested on the system using the system fluid, the following test mediums shall be used:

1) Air and gas service PRDs: air, nitrogen, or other suitable gas;

2) Liquid service PRDs: water or other suitable fluid.

2.5.7.~~1~~ 4 CORRECTIVE ACTION

a) If a ~~valve~~ pressure relief valve or a non-reclosing PRD that is actuated by a pin or bar is found to be stuck closed, the system should immediately be taken out of service until the condition can be corrected, unless special provisions have been made to operate on a temporary basis (such as additional relief capacity provided by another valve.) The owner shall be notified and corrective action such as repairing or replacing the inoperable ~~valve~~ device shall be taken.

b) If a pressure relief device leaks, the owner shall be notified and decide what corrective action (if any) will be taken.

NB15-0324 Testing, storage, and shelf life guidelines
1-15-20

New glossary entry

Pressure Relief Valve Shelf Life – For a pressure relief valve or pilot valve, the length of time for which the device can be stored, after it has been set and tested or repaired, prior to installation, without requiring a retest or reduced service interval.

New supplement

SUPPLEMENT SX
PRESSURE RELIEF AND PILOT VALVE STORAGE & SHELF LIFE

SX.1 SCOPE

This supplement provides guidance for proper conditions and duration of pressure relief valve storage. This guidance applies to pressure relief valves, temperature & pressure relief valves, and pilot operated pressure relief valves (including the main body valve and the pilot valve).

SX.2 PRESSURE RELIEF VALVE STORAGE

Pressure relief valve set pressure and/or seat tightness can deviate during storage. The manufacturer's recommendations should be followed regarding shelf life. In some cases, it may be necessary to retest the relief valve prior to installation or reduce maintenance interval if the relief valve was in storage for an extended period. When storing relief valves, a first in / first out policy should be followed.

SX.3 PRESSURE RELIEF VALVE STORAGE CONDITIONS
Relief valves should be stored per manufacturer recommendations. Where the manufacturer has no recommendations, the following guidelines should be followed.

a) Storage temperature should be between 40 and 72 °F, where practical. Otherwise, storage temperature should be within the operating or storage temperature range provided by the manufacturer.
b) Ideal relative humidity in the storage area should be 70 percent or less. For relief valves with soft seats, relative humidity should be kept between 30 and 70 percent. Some soft materials require a minimum humidity level to prevent material degradation.
c) Storage area should have a non-corrosive atmosphere. Otherwise, stored relief valves should be protected from the atmosphere.
d) Relief valves that utilize spindles or weights should be stored in a vertical position.
e) Temperature and pressure relief valves should have their probes supported to prevent bending or detachment.
f) All ports should be plugged, blanked, or capped.
g) Relief valves that have been cleaned for oxidizing gas or other specialty service should be sealed in a plastic bag. Plastic wrapping may be acceptable for larger relief valves.
h) Storage should be off the ground (e.g. on a shelf or pallet).
i) Storage area should limit exposure to direct sunlight

j) Relief valves constructed of materials subject to corrosion (such as carbon steel) should be painted or otherwise protected against the environment prior to storage.

SX.4 PRESSURE RELIEF VALVE SHELF LIFE

Pressure Relief valve shelf life shall be determined based upon manufacturer's recommendations and performance history. Shelf life may increase or decrease based upon storage conditions and performance history. In the absence of manufacturer or service provider recommendations, and performance history, the shelf life recommendations per table S8.4 should be used when stored in accordance with S8.3. Shelf life may be increased or decreased, from the recommended values, once performance history is established.

TABLE S8.4 RECOMMENDED RELIEF VALVE SHELF LIFE (IF NOT PROVIDED BY MANUFACTURER)

Pressure Relief Valve Description	Recommended Shelf Life (years)
Temperature and pressure relief valve	2
Pressure relief valve with metal-to-metal seat	5
Pressure relief valve with nonmetal seat	2

SX.4.1 EXCEEDING SHELF LIFE

If shelf life is exceeded, the valve shall either be tested prior to installation or tested using its lift lever (if applicable) following installation. Storage for a length of time less than the shelf life of the pressure relief valve does not reduce the time before the first regularly scheduled retest. If performance history shows that time in storage less than shelf life causes the device to function outside of acceptable tolerance, then the shelf life shall be reduced.

NB16-0805 AMR edits 1/15/20

Update language about pipe material able to handle temperature requirements, in line with IMC.

Proposed Edits (Note that we intentionally are not adding this to power boilers. Power boilers are getting their own supplement that will include PRV piping requirements specific to power boilers):

Part 1, 3.9.1.5 PRESSURE RELIEF VALVE DISCHARGE PIPING

c)Discharge piping shall be rated for the discharge fluid conditions of pressure and temperature including a minimum and maximum design temperature. Material selection for the- discharge piping shall consider the reduction in material toughness at the low end of design temperature and the reduction in material strength at the high end of design temperature. Rigid pipe or tubing ~~shall~~should be used for discharge lines that carry hot water or steam.

d) Plastic discharge pipe and fittings are permitted (when compatible with the process fluid, system design temperatures, and other ambient conditions such as light and humidity) and shall conform to NSF/ANSI 14 Plastics Piping System Components and Related Materials.

e) Discharge piping shall be rated for any static pressure present and the back pressure that may develop when the pressure relief device is at full capacity. Where multiple pressure relief devices or vents discharge into common piping, the back pressure that could develop due to simultaneous flow from all sources shall be considered.

Part 1, 3.9.4.7 TEMPERATURE AND PRESSURE RELIEF VALVE DISCHARGE PIPING

d) Discharge piping shall be rated for the discharge fluid conditions of pressure and temperature including a minimum and maximum design temperature. Material selection for the- discharge piping shall consider the reduction in material toughness at the low end of design temperature and the reduction in material strength at the high end of design temperature. Rigid pipe or tubing ~~shall~~should be used for discharge lines that carry hot water or steam.

e) Plastic discharge pipe and fittings are permitted (when compatible with the process fluid, system design temperatures, and other ambient conditions such as light and humidity) and shall conform to NSF/ANSI 14 Plastics Piping System Components and Related Materials.

f) Discharge piping shall be rated for any static pressure present and the back pressure that may develop when the pressure relief device is at full capacity. Where multiple pressure relief devices or vents discharge into common piping, the back pressure that could develop due to simultaneous flow from all sources shall be considered.

Part 4, 2.4.1.5 PRESSURE RELIEF VALVE DISCHARGE PIPING

c) Discharge piping shall be rated for the discharge fluid conditions of pressure and temperature including a minimum and maximum design temperature. Material selection for the discharge piping shall consider the reduction in material toughness at the low end of design temperature and the reduction in material strength at the high end of design temperature. Rigid pipe or tubing should be used for discharge lines that carry hot water or steam.

d) Plastic discharge pipe and fittings are permitted (when compatible with the process fluid, system design temperatures, and other ambient conditions such as light and humidity) and shall conform to NSF/ANSI 14 Plastics Piping System Components and Related Materials.

e) Discharge piping shall be rated for any static pressure present and the back pressure that may develop when the pressure relief device is at full capacity. Where multiple pressure relief devices or vents discharge into common piping, the back pressure that could develop due to simultaneous flow from all sources shall be considered.

Part 4, 2.4.4.7 TEMPERATURE AND PRESSURE RELIEF VALVE DISCHARGE PIPING

d) Discharge piping shall be rated for the discharge fluid conditions of pressure and temperature including a minimum and maximum design temperature. Material selection for the discharge piping shall consider the reduction in material toughness at the low end of design temperature and the reduction in material strength at the high end of design temperature. Rigid pipe or tubing should be used for discharge lines that carry hot water or steam.

e) Plastic discharge pipe and fittings are permitted (when compatible with the process fluid, system design temperatures, and other ambient conditions such as light and humidity) and shall conform to NSF/ANSI 14 Plastics Piping System Components and Related Materials.

f) Discharge piping shall be rated for any static pressure present and the back pressure that may develop when the pressure relief device is at full capacity. Where multiple pressure relief devices or vents discharge into common piping, the back pressure that could develop due to simultaneous flow from all sources shall be considered.

PART 4, SECTION 2
PRESSURE RELIEF DEVICES — INSTALLATION OF PRESSURE RELIEF DEVICES

2.1 SCOPE

NBIC Part 4 Section 2 provides requirements for the installation of pressure relief devices on power boilers,
steam heating boilers, hot-water heating boilers, hot-water supply boilers, potable water heaters, pressure vessels and piping.
The correct selection of appropriate pressure relief devices (PRDs) and the proper installation of those devices
are critical to the safe operation of pressure retaining items. Following are requirements for the installation of
pressure relief devices for protection of different types of pressurized equipment. See NBIC Part 1 for general
installation requirements.

2.1.1 GENERAL REQUIREMENTS FOR INSTALLATION OF PRESSURE RELIEF DEVICES

2.1.1.1 RELIEF DEVICE DESIGN & NUMBER

a) Pressure retaining items shall be equipped with one or more pressure relief devices unless the option for overpressure protection by system design is utilized (when permitted by the Jurisdiction and the original code of construction). Multiple isolatable chambers, or system portions with different maximum allowable working pressures, shall have their own pressure relief device(s) to protect the chambers under the most severe coincident conditions.
b) A pressure relief device and its associated piping shall be safely supported. Design of supports, foundations, and settings shall consider vibration (including seismic where necessary), movement (including thermal movement), and loadings (including reaction forces) in accordance with jurisdictional requirements, manufacturer's recommendations, and/or other industry standards, as applicable. Piping shall be supported in a manner that avoids placing undue stress on the body of the pressure relief device.
c) Pressure relief devices shall be manufactured in accordance with a national or international standard.
d) Pressure relief devices shall have their capacity certified by the National Board unless otherwise permitted by the original code of construction
e) Pressure relief devices shall be selected (i.e., material, pressure, etc.) and installed such that their proper functioning will not be hindered by the nature of the system's contents.
f) When a pressure relief valve is exposed to outdoor elements that may affect operation of the valve, the valve may be shielded with a cover. The cover shall be properly vented and arranged to permit servicing and normal operation of the valve.
g) A non-reclosing device (rupture disk) may be installed on the inlet and/or outlet of a pressure relief valve when permitted by the original code of construction. The reduction in capacity due to installation of the non-reclosing device shall be determined by use of a National Board certified Combination Capacity Factor (CCF).
For rupture disks, if a certified combination capacity factor is not available, the capacity of the pressure relief valve shall be multiplied by 0.9 and this value used as the capacity of the combination installation.
~~thereduction in capacity due to installation of the non-reclosing device shall be determined in accordance with the code of construction by use of a National Board certified Combination Capacity Factor (CCF).~~
~~For rupture disks, if a certified combination capacity factor is not available, the capacity of the pressure relief valve shall be multiplied by 0.9 and this value used as the capacity of the combination installation.~~
h) The effect of inlet pressure drop and discharge back pressure on relief device capacity shall be considered in the system design and relief device selection.
i) Twin pressure relief valves made by placing individual valves on Y-bases or duplex valves having two valves in the same body shall be of equal size.
j) The owner shall document the basis for selection of the pressure relief devices used, including capacity, and have such calculations available for review by the Jurisdiction.
k) Pressure relief devices shall be in accordance with the code of construction and

designed for liquid, vapor, or combination service as required for the specific installation, service fluids, and overpressure conditions.

2.1.1.2 DESIGN OF RELIEF DEVICE INLET LINES

a) Pressure relief devices shall be installed directly on, or as close as possible to, the pressure retaining item, and be installed so they are accessible for inspection, repair, or replacement. The opening in the pressure retaining item shall provide unobstructed flow to the pressure relief device. If multiple relief valves are installed on the same connection to the pressure retaining item, the opening shall have a cross-sectional area not less than the combined areas of inlet connections of all the pressure relief valves with which it connects.
b) Inlet lines shall be as short and straight as possible. Inlet lines shall be properly supported in accordance with 2.1.1.1 b).
c) The opening through all pipes and fittings between a pressure retaining item and its pressure relief device shall have at least the area of the pressure relief device inlet. The characteristics of this upstream system shall be such that the pressure drop will not reduce the relieving capacity below that required or adversely affect the operation of the pressure relief device.
d) When a pressure retaining item is fitted with one or more pressure relief devices on one connection, the inlet cross-sectional area of this connection shall be sized either to avoid restricting flow to the pressure relief devices or to have a cross sectional area not less than the combined areas of inlet connections of all the pressure relief devices with which it connects.
e) When a Y-base is used, the inlet area shall be not less than the combined outlet areas.
f) Inlets to pressure relief devices intended for use in compressible fluid or steam service shall be connected to the vessel in the vapor space above any contained liquid or in the piping system connected to the vapor space.
g) Pressure relief devices intended for use in liquid service shall be connected below the normal liquid line. The liquid level during upset conditions shall be considered.
h) Unless permitted by the code of construction, the Jurisdiction, and the requirements specific to the type of pressure retaining item found in Section 2, there shall be no intervening stop valve or changeover valve between the pressure retaining item and its pressure relief device(s).
i) Where an intervening stop valve is permitted and used, it shall comply with 2.1.1.4.
j) Where a changeover valve is permitted and used, it shall comply with 2.1.1.5.

2.1.1.3 DESIGN OF RELIEF DEVICE DISCHARGE LINES

a) Discharge lines shall be as short and straight as possible. Discharge lines shall be properly supported in accordance with 2.1.1.1 b).
b) The opening through all discharge pipes and fittings shall have at least the area of the pressure relief device outlet. The characteristics of this downstream system shall be such that the pressure drop (back pressure) will not reduce the relieving capacity below that required or adversely affect the operation of the pressure relief device.
c) Pressure relief device discharges shall be arranged such that they are not a hazard to personnel or other equipment and, when necessary, lead to a safe location for disposal of fluids being relieved.
d) Discharge lines from pressure relief devices shall be designed to facilitate drainage and steam venting, or be fitted with drains, to prevent liquid from collecting in the discharge side of a pressure relief device. Drain piping shall discharge to a safe location for the disposal of the fluids being relieved. There are additional requirements specific to boilers and heaters.
e) Where an intervening stop valve is permitted and used, it shall comply with 2.1.1.4.
f) Where a changeover valve is permitted and used, it shall comply with 2.1.1.5.
j) If a muffler is used on a pressure relief valve, it shall have sufficient outlet area to prevent back pressure from interfering with the proper operation and discharge capacity of the valve. The muffler plates or other devices shall be so constructed as to avoid a possibility of restriction of the passages due to deposits. Mufflers shall not be used on high temperature water boiler pressure relief valves.
k) Pressure relief device discharges shall be arranged such that they are not a hazard to personnel or

other equipment and, when necessary, lead to a safe location, such as a catchment tank, for the disposal of fluids being relieved.

2.1.1.4 REQUIREMENTS FOR PRESSURE RELIEF STOP VALVES (WHERE PERMITTED)

a1) These stop valves shall be so constructed or positively controlled that the closing of the maximum number of block valves at one time will not reduce the pressure relieving capacity below the required relieving capacity;

2b) Upon specific acceptance of the Jurisdiction, when necessary for the continuous operation of processing
equipment of such a complex nature that shutdown of any part is not feasible, a full area stop valve between a piping system and its pressure relief device may be provided for inspection and repair purposes only. This stop valve shall be arranged so that it can be locked or sealed open and it shall not be closed except by an authorized person who shall remain stationed there during that period of operation while the valve remains closed. The valve shall be locked or sealed in the open position before the authorized person leaves the station;

3c) A full area stop valve may be placed on the discharge side of a pressure relief device when its discharge is connected to a common header for pressure relief devices to prevent discharges from these other devices from flowing back to the first device during inspection and repair. This stop valve shall be arranged so that it can be locked or sealed open and it shall not be closed except by an authorized person who shall remain stationed there during that period of operation while the valve remains closed. The valve shall be locked or sealed in the open position before the authorized person leaves the station. This valve shall only be used when a stop valve on the inlet side of the pressure relief device is first closed; or

4d) A piping system where the pressure originates from an outside source may have a stop valve between the system and the pressure relief device, and this valve need not be sealed open, provided it also closes off that vessel from the source of pressure.

2.1.1.5 REQUIREMENTS FOR PRESSURE RELIEF CHANGEOVER VALVES (WHERE PERMITTED)

a) A changeover valve, which allows two redundant pressure relief valves to be installed for the purpose of changing from one pressure relief valve to the other while the pressure retaining item is operating, may be used provided the changeover valve is in accordance with the original code of construction. It is recommended that the Jurisdiction be contacted to determine the acceptability of the changeover valves on boiler applications.

b) The changeover valve shall be designed such that there is no intermediate position where both pressure relief valves are isolated from the pressure retaining item.

c) The additional flow restriction caused by a changeover valve shall be considered in the system design.

2.2 PRESSURE RELIEF VALVES FOR POWER BOILERS

See NBIC Part 1, 2.2 for the boilers covered under Part 4, 2.2

2.2.1 GENERAL REQUIREMENTS

a) Only direct spring loaded pressure relief valves or pilot operated pressure relief valves designed to relieve steam shall be used for steam service.

b) Pressure relief valves are valves designed to relieve either steam or water, depending on the application.

~~c) Pressure relief valves shall be manufactured in accordance with a national or international standard.~~

~~d~~c) Deadweight or weighted-lever pressure relief valves shall not be used.

~~e~~d) For high temperature water boilers, pressure relief valves shall have a closed bonnet, and valve bodies
shall not be constructed of cast iron.

~~f~~e) Pressure relief valves with an inlet connection greater than NPS 3 (DN 80) and used for pressure greater than 15 psig (100 kPa), shall have a flanged or a welded inlet connection. The dimensions of flanges subjected to boiler pressure shall conform to the applicable standards.

~~g) When a pressure relief valve is exposed to outdoor elements that may affect operation of the valve, the valve may be shielded with a cover. The cover shall be properly vented and arranged to permit servicing and normal operation of the valve.~~

2.2.2 NUMBER

At least one National Board capacity certified pressure relief valve shall be installed on the boiler in accordance with 2.1.1.1 a). If the boiler has more than 500 ft_2 (46 m_2) of heating surface, or if an electric boiler has a power input of more than 3.76 million BTU/hr (1100 kW), two or more National Board capacity certified pressure relief valves shall be installed.

2.2.3 LOCATION

~~a) Pressure relief valves shall be placed on, or as close as physically possible, to the boiler proper.~~

~~b~~a) Pressure relief valves shall not be placed on the feedline.

c) Pressure relief valves shall be connected to the boiler independent of any other connection without any unnecessary intervening pipe or fittings. Such intervening pipe or fittings shall not be longer than the face-to-face dimension of the corresponding tee fitting of the same diameter and pressure rating as listed in the applicable standards.

2.2.4 CAPACITY

a) The pressure relief valve capacity for each boiler shall be such that the valve or valves will discharge all the steam that can be generated by the boiler without allowing the pressure to rise more than 6% above the highest pressure at which any valve is set and in no case to more than 6% above the maximum allowable working pressure of the boiler.

b) The minimum relieving capacity for other than electric boilers and forced-flow steam generators with no fixed steam line and waterline shall be estimated for the boiler and waterwall heating surfaces as given in Table 2.2.4.1, but in no case shall the minimum relieving capacity be less than the maximum designed steaming capacity as determined by the manufacturer.

c) The required relieving capacity in lbs/hr of the pressure relief valves on a high temperature water boiler shall be determined by dividing the maximum output in Btu at the boiler nozzle obtained by the firing of any fuel for which the unit is designed by one thousand.

d) The minimum pressure relief valve relieving capacity for electric boilers shall not be less than 3.5 lbs/hr/kW (1.6 kg/hr/kW) input.

e) If the pressure relief valve capacity cannot be computed, or if it is desirable to prove the computations, it should be checked by any one of the following methods; and if found insufficient, additional relieving capacity shall be provided:

1) By performing an accumulation test, that is, by shutting off all other steam discharge outlets from the boiler and forcing the fires to the maximum. This method should not be used on a boiler with a superheater or reheater or on a high-temperature water boiler.

2) By measuring the maximum amount of fuel that can be burned and computing the corresponding evaporative capacity upon the basis of the heating value of the fuel.

3) By determining the maximum evaporative capacity by measuring the feedwater. The sum of the pressure relief valve capacities marked on the valves shall be equal to or greater than the maximum evaporative capacity of the boiler. This method should not be used on high-temperature water boilers.

TABLE 2.2.4.1

MINIMUM POUNDS OF STEAM PER HOUR PER SQUARE FOOT OF HEATING SURFACE
LB STEAM/HR FT_2 (KG STEAM/HR M_2)

Firetube Boiler	**Watertube Boiler**
Boiler Heating Surface	

Hand-fired 5 (24) 6 (29)
Stoker-fired 7 (34) 8 (39)
Oil, gas, or pulverized fuel-fired 8 (39) 10 (49)
Waterwall Heating Surface
Hand-fired 8 (39) 8 (39)
Stoker-fired 10 (49) 12 (59)
Oil, gas, or pulverized coal 14 (68) 16 (78)
Copper-finned Watertubes
Hand-fired 4 (20)
Stoker-fired 5 (24)
Oil, gas, or pulverized fuel-fired 6 (29)

Notes:

• When a boiler is fired only by a gas having a heat value not in excess of 200 Btu/ft_3(7.5MJ/m_3), the minimum relieving capacity should be based on the values given for hand-fired boilers above.

• The heating surface shall be computed for that side of the boiler surface exposed to the products of combustion, exclusive of the superheating surface. In computing the heating surface for this purpose only the tubes, fireboxes,shells, tubesheets, and the projected area of headers need to be considered, except that for vertical firetube steam boilers, only that portion of the tube surface up to the middle gage cock is to be computed.

• For firetube boiler units exceeding 8000 Btu/ft_2 (9085 J/cm_2) (total fuel Btu (J) Input divided by total heating surface), the factor from the table will be increased by 1 (4.88) for every 1000 Btu/$ft.^2$ (1136 J/cm_2) above 8000 Btu/$ft.^2$ (9085 J/cm_2) For units less than 7000 Btu/ft_2 (7950 J/cm_2), the factor from the table will be decreased by 1 (4.88).

• For watertube boiler units exceeding 16000 Btu/ft_2 (18170 J/cm_2)(total fuel Btu input divided by the total heating surface) the factor from the table will be increased by 1 (4.88) for every 1000 Btu/$ft.^2$ (1136 J/cm_2) above 16000 Btu/$ft.^2$ (18170 J/cm_2). For units with less than 15000 Btu/$ft.^2$ (17034 J/cm_2), the factor in the table will be decreased by 1 (4.88) for every 1000 Btu/ft.2 (1136 J/cm_2) below 15000 Btu/$ft.^2$ (17034 J/cm_2).

2.2.5 SET PRESSURE

One or more pressure relief valves on the boiler proper shall be set at or below the maximum allowable working pressure. If additional valves are used, the highest pressure setting shall not exceed the maximum
allowable working pressure by more than 3%. The complete range of pressure settings of all the pressure relief valves on a boiler shall not exceed 10% of the highest pressure to which any valve is set. Pressure setting of pressure relief valves on high temperature water boilers may exceed this 10% range.

2.2.6 FORCED-FLOW STEAM GENERATORS

For a forced-flow steam generator with no fixed steamline and waterline, equipped with automatic controls
and protective interlocks responsive to steam pressure, pressure relief valves may be provided in accordance
with the above paragraphs identified in 2.2.5 or the following protection against overpressure shall be provided:

a) One or more power-actuated pressure relief valves shall be provided in direct communication with the boiler when the boiler is under pressure and shall receive a control impulse to open when the maximum allowable working pressure at the superheater outlet is exceeded. The total combined relieving capacity of the power actuated pressure relief valves shall be not less than 10% of the maximum design steaming capacity of the boiler under any operating condition as determined by the manufacturer. The valves shall be located in the pressure part system where they will relieve the overpressure. An isolating stop valve of the outside-screw-and-yoke type should be installed between the power actuated pressure relief valve and the boiler to permit repairs provided an alternate power-actuated pressure relief valve of the same capacity is so installed as to be in direct communication with the boiler.

b) Pressure relief valves shall be provided having a total combined relieving capacity, including that of the power-actuated pressure relief valve, of not less than 100% of the maximum designed steaming capacity of the boiler, as determined by the manufacturer. In this total, credit in excess of 30% of the

total relieving capacity shall not be allowed for the power-actuated pressure relief valves actually installed. Any or all of the pressure relief valves may be set above the maximum allowable working pressure of the parts to which they are connected, but the set pressures shall be such that when all these valves (together with the power-actuated pressure relief valves) are in operation the pressure will not rise more than 20% above the maximum allowable working pressure of any part of the boiler, except for the steam piping between the boiler and the prime mover.

c) When stop valves are installed in the water steam flow path between any two sections of a forced-flow steam generator with no fixed steamline and waterline:

1) The power-actuated pressure relief valve shall also receive a control impulse to open when the maximum allowable working pressure of the component, having the lowest pressure level upstream to the stop valve, is exceeded.

2) The pressure relief valve shall be located to provide overpressure protection for the component having the lowest working pressure.

3) A reliable pressure-recording device shall always be in service and records kept to provide evidence of conformity to the above requirements.

2.2.7 SUPERHEATERS

a) ~~Every attached superheater shall have one or more pressure relief valves. The location shall be suitable for the service intended and shall provide the overpressure protection required. The pressure drop upstream of each pressure relief valve shall be considered in determining the set pressure and relieving capacity of that valve.~~ If the superheater outlet header has a full, free steam passage from end to end and is so constructed that steam is supplied to it at practically equal intervals throughout its length so that there is a uniform flow of steam through the superheater tubes and the header, the pressure relief valve or valves may be located anywhere in the length of header.

b) The pressure-relieving capacity of the pressure relief valve or valves on an attached superheater shall be included in determining the number and size of the pressure relief valves for the boiler provided there are no intervening valves between the superheater pressure relief valve and the boiler and the discharge capacity of the pressure relief valve or valves, on the boiler, as distinct from the superheater, is at least 75% of the aggregate capacity required.

c) Every independently fired superheater that may be shut off from the boiler and permit the superheater to become a fired pressure vessel shall have one or more pressure relief valves having a discharge capacity equal to 6 lbs steam/hr/ft_2 (29 kg steam/hr/m_2) of superheater surface measured on the side exposed to the hot gases.

d) Every pressure relief valve used on a superheater discharging superheated steam at a temperature over 450°F (230°C) shall have a casing, including the base, body, bonnet, and spindle constructed of steel, steel alloy, or equivalent heat-resistant material. The valve shall have a flanged inlet connection or a welding-end inlet connection. The seat and disk shall be constructed of suitable heat-erosive and corrosive-resistant material, and the spring fully exposed outside of the valve casing so that it is protected from contact with the escaping steam.

2.2.8 ECONOMIZERS

An economizer that may not be isolated from a boiler does not require a pressure 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 pressure relief valve. Discharge capacity, rated in lbs/hr (kg/hr), of the pressure relief valve or valves shall be calculated from the maximum expected heat absorption rate in Btu/hr (kJ/hr) of the economizer, and will be determined from manufacturer data, divided by 1,000 Btu/lb (2,326 kJ/kg). The pressure relief valve shall be located as close as possible to the economizer outlet.

2.2.9 PRESSURE REDUCING VALVES

a) Where pressure reducing valves are used, one or more pressure relief valves shall be installed on the low pressure side of the reducing valve in those installations where the piping or equipment on the low pressure side does not meet the requirements for the steam supply piping.

b) The pressure relief valves shall be located as close as possible to the pressure reducing valve.

c) Capacity of the pressure relief valves shall not be less than the total amount of steam that can pass

from the high pressure side to the low pressure side and be such that the pressure rating of the lower pressure piping or equipment shall not be exceeded.
d) The use of hand-controlled bypasses around reducing valves is permissible. The bypass around a reducing valve may not be greater in capacity than the reducing valve unless the piping or equipment is adequately protected by pressure relief valves or meets the requirements of the high pressure system.
e) See Supplement 1 for additional information on the calculation of the required capacity of pressure relief
valves installed after pressure-reducing valves.

2.2.10 INSTALLATION AND DISCHARGE REQUIREMENTS

a) Every boiler shall have outlet connections for the pressure relief valve, or valves, independent of any other outside steam connection, the area of opening shall be at least equal to the aggregate areas of inlet connections of all of the attached pressure relief valves. An internal collecting pipe, splash plate, or pan should be used, provided the total area for inlet of steam is not less than twice the aggregate areas of the inlet connections of the attached pressure relief valves. The holes in such collecting pipes shall be at least 1/4 in. (6 mm) in diameter, and the least dimension in any other form of opening for inlet of steam shall be 1/4 in. (6 mm). If pressure relief valves are attached to a separate steam drum or dome, the opening between the boiler proper and the steam drum or dome shall be not less than 10 times the total area of the pressure relief valve inlet.
b) Every pressure relief valve shall be connected so as to stand in an upright position with spindle vertical.
c) ~~The opening or connection between the boiler and the pressure relief valve shall have at least the area of the valve inlet and t~~The inlet pipe to the pressure relief valve shall be ~~be as short and straight as possible,~~
no longer than twice the center-to-end (face) dimension of a corresponding tee fitting of the same diameter,
pressure class, and connection type. ~~When a discharge pipe is used, the cross-sectional area shall not be less than the full area of the valve outlet or of the total of the areas of the valve outlets. It shall be as short and straight as possible and arranged to avoid undue stresses on the valve or valves.~~
d) No valves of any type except a changeover valve in accordance with 2.1.1.5 ~~as defined below~~ shall be placed between the pressure
relief valves and the boiler, nor on the discharge pipe between the pressure relief valves and the atmosphere.
~~A changeover valve, which allows two redundant pressure relief valves to be installed for the purpose of changing from one pressure relief valve to the other while the boiler is operating, may be used provided the changeover valve is in accordance with the original code of construction. It is recommended that the Jurisdiction be contacted to determine the acceptability of the changeover valves on boiler applications. The changeover valve shall be designed such that there is no intermediate position where both pressure relief valves are isolated from the boiler.~~
e) When two or more pressure relief valves are used on a boiler, they should be mounted either separately
or as twin valves made by placing individual valves on Y-bases, or duplex valves having two valves in the same body casing. ~~Twin valves made by placing individual valves on Y-bases or duplex valves having two valves in the same body shall be of equal size.~~
f) When two valves of different sizes are installed singly, the relieving capacity of the smaller valve shall not be less than 50% of that of the larger valve.
~~g) When a boiler is fitted with two or more pressure relief valves on one connection, this connection to the boiler shall have a cross-sectional area not less than the combined areas of inlet connections of all the pressure relief valves with which it connects.~~
h) All pressure relief valves shall be piped to a safe point of discharge so located or piped as to be carried clear from running boards or platforms. Provision for an ample gravity drain shall be made in the discharge
pipe at or near each pressure relief valve, and where water or condensation may collect. Each valve shall have an open gravity drain through the casing below the level of the valve seat. For ironand steel- bodied valves exceeding NPS 2 (DN 50), the drain hole shall be tapped not less than NPS 3/8 (DN 10).
~~i) Discharge piping from pressure relief valves on high temperature water boilers shall have adequate~~

provisions for water drainage as well as steam venting.
j) If a muffler is used on a pressure relief valve, it shall have sufficient outlet area to prevent back pressure
from interfering with the proper operation and discharge capacity of the valve. The muffler plates or other devices shall be so constructed as to avoid a possibility of restriction of the steam passages due to deposits. Mufflers shall not be used on high temperature water boiler pressure relief valves.

2.2.11 SUPPORTS, FOUNDATIONS, AND SETTINGS

Each boiler pressure relief valve and its associated piping must be safely supported. Design of supports, foundations, and settings shall consider vibration (including seismic where necessary), movement (including
thermal movement), and loadings (including reaction forces) in accordance with jurisdictional requirements,
manufacturer's recommendations, and/or other industry standards, as applicable.

2.3 OVERPRESSURE PROTECTION FOR THERMAL FLUID HEATERS

2.3.1 GENERAL REQUIREMENTS

Thermal fluid heaters shall be provided with overpressure protection in accordance with the code of construction.

2.3.2 PRESSURE RELIEF DEVICES

Thermal fluid heaters shall be equipped with one or more pressure relief devices unless the option for overpressure
protection by system design is utilized (when permitted by the original code of construction). When pressure relief devices are used, the following shall apply:
a) Pressure relief valve(s) shall be of a totally enclosed type and shall not have a lifting lever. A body drain
is not required.
b) Rupture disks may be installed upstream or downstream of the pressure relief valve(s) in accordance with the original code of construction.
c) Pressure relief valves and rupture disks shall be in accordance with the code of construction and designed for liquid, vapor, or combination service as required for the specific installation, service fluids, and overpressure conditions.
cd) The inlet connection to the valve shall be not less than NPS ½ (DN 15).

2.3.3 LOCATION

Pressure relief devices shall be connected to the heater in accordance with the original code of construction.

2.3.4 CAPACITY

The pressure relief device(s) shall have sufficient capacity to prevent the pressure vessel from exceeding the
maximum pressure specified in the vessel code of construction.

2.3.5 SET PRESSURE

a) When a single relief device is used, the set pressure marked on the device shall not exceed the maximum
allowable working pressure.
b) When more than one pressure relief device is provided to obtain the required capacity, only one pressure
relief device set pressure needs to be set at or below the maximum allowable working pressure.
The set pressure of the additional relief devices shall be such that the pressure cannot exceed the maximum
pressure permitted by the code of construction.

2.3.6 INSTALLATION

a) When a discharge pipe is used, the cross-sectional area shall not be less than the full area of the valve outlet. The size of the discharge lines shall be such that any pressure that may exist or develop will not reduce the relieving capacity or adversely affect the operation of the attached pressure vessel relief devices. Discharge piping shall be as short and straight as possible and arranged to avoid undue stress on the pressure relief device.
b) The cross-sectional area of the piping between the heater and the relief device shall be sized either to

~~avoid restricting the flow to the pressure relief devices or made at least equal to the inlet area of the pressure relief devices connected to it.~~
~~c) When two or more required pressure relief devices are placed on one connection, the inlet cross-sectional~~
~~area of this connection shall be sized either to avoid restricting the flow to the pressure relief devices or made at least equal to the combined inlet areas of the pressure relief devices connected to it.~~
~~d) Unless permitted by the code of construction, there shall be no intervening stop valve between the vessel and its pressure relief device(s), or between the pressure relief device and the point of discharge.~~
~~e) Pressure relief device discharges shall be arranged such that they are not a hazard to personnel or other equipment and, when necessary, lead to a safe location, such as a catchment tank, for the disposal of fluids being relieved.~~
~~f) Discharge lines from pressure relief devices shall be designed to facilitate drainage or be fitted with low point or valve body drains to prevent liquid from collecting in the discharge side of a pressure relief device. Drain piping shall discharge to a safe location for the disposal of the fluids being relieved.~~
g) The pressure relief discharge should be connected to a closed, vented storage tank or blowdown tank with solid piping (no drip pan elbow, or other air gap). When outdoor discharge is used, the following should be considered for discharge piping at the point of discharge:
1) Both thermal and chemical reactions (personnel hazard);
2) Combustible materials (fire hazard);
3) Surface drains (pollution and fire hazard);
4) Loop seal or rain cap on the discharge (keep both air and water out of the system);
5) Drip leg near device (prevent liquid collection); and
6) Heat tracing for systems using high freeze point fluids (prevent blockage).
h) A suitable condenser that will condense all the vapors discharged from the pressure relief valve may be
used in lieu of piping the vapors to the atmosphere.
i) In order to minimize the loss by leakage of material through the pressure relief valve, a rupture disk may be installed between the pressure relief valve and the vaporizer, provided the following requirements are met:
1) The cross-sectional area of the connection to a vaporizer shall be not less than the required relief area of the rupture disk.
2) The maximum pressure of the range for which the disk is designed to rupture shall not exceed the opening pressure for which the pressure relief valve is set or the maximum allowable working pressure of the vessel.
3) The opening provided through the rupture disk, after breakage, shall be sufficient to permit a flow equal to the capacity of the attached valve, and there is no chance of interference with the proper functioning of the valve, but in no case shall this area be less than the inlet area of the valve.
4) The space between a rupture disk and the valve shall be provided with a pressure gage, try cock, free vent, or a suitable telltale indicator. This arrangement permits the detection of disk rupture or leakage.

j) Pressure relief valve discharge capacity shall be determined from the following equation:
$W = CKAP \sqrt{(M/T)}$
Where:
A = discharge area of pressure relief valve
C = constant for vapor that is a function of the ratio of specific heats $k = c_p/c_v$.
Note: Where k is not known, k = 1.001.
K = coefficient of discharge for the valve design
M = molecular weight
P = (set pressure × 1.03) + Atmosphere Pressure
T = absolute temperature at inlet, °F + 460 (°C + 273)
W = flow of vapor
The required minimum pressure relief valve relieving capacity shall be determined from the following equation:

W = C x H x 0.75/h
Where:
C = maximum total weight or volume of fuel burned per hour, lb (kg) or ft_3 (m_3)
H = heat of combustion of fuel, Btu/lb (J/kg) or Btu/ft_3 (J/m_3)
h = latent heat of heat transfer fluid at relieving pressure, Btu/lb (J/kg)
W = weight of organic fluid vapor generated per hour
The sum of the pressure relief valve capacities marked on the valves shall be equal to or greater than W.

2.4 PRESSURE RELIEF VALVES FOR STEAM HEATING, HOT WATER HEATING, AND HOT WATER SUPPLY BOILERS

See NBIC Part 1, 3.2 for the scope of pressure retaining items covered by Part 4, 2.4.

2.4.1 GENERAL REQUIREMENTS

The following general requirements pertain to the installation of pressure relief valves on heating boilers.

2.4.1.1 INSTALLATION OF PRESSURE RELIEF VALVES FOR HEATING BOILERS

2.4.1.1.1 PERMISSIBLE INSTALLATION

Pressure relief valves shall be located at the top side of the boiler. The top side of the boiler shall mean the highest practicable part of the boiler proper but in no case shall the pressure relief valves be located below the normal operating level and in no case shall the pressure relief valve be located below the lowest permissible water level. They shall be connected directly to a tapped or flanged opening in the boiler, to a fitting connected to the boiler by a short nipple, to a Y-base, or to a valveless header connecting steam or water outlets on the same boiler. Coil or header type boilers shall have the pressure relief valve located on the steam or hot water outlet end. Pressure relief valves shall be installed with their spindles vertical. The opening or connection between the boiler and any pressure relief valve shall have at least the area of the valve inlet.

2.4.1.1.2 REQUIREMENTS FOR COMMON CONNECTIONS FOR TWO OR MORE VALVES

~~a) When a boiler is fitted with two or more pressure relief valves on one connection, this connection shall have a cross-sectional area not less than the combined areas of inlet connections of all the pressure relief valves with which it connects.~~

~~b~~a) When a Y-base is used, the inlet area shall be not less than the combined outlet areas. When the size of the boiler requires a pressure relief valve larger than NPS 4 (DN 100), two or more valves having the required combined capacity shall be used. When two or more valves are used on a boiler, they may be single, directly attached, or installed on a Y-base.

2.4.1.2 THREADED CONNECTIONS

A threaded connection may be used for attaching a valve.

2.4.1.3 PROHIBITED INSTALLATIONS

Pressure relief valves shall not be connected to an internal pipe in the boiler.

2.4.1.4 USE OF SHUTOFF VALVES PROHIBITED

No shutoff valve of any description shall be placed between the pressure relief valve and the boiler or on discharge pipes between such valves and the atmosphere.

2.4.1.5 PRESSURE RELIEF VALVE DISCHARGE PIPING

a) A discharge pipe shall be used. Its internal cross-sectional area shall be not less than the full area of the valve outlet or of the total of the valve outlets that discharge into the pipe, and shall be as short and straight as possible and arranged as to avoid undue stress on the valve or valves. A union may be installed in the discharge piping close to the valve outlet. When an elbow is placed on a pressure relief valve discharge pipe, it shall be located close to the valve outlet downstream of the union to minimize reaction moment stress.

b) The discharge from pressure relief valves shall be so arranged that there will be no danger of scalding attendants. The pressure relief valve discharge shall be piped away from the boiler to a safe point of discharge, and there shall be provisions made for properly draining the piping. The size and arrangement of discharge piping shall be such that any pressure that may exist or develop will not reduce the relieving capacity of the relieving devices below that required to protect the boiler.

2.4.1.6 TEMPERATURE AND PRESSURE RELIEF VALVES

Hot-water heating or supply boilers limited to a water temperature of 210°F (99°C) may have one or more National Board capacity certified temperature and pressure relief valve(s) installed. The requirements of 2.4.1.1 through 2.4.1.5 shall be met, except as follows:

a) A Y-type fitting shall not be used.

b) If additional valves are used, they shall be temperature and pressure relief valves.

c) When the temperature and pressure relief valve is installed directly on the boiler with no more than 4 in.

(100 mm) maximum interconnecting piping, the valve may be installed in the horizontal position with the outlet pointed down.

2.4.2 PRESSURE RELIEF VALVE REQUIREMENTS FOR STEAM HEATING BOILERS

a) Pressure relief valves shall be manufactured in accordance with a national or international standard.

b) Each steam boiler shall have one or more National Board capacity certified pressure relief valves of the spring pop type adjusted and sealed to discharge at a pressure not to exceed 15 psig (100 kPa).

c) No pressure relief valve for a steam boiler shall be smaller than NPS 1/2 (DN 15). No pressure relief valve shall be larger than NPS 4 (DN 100). The inlet opening shall have an inside diameter equal to, or greater than, the seat diameter.

d) The minimum valve capacity in lbs/hr (kg/hr) shall be the greater of that determined by dividing the maximum Btu/hr (W) output at the boiler nozzle obtained by the firing of any fuel for which the unit is installed by 1,000 Btu/hr/lb (645 W/kg), or shall be determined on the basis of the lbs steam/hr/ft_2 (kg steam/hr/m_2) of boiler heating surface as given in Table 2.2.4.1. For cast-iron boilers, the minimum valve capacity shall be determined by the maximum output method. In many cases a greater relieving capacity of valves will have to be provided than the minimum specified by these rules. In every case, the requirement of 2.4.2 e) shall be met.

e) The pressure relief valve capacity for each steam boiler shall be such that with the fuel burning equipment

installed, and operated at maximum capacity, the pressure cannot rise more than 5 psig (34 kPa) above the maximum allowable working pressure.

f) When operating conditions are changed, or additional boiler heating surface is installed, the valve capacity shall be increased, if necessary, to meet the new conditions and be in accordance with 2.4.2 e).The additional valves required, on account of changed conditions, may be installed on the outlet piping provided there is no intervening valve.

2.4.3 PRESSURE RELIEF VALVE REQUIREMENTS FOR HOT WATER HEATING OR HOT WATER SUPPLY BOILERS

a) Pressure relief valves shall be manufactured in accordance with a national or international standard.

b) Each hot-water heating or hot-water supply boiler shall have at least one National Board capacity certified pressure relief valve, of the automatic reseating type set to relieve at or below the maximum allowable working pressure of the boiler.

c) Hot-water heating or hot-water supply boilers limited to a water temperature not in excess of 210°F (99°C) may have, in lieu of the valve(s) specified in (b) above, one or more National Board capacity certified

temperature and pressure relief valves of the automatic reseating type set to relieve at or below the maximum allowable working pressure of the boiler.

d) When more than one pressure relief valve is used on either hot-water heating or hot water supply boilers,

the additional valves shall be National Board capacity certified and may have a set pressure within a range not to exceed 6 psig (40 kPa) above the maximum allowable working pressure of the boiler up to and including 60 psig (414 kPa), and 5% for those having a maximum allowable working pressure exceeding 60 psig (414 kPa).

e) No pressure relief valve shall be smaller than NPS 3/4 (DN 20) nor larger than NPS 4 (DN 100), except that boilers having a heat input not greater than 15,000 Btu/hr (4.4 kW) should be equipped with a rated pressure relief valve of NPS 1/2 (DN 15).

f) The required relieving capacity, in lbs/hr (kg/hr), of the pressure relief valve(s) on a boiler shall be the greater of that determined by dividing the maximum output in Btu/hr (W) at the boiler nozzle obtained by the firing of any fuel for which the unit is installed by 1,000 Btu//hr/lb (645 W/kg), or shall be determined

on the basis of lbs steam/hr/ft_2 (kg steam/hr/m_2) as given in Table 2.2.4.1. For cast-iron boilers, the minimum valve capacity shall be determined by the maximum output method. In many cases a greater relieving capacity of valves will have to be provided than the minimum specified by these rules. In every case, the requirements of 2.4.3 h) shall be met.

g) When operating conditions are changed, or additional boiler heating surface is installed, the valve capacity shall be increased, if necessary, to meet the new conditions and be in accordance with 2.4.3 h). The additional valves required, on account of changed conditions, may be installed on the outlet piping provided there is no intervening valve.

h) Pressure relief valve capacity for each boiler with a single pressure relief valve shall be such that, with the fuel burning equipment installed and operated at maximum capacity, the pressure cannot rise more than 10% above the maximum allowable working pressure. When more than one pressure relief valve is used, the over pressure shall be limited to 10% above the set pressure of the highest set valve allowed by 2.4.3 b).

2.4.4 TEMPERATURE AND PRESSURE RELIEF VALVE REQUIREMENTS FOR POTABLE WATER HEATERS

a) ~~Each water heater shall have at least one National Board capacity certified temperature and pressure relief valve.~~ No temperature and pressure relief valve shall be smaller than NPS 3/4 (DN 20).

b) The pressure setting shall be less than or equal to the maximum allowable working pressure of the water heater. However, if any of the other components in the hot-water supply system (such as valves, pumps, expansion or storage tanks, or piping) have a lesser working pressure rating than the water heater, the pressure setting for the temperature and pressure relief valve(s) shall be based upon the component with the lowest maximum allowable working pressure rating. If more than one temperature and relief valve is used, the additional valve(s) may be set within a range not to exceed 10% above the set pressure of the first valve.

c) The required relieving capacity in Btu/hr (W) of the temperature and pressure relief valve shall not be less than the maximum allowable input unless the water heater is marked with the rated burner input capacity of the water heater on the casing in a readily visible location, in which case the rated burner input capacity may be used as a basis for sizing the temperature and pressure relief valves. The relieving capacity for electric water heaters shall be 3500 Btu/hr (1.0 kW) per kW of input. In every case, the following requirements shall be met. Temperature and pressure relief valve capacity for each water heater shall be such that with the fuel burning equipment installed and operating at maximum capacity, the pressure cannot rise more than 10% above the maximum allowable working pressure.

Many temperature and pressure relief valves have a National Board capacity certified rating which was determined according to ASME Code requirements, and a lower Canadian Standards Association (CSA) rating value. Where the ASME Code is the only referenced code of construction the National Board capacity certified rating may be used. If the water heater is not an ASME vessel, or the CSA rating is required by another standard (such as a plumbing or building code) then that rating shall be used.

d) If operating conditions are changed or additional heating surface is installed, the temperature and pressure
relief valve capacity shall be increased, if necessary, to meet the new conditions and shall be in accordance with the above provisions. In no case shall the increased input capacity exceed the maximum allowable input capacity. The additional valves required, on account of changed conditions, may be installed on the outlet piping providing there is no intervening valve.

2.4.4.1 INSTALLATION

Temperature and pressure relief valves shall be installed by either the installer or the manufacturer before a
water heater is placed in operation.

2.4.4.2 PERMISSIBLE INSTALLATIONS

Temperature and pressure relief valves shall be connected directly to a tapped or flanged opening in the top
of the water heater, to a fitting connected to the water heater by a short nipple, to a Y-base, or to a valveless

header connecting water outlets on the same heater. Temperature and pressure relief valves shall be installed

with their spindles upright and vertical with no horizontal connecting pipe, except that, when the temperature
and pressure relief valve is installed directly on the water heater vessel with no more than 4 in. (100 mm) maximum interconnecting piping, the valve may be installed in the horizontal position with the outlet pointed
down. The center line of the temperature and pressure relief valve connection shall be no lower than 4 in. (100 mm) from the top of the shell. No piping or fitting used to install the temperature and pressure relief valve
shall be of nominal pipe size less than that of the valve inlet.

2.4.4.3 REQUIREMENTS FOR COMMON CONNECTION FOR TWO OR MORE VALVES

a) When a potable water heater is fitted with two or more temperature and pressure relief valves on one connection, this connection shall have a cross sectional area not less than the combined areas of inlet connections of all the temperature and pressure relief valves with which it connects.
b) When a Y-base is used, the inlet area shall be not less than the combined outlet areas.
c) When the size of the water heater requires a temperature and pressure relief valve larger than NPS 4 (DN 100) two or more valves having the required combined capacity shall be used. When two or more valves are used on a water heater, they may be single, directly attached, or installed on a Y-base.

2.4.4.4 THREADED CONNECTIONS

A threaded connection may be used for attaching a temperature and pressure relief valve.

2.4.4.5 PROHIBITED INSTALLATIONS

Temperature and pressure relief valves shall not be connected to an internal pipe in the water heater or a cold
water feed line connected to the water heater.

2.4.4.6 USE OF SHUTOFF VALVES PROHIBITED

No shutoff valve of any description shall be placed between the temperature and pressure relief valve and the
water heater or on discharge pipes between such valves and the atmosphere.

2.4.4.7 TEMPERATURE AND PRESSURE RELIEF VALVE DISCHARGE PIPING

a) The discharge from temperature and pressure relief valves shall be so arranged that there will be no danger of scalding attendants. When the temperature and pressure relief valve discharge is piped away from the water heater to the point of discharge, there shall be provisions for properly draining the piping and valve body. The size and arrangement of discharge piping shall be such that any pressure that may exist or develop will not reduce the relieving capacity of the relieving devices below that required to protect
the water heater.
b) When a discharge pipe is used, it shall be not less than the nominal size of the valve outlet and shall be as short and straight as possible and so arranged as to avoid undue stress on the valve. When an elbow is placed on a temperature and pressure relief discharge pipe, it shall be located close to the valve outlet.
c) Where multiple valves relieve into a common discharge pipe, the cross-sectional flow area of the common discharge pipe shall be equal to or greater than the sum of the individual temperature and pressure valve discharge pipe areas.

2.4.5 PRESSURE RELIEF VALVES FOR TANKS AND HEAT EXCHANGERS

2.4.5.1 STEAM TO HOT-WATER SUPPLY

When a hot-water supply is heated indirectly by steam in a coil or pipe within the service limitations set forth
in Part 1, 3.2*, Definitions*, the pressure of the steam used shall not exceed the safe working pressure of the
hot water tank, and a pressure relief valve at least NPS 1 (DN 25), set to relieve at or below the maximum allowable working pressure of the tank, shall be applied on the tank.

2.4.5.2 HIGH TEMPERATURE WATER TO WATER HEAT EXCHANGER

When high temperature water is circulated through the coils or tubes of a heat exchanger to warm water for

space heating or hot-water supply, within the service limitations set forth in Part 1, 3.2, *Definitions*, the heat
exchanger shall be equipped with one or more National Board capacity certified pressure relief valves set to
relieve at or below the maximum allowable working pressure of the heat exchanger, and of sufficient rated
capacity to prevent the heat exchanger pressure from rising more than 10% above the maximum allowable
working pressure of the vessel.

2.4.5.3 HIGH TEMPERATURE WATER TO STEAM HEAT EXCHANGER

When high temperature water is circulated through the coils or tubes of a heat exchanger to generate low pressure steam, within the service limitations set forth in Part 1, 3.2, *Definitions*, the heat exchanger shall be
equipped with one or more National Board capacity certified pressure relief valves set to relieve at a pressure
not to exceed 15 psig (100 kPa), and of sufficient rated capacity to prevent the heat exchanger pressure from rising more than 5 psig (34 kPa) above the maximum allowable working pressure of the vessel. For heat exchangers requiring steam pressures greater than 15 psig (100 kPa), refer to NBIC Part 1, Section 2
or Section 4.

2.5 PRESSURE VESSEL PRESSURE RELIEF DEVICES

See NBIC Part 1, 4.1 for the scope of pressure vessels covered by the requirements of Part 4, 2.5. Pressure relief devices protecting pressure vessels shall meet the following requirements:

2.5.1 DEVICE REQUIREMENTS

a) Pressure relief devices shall be manufactured in accordance with a national or international standard and be certified for capacity or flow resistance by the National Board.
b) Dead weight or weighted lever pressure relief valves shall not be used.
c) An unfired steam boiler shall be equipped with pressure relief valves as required in NBIC Part 4, 2.2.
~~d) Pressure relief devices shall be selected (i.e., material, pressure, etc.) and installed such that their proper functioning will not be hindered by the nature of the vessel's contents.~~

~~2.5.2 NUMBER OF DEVICES~~

~~At least one device shall be provided for protection of a pressure vessel. Pressure vessels with multiple chambers
with different maximum allowable working pressures shall have a pressure relief device to protect each chamber under the most severe coincident conditions.~~

2.5.3 LOCATION

~~a) The pressure relief device shall be installed directly on the pressure vessel, unless the source of pressure
is external to the vessel and is under such positive control that the pressure cannot exceed the maximum overpressure permitted by the original code of construction and the pressure relief device cannot be isolated from the vessel, except as permitted by 2.5.6 e) 2).~~
~~b) Pressure relief devices intended for use in compressible fluid service shall be connected to the vessel in the vapor space above any contained liquid or in the piping system connected to the vapor space.~~
~~c) Pressure relief devices intended for use in liquid service shall be connected below the normal liquid line.~~
~~The liquid level during upset conditions shall be considered.~~

2.5.4 CAPACITY

a) The pressure relief device(s) shall have sufficient capacity to ensure that the pressure vessel is not exposed to pressure greater than that specified in the original code of construction.
b) Pressure vessels that can be exposed to fire or other sources of unexpected external heat may require supplemental pressure relief devices to provide additional relieving capacity.
1) The combined capacity of all installed pressure relief devices shall be adequate to prevent the pressure
from rising more than 21% above maximum allowable working pressure.

2) The set point of any supplemental pressure relief device(s) shall not exceed 110% of the maximum allowable working pressure. If a single pressure relief device is utilized to protect the vessel during both operational and fire or other unexpected external heating conditions, the set point shall not exceed maximum allowable working pressure.
c) Vessels connected together by a system of piping not containing valves that can isolate any pressure vessel may be considered as one unit when determining capacity requirements.
d) Heat exchangers and similar vessels shall be protected with a pressure relief device of sufficient capacity
to avoid overpressure in case of internal failure.

2.5.5 SET PRESSURE

a) When a single pressure relief device is used, the set pressure marked on the device shall not exceed the maximum allowable working pressure.
b) When more than one pressure relief device is provided to obtain the required capacity, only one pressure relief device set pressure needs to be at the maximum allowable working pressure. The set pressures of the additional pressure relief devices shall be such that the pressure cannot exceed the overpressure permitted by the code of construction.

2.5.6 INSTALLATION AND DISCHARGE PIPING REQUIREMENTS

~~a) The opening through all pipe and fittings between a pressure vessel and its pressure relief device shall have at least the area of the pressure relief device inlet. The characteristics of this upstream system shall be such that the pressure drop will not reduce the relieving capacity below that required or adversely affect the proper operation of the pressure relief device. When a discharge pipe is used, the size shall be such that any pressure that may exist or develop will not reduce the relieving capacity below that required or adversely affect the proper operation of the pressure relief device. It shall be as short and straight as possible and arranged to avoid undue stress on the pressure relief device.~~
~~b) A non-reclosing device installed between a pressure vessel and a pressure relief valve shall meet the requirements of 2.5.6 a).~~
~~c) The opening in the pressure vessel wall shall be designed to provide unobstructed flow between the vessel and its pressure relief device.~~
d) When two or more required pressure relief devices are placed on one connection, the inlet cross-sectional
area of this connection shall be sized either to avoid restricting flow to the pressure relief devices or made at least equal to the combined inlet areas of the pressure relief devices connected to it. The flow characteristics of the upstream system shall satisfy the requirements of 2.5.6 a).
e) There shall be no intervening stop valves between the vessel and its pressure relief device(s), or between the pressure relief device(s) and the point of discharge, except under the following conditions:
1) When these stop valves are so constructed or positively controlled that the closing of the maximum number of block valves at one time will not reduce the pressure relieving capacity below the required relieving capacity.
2) Upon specific acceptance of the Jurisdiction, when necessary for the continuous operation of processing
equipment of such a complex nature that shutdown of any part is not feasible, a full area stop valve between a pressure vessel and its pressure relief device may be provided for inspection and repair purposes only. This stop valve shall be arranged so that it can be locked or sealed open, and it shall not be closed except by an authorized person who shall remain stationed there during that period of operation while the valve remains closed. The valve shall be locked or sealed in the open position before the authorized person leaves the station.
3) A full area stop valve may also be placed on the discharge side of a pressure relief device when its discharge is connected to a common header for pressure relief devices to prevent discharges from these other devices from flowing back to the first device during inspection and repair. This stop valve shall be arranged so that it can be locked or sealed open, and it shall not be closed except by an authorized person who shall remain stationed there during that period of operation while the valve remains closed. The valve shall be locked and sealed in the open position before the authorized person leaves the station. This valve shall only be used when a stop valve on the inlet side of the pressure relief device is first closed.
4) A pressure vessel in a system where the pressure originates from an outside source may have a stop valve between the vessel and the pressure relief device, and this valve need not be sealed

open, provided it also closes off that vessel from the source of the pressure.
5) Pressure vessels designed for human occupancy (such as decompression or hyperbaric chambers) shall be provided with a quick opening stop valve between the pressure vessel and its pressure relief valve. The stop valve shall be normally sealed open with a frangible seal and be readily accessible to the pressure relief attendant.
f) Pressure relief device discharges shall be arranged such that they are not a hazard to personnel or other equipment and, when necessary, lead to a safe location for disposal of fluids being relieved.

g) Discharge lines from pressure relief devices shall be designed to facilitate drainage or be fitted with drains to prevent liquid from collecting in the discharge side of a pressure relief device. The size of discharge lines shall be such that any pressure that may exist or develop will not reduce the relieving capacity of the pressure relief device or adversely affect the operation of the pressure relief device. It shall be as short and straight as possible and arranged to avoid undue stress on the pressure relief device.
h) Pressure relief devices shall be installed so they are readily accessible for inspection, repair, or replacement.
i) Pressure vessel pressure relief devices and discharge piping shall be safely supported. The reaction forces due to discharge of pressure relief devices shall be considered in the design of the inlet and discharge
piping. Design of supports, foundations, and settings shall consider vibration (including seismic where necessary), movement (including thermal movement), and loadings (including reaction forces during device operation in accordance with jurisdictional requirements, manufacturer's recommendations, and/or other industry standards, as applicable.

2.5.7 TEMPERATURE AND PRESSURE RELIEF DEVICES FOR HOT WATER STORAGE TANKS

a) Each hot water storage tank shall be equipped with an ASME/NB certified temperature and pressure relief device set at a pressure not to exceed the maximum allowable working pressure and 210°F. (99°C).
b) The temperature and pressure relief device shall meet the requirements of 2.5.1 through 2.5.6 above.

2.6 PIPING SYSTEM PRESSURE RELIEF DEVICES

See NBIC Part 1, Section 5 for the piping systems associated with Part 4, 2.6.
When required by the original code of construction, piping shall be protected by pressure relief devices in accordance with the following requirements.

2.6.1 DEVICE REQUIREMENTS

a) Pressure relief devices shall be manufactured in accordance with a national or international standard and be certified for capacity or flow resistance by the National Board.
1) In certain cases piping codes of construction permit the use of regulators, which may include integral pressure relief valves to limit the pressure in a piping system. In this case, capacity certification of the pressure relief valve is not required.
2) Some piping codes of construction permit the use of pressure relief devices without capacity certification.
In this case, capacity certification of the pressure relief device by the National Board is not required.
b) Dead weight or weighted lever pressure relief devices shall not be used.
~~c) Pressure relief devices shall be selected (i.e., material, pressure, etc.) and installed such that their proper functioning will not be hindered by the nature of the piping system's contents.~~

2.6.2 NUMBER OF DEVICES

~~At least one pressure relief device shall be provided for protection of a piping system. A pressure relief device~~
~~installed on a pressure vessel or other component connected to the piping system may be used to meet this~~
~~requirement. Portions of piping systems with different maximum allowable working pressures shall have a pressure relief device to protect each portion separately.~~

2.6.3 LOCATION

Pressure relief devices, except those covered by NBIC Part 4, 2.1 through 2.2, may be installed at any

location in the system provided the pressure in any portion of the system cannot exceed the maximum overpressure
permitted by the original code of construction. ~~Pressure drop to the pressure relief device under flowing conditions shall be considered when determining pressure relief device location. The pressure-relief~~
~~device shall not be isolated from the piping system except as permitted by 2.6.6 e).~~

2.6.4 CAPACITY

a) The pressure relief device(s) shall have sufficient capacity to ensure that the piping is not exposed to pressures greater than that specified in the original code of construction.
~~b) When a non-reclosing device is installed between a pressure relief valve and the pipe, the reduction in capacity due to installation of the non-reclosing device shall be determined in accordance with the code of construction by use of a National Board certified Combination Capacity Factor (CCF). For rupture disks, if a certified combination capacity factor is not available, the capacity of the pressure relief valve shall be multiplied by 0.9 and this value used as the capacity of the combination installation.~~
~~c) The owner shall document the basis for selection of the pressure relief devices used, including capacity,~~
~~and have such calculations available for review by the Jurisdiction, when required.~~

2.6.5 SET PRESSURE

a) When a single pressure relief device is used, the set pressure marked on the device shall not exceed the maximum allowable working pressure, except when allowed by the original code of construction.
b) When more than one pressure relief device is provided to obtain the required capacity, only one pressure
relief device set pressure need be at or below the maximum allowable working pressure. The set pressures of the additional pressure relief devices shall be such that the pressure cannot exceed the overpressure permitted by the code of construction.

2.6.6 INLET AND DISCHARGE PIPING REQUIREMENTS

~~a) The opening through all pipes and fittings between a piping system and its pressure relief device shall have at least the area of the pressure relief device inlet. The characteristics of this upstream system shall be such that the pressure drop will not reduce the relieving capacity below that required or adversely affect the operation of the pressure relief device.~~
~~b) A non-reclosing device installed between a piping system and a pressure relief valve shall meet the requirements of 2.6.6 a).~~
~~c) The opening in the pipe shall be designed to provide unobstructed flow between the pipe and its pressure~~
~~relief device.~~
~~d) When two or more required pressure relief devices are placed on the connection, the inlet cross-sectional~~
~~area of this connection shall be sized either to avoid restricting flow to the pressure relief devices or made at least equal to the combined inlet areas of the pressure relief devices connected to it. The flow characteristics of the upstream system shall satisfy the requirements of 2.6.6 a).~~
~~e) There shall be no intervening stop valves between the piping system and its pressure relief device(s), or~~
~~between the pressure relief device(s) and the point of discharge except under the following conditions:~~

~~1) These stop valves shall be so constructed or positively controlled that the closing of the maximum number of block valves at one time will not reduce the pressure relieving capacity below the required relieving capacity;~~
~~2) Upon specific acceptance of the Jurisdiction, when necessary for the continuous operation of processing~~
~~equipment of such a complex nature that shutdown of any part is not feasible, a full area stop valve between a piping system and its pressure relief device may be provided for inspection and repair purposes only. This stop valve shall be arranged so that it can be locked or sealed open and it shall not be closed except by an authorized person who shall remain stationed there during that period of operation while the valve remains closed. The valve shall be locked or sealed in the open position before the authorized person leaves the station;~~
~~3) A full area stop valve may be placed on the discharge side of a pressure relief device when its~~

discharge is connected to a common header for pressure relief devices to prevent discharges from these other devices from flowing back to the first device during inspection and repair. This stop valve shall be arranged so that it can be locked or sealed open and it shall not be closed except by an authorized person who shall remain stationed there during that period of operation while the valve remains closed. The valve shall be locked or sealed in the open position before the authorized person leaves the station. This valve shall only be used when a stop valve on the inlet side of the pressure relief device is first closed; or

4) A piping system where the pressure originates from an outside source may have a stop valve between the system and the pressure relief device, and this valve need not be sealed open, provided it also closes off that vessel from the source of pressure.

f) Pressure relief device discharges shall be arranged such that they are not a hazard to personnel or other equipment and, when necessary, lead to a safe location for disposal of fluids being relieved.

g) Discharge lines from pressure relief devices shall be designed to facilitate drainage or be fitted with drains to prevent liquid from collecting in the discharge side of a pressure relief device. The size of discharge lines shall be such that any pressure that may exist or develop will not reduce the relieving capacity of the pressure relief device or adversely affect the operation of the pressure relief device. It shall be as short and straight as possible and arranged to avoid undue stress on the pressure relief device.

h) The reaction forces due to discharge of pressure relief devices shall be considered in the design of the inlet and discharge piping.

i) Pressure relief devices shall be installed so they are accessible for inspection, repair, or replacement.

2.4.4.2 PERMISSIBLE INSTALLATIONS (19)

Temperature and pressure relief valves shall be connected directly to a tapped or flanged opening in the top of the water heater or to a fitting connected to the water heater by a short nipple. Temperature and pressure relief valves shall be installed with their spindles upright and vertical with no horizontal connecting pipe, except that, when the temperature and pressure relief valve is installed directly on the water heater vessel with no more than 4 in. (100 mm) maximum interconnecting piping, the valve may be installed in the horizontal position with the outlet pointed down. The center line of the temperature and pressure relief valve connection shall be no lower than 4 in.(100 mm) from the top of the shell. No piping or fitting used to install the temperature and pressure relief valve shall be of nominal pipe size less than that of the valve inlet.

2.4.4.3 REQUIREMENTS FOR COMMON CONNECTION FOR TWO OR MORE VALVES

a) When a potable water heater is fitted with two or more temperature and pressure relief valves on one connection, this connection shall have a cross sectional area not less than the combined areas of inlet connections of all the temperature and pressure relief valves with which it connects.

b) ~~When a Y base is used, the inlet area shall be not less than the combined outlet areas.~~

~~c)~~ When the size of the water heater requires a temperature and pressure relief valve larger than NPS 4 (DN 100) two or more valves having the required combined capacity shall be used. ~~When two or more valves are used on a water heater, they may be single, directly attached, or installed on a Y base.~~

2.4.4.4 THREADED CONNECTIONS

A threaded connection may be used for attaching a temperature and pressure relief valve.

2.4.4.5 PROHIBITED INSTALLATIONS

Temperature and pressure relief valves shall not be connected to an internal pipe in the water heater or a cold water feed line connected to the water heater.

2.4.4.6 USE OF SHUTOFF VALVES PROHIBITED

No shutoff valve of any description shall be placed between the temperature and pressure relief valve and the water heater or on discharge pipes between such valves and the atmosphere.

2.4.4.7 TEMPERATURE AND PRESSURE RELIEF VALVE DISCHARGE PIPING

a) The discharge from temperature and pressure relief valves shall be so arranged that there will be no danger of scalding attendants. When the temperature and pressure relief valve discharge is piped away from the water heater to the point of discharge, there shall be provisions for properly draining the piping and valve body. The size and arrangement of discharge piping shall be such that any pressure that may exist or develop will not reduce the relieving capacity of the relieving devices below that required to protect the water heater.

b) When a discharge pipe is used, it shall be not less than the nominal size of the valve outlet and shall be as short and straight as possible and so arranged as to avoid undue stress on the valve. When an elbow is placed on a temperature and pressure relief discharge pipe, it shall be located close to the valve outlet.

c) Where multiple valves relieve into a common discharge pipe, the cross-sectional flow area of the common discharge pipe shall be equal to or greater than the sum of the individual temperature and pressure valve discharge pipe areas.

3.9.4.1 INSTALLATION (19)

Temperature and pressure relief valves shall be installed by either the water heater manufacturer or installer before a water heater is placed in operation.

3.9.4.2 PERMISSIBLE INSTALLATIONS (19)

Temperature and pressure relief valves shall be connected directly to a tapped or flanged opening in the top of the water heater or to a fitting connected to the water heater by a short nipple. Temperature and pressure relief valves shall be installed with their spindles upright and vertical with no horizontal connecting pipe, except that, when the temperature and pressure relief valve is installed directly on the water heater vessel with no more than 4 in. (100 mm) maximum interconnecting piping, the valve may be installed in the horizontal position with the outlet pointed down. The center line of the temperature and pressure relief valve connection shall be no lower than 4 in. (100 mm) from the top of the shell. No piping or fitting used to install the temperature and pressure relief valve shall be of nominal pipe size less than that of the valve inlet.

3.9.4.3 REQUIREMENTS FOR COMMON CONNECTION FOR TWO OR MORE VALVES

a) When a potable water heater is fitted with two or more temperature and pressure relief valves on one connection, this connection shall have a cross-sectional area not less than the combined areas of inlet connections of all the temperature and pressure release valves with which it connects.

b) ~~When a Y base is used, the inlet area shall be not less than the combined outlet areas.~~

~~c)~~ When the size of the water heater requires a temperature and pressure relief valve larger than NPS 4 (DN 100) two or more valves having the required combined capacity shall be used. ~~When two or more valves are used on a water heater, they may be single, directly attached, or installed on a Y base.~~

3.9.4.4 THREADED CONNECTIONS

A threaded connection may be used for attaching a temperature and pressure relief valve.

3.9.4.5 PROHIBITED INSTALLATIONS

Temperature and pressure relief valves shall not be connected to an internal pipe in the water heater or a cold water feed line connected to the water heater.

3.9.4.6 USE OF SHUTOFF VALVES PROHIBITED

No shutoff valve of any description shall be placed between the temperature and pressure relief valve and the water heater or on discharge pipes between such valves and the atmosphere.

3.9.4.7 TEMPERATURE AND PRESSURE RELIEF VALVE DISCHARGE PIPING

a) The discharge from temperature and pressure relief valves shall be so arranged that there will be no danger of scalding attendants. When the temperature and pressure relief valve discharge is piped away from the water heater to the point of discharge, there shall be provisions for properly draining the piping and valve body. The size and arrangement of discharge piping shall be such that any pressure that may exist or develop will not reduce the relieving capacity of the relieving devices below that required to protect the water heater.

b) When a discharge pipe is used, it shall be not less than the nominal size of the valve outlet, and shall be as short and straight as possible and so arranged as to avoid undue stress on the valve. When an

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PART 4, 3.2.6 RECOMMENDED INSPECTION AND TEST FREQUENCIES FOR PRESSURE RELIEF DEVICES

~~a) Power Boilers~~

~~1) Pressure less than 400 psig (2.76 MPa): Manual check every 6 months; pressure test annually to verify nameplate set pressure or as determined by operating experience as verified by testing history.~~

~~2) Pressure of 400 psig (2.76 MPa) or greater: Set pressure test to verify nameplate set pressure every three years or as determined by operating experience as verified by testing history.~~

~~3) Set pressure tests should be performed prior to bringing the boiler down for planned internal inspection so needed repairs or adjustments can be made while the boiler is down.~~

~~b) High-Temperature Hot-Water Boilers~~

~~Set pressure test annually to verify nameplate set pressure or as determined by operating experience as verified by testing history. For safety reasons, removal and testing on a steam test bench is recommended. Such testing will avoid damaging the pressure relief valve by discharge of a steam water mixture, which could occur if the valve is tested in place.~~

~~c) Organic Fluid Vaporizers~~

~~Pressure relief valves shall be disconnected from the vaporizer at least once yearly, when they shall be inspected, tested, repaired if necessary, and then replaced on the vaporizer.~~

~~d) Low-Pressure Steam Heating Boilers~~

~~Manual check quarterly; set pressure test annually prior to steam heating season to verify nameplate set pressure.~~

~~e) Hot-Water Heating Boilers~~

~~Manual check quarterly; pressure test annually prior to heating season to verify nameplate set pressure.~~

~~**Note**: The frequencies specified for the testing of pressure relief valves on boilers is primarily based on differences between high pressure boilers that are continuously manned, and lower pressure automatically controlled boilers that are not monitored by a boiler operator at all times. When any boiler experiences an overpressure condition such that the pressure relief valves actuate, the valves should be inspected for seat leakage and other damage as soon as possible and any deficiencies corrected.~~

~~f) Water Heaters~~

~~Manual check every two months, or as determined based upon inspection history and manufacturer recommendations. Every 3 years, remove temperature and pressure relief valve to inspect temperature probe for damage, buildup, or corrosion. The temperature probe shall be checked for the condition of the coating material and freedom of movement without detaching. If the probe pulls out or falls off during inspection, the valve shall be repaired or replaced. Due to the relatively low cost of temperature and pressure relief valves for this service, it is recommended that a defective valve be replaced with a new valve if a repair or resetting is indicated.~~

~~g) 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~~service, external environment, and operation of the system, therefore only general recommendations can be given. Inspection frequency should be based on previous inspection history and/or manufacturer's recommendations. If, during inspection, valves are found to be defective or damaged, 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:[TB1]

Table 3.2.6

Service	**Inspection Type/Frequency**
Power boilers less than 400 psi (2.76 MPa)	Lift lever test every six months, set pressure test annually or prior to planned boiler shutdown
Power boilers 400 psi (2.76 MPa) or greater	Set pressure test every three years or prior to planned boiler shutdown
High-temperature hot water boilers (See Note 1)	Set pressure test annually
Low-pressure steam heating boilers	Lift lever test quarterly, set pressure test annually prior to heating season
Organic Fluid Vaporizers	Remove, inspect, and set pressure test annually
Hot water heating boilers (See Note 2)	Lift lever test quarterly, set pressure test annually prior to heating season
Water heaters (See Note 3)	Lift lever test every two months, remove and inspect temperature probe for damage, buildup or corrosion every three years.
Pressure vessels/piping-steam service	Set pressure test annually
Pressure vessels/piping-air/clean, dry gas	Set pressure test every three years
Pressure vessels/piping-propane/refrigerant	Set pressure test every five years
Pressure relief valves in combination with rupture disks	Set pressure test every five years
All others	Per inspection history

[TB2]

Note 1: For safety reasons, removal and testing on a steam test bench is recommended. Such testing will avoid damaging the pressure relief valve by discharge of a steam water mixture, which could occur if the valve is tested in place.[TB3]

Note 2: The frequencies specified for the testing of pressure relief valves on boilers is primarily based on differences between high pressure boilers that are continuously manned, and lower pressure automatically controlled boilers that are not monitored by a boiler operator at all times. When any boiler experiences an overpressure condition such that the pressure relief valves actuate, the valves should be inspected for seat leakage and other damage as soon as possible and any deficiencies corrected.[TB4]

Note 3: The temperature probe shall be checked for the condition of the coating material and freedom of movement without detaching. If the probe pulls out or falls off during inspection, the valve shall be repaired or replaced. Due to the relatively low cost of temperature and pressure relief valves for this service, it is recommended that a defective valve be replaced with a new valve if a repair or resetting is indicated.[TB5]

PART 2, 2.5.8 RECOMMENDED INSPECTION AND TEST FREQUENCIES FOR PRESSURE RELIEF DEVICES

a) Power Boilers

1) Pressure less than 400 psig (2.76 MPa): Manual check every 6 months; pressure test annually to verify nameplate set pressure or as determined by operating experience as verified by testing history.

2) Pressure of 400 psig (2.76 MPa) or greater: Set pressure test to verify nameplate set pressure every three years or as determined by operating experience as verified by testing history.

3) Set pressure tests should be performed prior to bringing the boiler down for planned internal inspection so needed repairs or adjustments can be made while the boiler is down.

b) High-Temperature Hot-Water Boilers

Set pressure test annually to verify nameplate set pressure or as determined by operating experience as verified by testing history. For safety reasons, removal and testing on a steam test bench is recommended. Such testing will avoid damaging the pressure relief valve by discharge of a steam water mixture, which could occur if the valve is tested in place.

c) Organic Fluid Vaporizers

Pressure relief valves shall be disconnected from the vaporizer at least once yearly, when they shall be inspected, tested, repaired if necessary, and then replaced on the vaporizer.

d) Low-Pressure Steam Heating Boilers

Manual check quarterly; set pressure test annually prior to steam heating season to verify nameplate set pressure.

e) Hot-Water Heating Boilers

Manual check quarterly; pressure test annually prior to heating season to verify nameplate set pressure.

Note: The frequencies specified for the testing of pressure relief valves on boilers is primarily based on differences between high pressure boilers that are continuously manned, and lower pressure automatically controlled boilers that are not monitored by a boiler operator at all times. When any boiler experiences an overpressure condition such that the pressure relief valves actuate, the valves should be inspected for seat leakage and other damage as soon as possible and any deficiencies corrected.

f) Water Heaters

Manual check every two months, or as determined based upon inspection history and manufacturer recommendations. Every 3 years, remove temperature and pressure relief valve to inspect temperature probe for damage, buildup, or corrosion. The temperature probe shall be checked for the condition of the coating material and freedom of movement without detaching. If the probe pulls out or falls off during inspection, the valve shall be repaired or replaced. Due to the relatively low cost of temperature and pressure relief valves for this service, it is recommended that a defective valve be replaced with a new valve if a repair or resetting is indicated.

~~g) 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~~service, external environment, and operation of the system, therefore only general recommendations can be given. Inspection frequency should be based on previous inspection history and/or manufacturer's recommendations. If, during inspection, valves are found to be defective or damaged, 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:[TB6]

Table 3.2.6

Service	**Inspection Type/Frequency**
Power boilers less than 400 psi (2.76 MPa)	Lift lever test every six months, set pressure test annually or prior to planned boiler shutdown
Power boilers 400 psi (2.76 MPa) or greater	Set pressure test every three years or prior to planned boiler shutdown
High-temperature hot water boilers (See Note 1)	Set pressure test annually
Low-pressure steam heating boilers	Lift lever test quarterly, set pressure test annually prior to heating season
Organic Fluid Vaporizers	Remove, inspect, and set pressure test annually
Hot water heating boilers (See Note 2)	Lift lever test quarterly, set pressure test annually prior to heating season
Water heaters (See Note 3)	Lift lever test every two months, remove and inspect temperature probe for damage, buildup or corrosion every three years.
Pressure vessels/piping-steam service	Set pressure test annually
Pressure vessels/piping-air/clean, dry gas	Set pressure test every three years
Pressure vessels/piping-propane/refrigerant	Set pressure test every five years
Pressure relief valves in combination with rupture disks	Set pressure test every five years
All others	Per inspection history

[TB7]

Note 1: For safety reasons, removal and testing on a steam test bench is recommended. Such testing will avoid damaging the pressure relief valve by discharge of a steam water mixture, which could occur if the valve is tested in place.[TB8]

Note 2: The frequencies specified for the testing of pressure relief valves on boilers is primarily based on differences between high pressure boilers that are continuously manned, and lower pressure automatically controlled boilers that are not monitored by a boiler operator at all times. When any boiler experiences an overpressure condition such that the pressure relief valves actuate, the valves should be inspected for seat leakage and other damage as soon as possible and any deficiencies corrected.[TB9]

Note 3: The temperature probe shall be checked for the condition of the coating material and freedom of movement without detaching. If the probe pulls out or falls off during inspection, the valve shall be repaired or replaced. Due to the relatively low cost of temperature and pressure relief valves for this service, it is recommended that a defective valve be replaced with a new valve if a repair or resetting is indicated.[TB10]

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PART 4

SUPPLEMENT 4
RECOMMENDED PROCEDURES FOR REPAIRING PRESSURE RELIEF VALVES

S4.1 ~~INTRODUCTION~~SCOPE

This supplement contains recommended procedures for the repair, packaging, shipping and transportation of pressure relief valves. S4.2 contains recommended procedures for the repair of spring-loaded pressure relief valves. ~~and~~ S4.3 contains recommended procedures for the repair of pilot operated types of pressure relief valves. S4.4 contains ~~I~~information on packaging, shipping and transportation. ~~is included as S4.5.~~

~~a)~~ It is essential that the repair organization establish basic, specific procedures for the repair of pressure relief valves. The purpose of these recommended procedures is to provide the repair organization with guidelines for this important aspect of valve repair. It is realized that there are many types of valves and conditions under which they are repaired and, for this reason, the specific items in these recommended procedures may not apply, or they may be inadequate for each of those types or to the detailed repairs that may be required for each valve.

~~b) S4.2 contains recommended procedures for the repair of spring-loaded pressure relief valves, and S4.3 contains recommended procedures for the repair of pilot operated types of pressure relief valves. Information on packaging, shipping and transportation is included as S4.5.~~

SUPPLEMENT 5
RECOMMENDED GUIDE FOR THE DESIGN OF A TEST SYSTEM FOR PRESSURE RELIEF DEVICES IN COMPRESSIBLE FLUID SERVICE

S5.1 SCOPE

This supplement provides guidance for the design of a test system using compressible fluids (e.g., steam or air/gas) and permits the determination of pressure relief valve set pressure and valve operating characteristics such as blowdown.
The size of the test vessel needed depends on the size of the valve, its set pressure, the design of the test system, and whether blowdown must be demonstrated. A repair organization may use the information provided in this supplement to determine the minimum size test vessel needed so that the measured performance is characteristic of the valve and not the test system.

~~S5.2 GENERAL~~

a) The National Board administrative rules and procedures for the “VR” *Certificate of Authorization* and symbol stamp require that pressure relief valves, after repair, be tested in accordance with the manufacturer’s recommendations and the applicable ASME Code. The purpose of this testing is to provide reasonable assurance that valves will perform according to design when they are returned to service.

b) It is recognized that a full evaluation of the performance of some pressure relief valve designs requires testing at maximum allowable overpressure. However, it is beyond the scope of this supplement to define test equipment or facilities for such testing.

c) Section 6 of this part provides a glossary, S5.3 describes typical test equipment, and S5.4 provides data for estimating the size of test vessels required.

(Renumber all remaining sections)

SUPPLEMENT 6
PROCEDURES FOR REPAIRS TO ASME "NV" STAMPED PRESSURE RELIEF DEVICES

S6.1 ~~INTRODUCTION~~SCOPE

This supplement provides procedures and requirements for repair of ASME Code "NV" Class 1, 2, or 3 stamped pressure relief devices, which have been capacity certified by the National Board~~, may be repaired provided the following requirements are met~~.

Item 19-18: Change to Part 4, 4.8.5.4 n) 5)

Explanation of Need: Current wording allows for implementation of the revision once the change is merely submitted to the National Board for approval.

Background Information: When changes are made to a QC Manual at times other than reviews, they may be done so by submission to NB via mail, email etc. But implementation of the change should not take place until after NB acceptance of the change is received.

Proposed Text:

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 to ~~for acceptance~~ and accepted by the National Board prior to being implemented.

(19) **4.7.2 REPAIR NAMEPLATE**

When a pressure relief valve is repaired, a metal repair nameplate stamped with the information required below shall be securely attached to the valve adjacent to the original manufacturer's stamping or nameplate. If not installed directly on the valve, the nameplate shall be securely attached to the valve independent of the external adjustment seals in a manner that does not interfere with valve operation and sealed in accordance with the quality system.

a) Prior to attachment of the repair nameplate, the previous repair nameplate, if applicable, shall be removed from the repaired valve.

b) As a minimum, the information on the valve repair nameplate (see Figure 4.7.2-a) shall include:

1) The name of the repair organization preceded by the words "repaired by";

2) The "VR" repair symbol stamp and the "VR" certificate number;

3) Unique identifier (e.g., repair serial number, shop order number, etc.);

4) Date of repair;

5) Set pressure;

6) Capacity and capacity units (if changed from original nameplate due to set pressure or service fluid change);

7) Type/Model number (if changed from original nameplate by a conversion. See 4.2); and

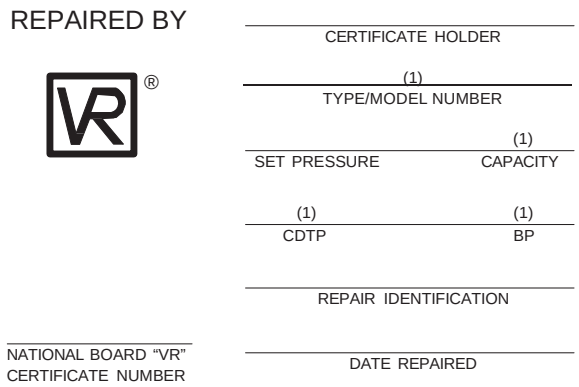
8) When an adjustment is made to correct for service conditions of superimposed back pressure and/or temperature or the differential between popping pressure between steam and air (see 4.6.2), the information on the valve repair nameplate shall include the:

a. Cold Differential Test Pressure (CDTP); and

b. Superimposed Back Pressure (BP) (only when applicable).

FIGURE 4.7.2-a

EXAMPLE LAYOUT OF REQUIRED MARKINGS FOR REPAIR OF ASME/NATIONAL BOARD "V," "UV," AND "HV"- STAMPED PRESSURE RELIEF VALVES



Note:. To be indicated only when changed.

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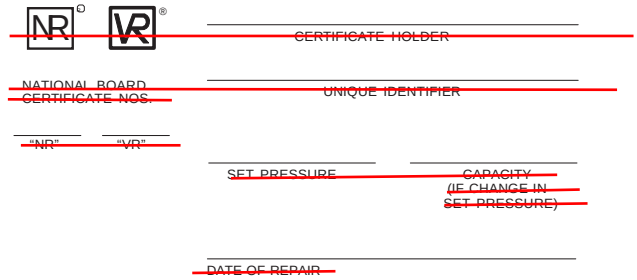
~~**FIGURE 4.7.2-b**~~

~~REQUIRED MARKINGS FOR REPAIR OF NUCLEAR PRESSURE RELIEF VALVES~~



Relocate to Supplement 6

4.7.3 CHANGES TO ORIGINAL PRESSURE RELIEF VALVE NAMEPLATE INFORMATION

a) If the set pressure is changed, the set pressure, capacity, and blowdown, if applicable, on the original nameplate or stamping shall be marked out but left legible. The new capacity shall be based on that for which the valve was originally certified.

b) If the service fluid is changed, the capacity, including units, on the original nameplate or stamping shall be marked out but left legible. The new capacity shall be based on that for which the valve was originally certified, or if a conversion has been made, as described in 4.2 on the capacity certification for the valve as converted.

c) If the Type/Model number is changed, the Type/Model number on the original nameplate or stamping shall be marked out but left legible.

d) If the blowdown is changed, the blowdown, if shown on the original nameplate or stamping, shall be marked out but left legible. The new blowdown may be based on the current ASME Code requirements.

e) Repair organizations shall verify the Type/Model number, inlet size, set pressure, and capacity on the original nameplate or stamping that is not marked out. Incorrect information on the original manufacturer's nameplate or stamping shall be marked out but left legible. Corrected information shall be indicated on the repair nameplate and noted on the document as required by the quality system.

4.7.4 REPLACEMENT OF ILLEGIBLE OR MISSING NAMEPLATES

a) Illegible Nameplates

When the information on the original manufacturer's or assembler's nameplate or stamping is illegible, but traceability can be confirmed, the nameplate or stamping shall be augmented by a nameplate furnished by the "VR" stamp holder stamped "Duplicate." It shall contain all information that originally appeared on the nameplate or valve, as required by the applicable section of the ASME Code, except the "V," "HV," or "UV" symbol and the National Board mark. The repair organization's nameplate, with the "VR" stamp and other required data specified in 4.7.2, will make the repairer responsible to the owner and the Jurisdiction that the information on the duplicate nameplate is correct.

b) Missing Nameplates

When the original valve nameplate is missing, the repair organization is not authorized to perform repairs to the valve under the "VR" program, unless positive identification can be made to that specific valve and verification that the valve was originally stamped with an ASME "V" or UV" symbol or marked with an ASME "HV" symbol. Valves that can be positively identified shall be equipped with a duplicate nameplate,

SUPPLEMENT 6
PROCEDURES FOR REPAIRS OF NUCLEAR SAFETY RELATED PRESSURE RELIEF VAVLES

S6.1 SCOPE

Nuclear safety related pressure relief valves and power actuated pressure relief valves may be repaired provided the following requirements are met. Valves being repaired under these provisions are intended to be those protecting the nuclear pressure boundary. Other pressure relief valves in the nuclear power plant (such as pressure relief valves on air compressors and auxiliary boilers) shall be repaired as required by the applicable Jurisdiction.

S6.2 DEFINITIONS

Safety Related – As used in this supplement and when applied to nuclear power plants, safety related means a structure, system, or component or part thereof that affects its safety function necessary to assure:

a) The integrity of the reactor coolant pressure boundary;

b) The capability to shut down the reactor and maintain it in a safe shutdown condition; or

c) The capability to prevent or mitigate the consequence of accidents which could result in potential offsite exposures.

S6.3 NUCLEAR SAFETY RELATED VALVE GROUPS

These rules classify nuclear safety related pressure relief valves into three groups based upon the original code of construction and capacity certification status.

Group 1: ASME Section I and Section VIII pressure relief valves accepted by the Jurisdiction for use in nuclear safety related service with National Board capacity certification.

Group 2: ASME Section III "NV" stamped Class 1, 2, or 3 pressure relief valves with National Board capacity certification.

Group 3: Pressure relief valves not addressed in Group 1 or Group 2. This group shall include pressure relief valves without National Board capacity certification and/or pressure relief valves constructed to codes or standards other than ASME (see NBIC Part 3, Category 3).

The term pressure relief valve includes power actuated pressure relief valves. Replacement of rupture disks in rupture disk holders or in systems is not considered a repair activity under the scope of this supplement.

S6.4 ADMINISTRATIVE PROCEDURES

a) The repair organization shall obtain a “VR” *Certificate of Authorization*.

b) The repair organization shall obtain a National Board “NR” *Certificate of Authorization.* The requirements for said certificate include, but is not limited to, the following. The repair organization shall:

1) Maintain a documented quality assurance program that meets the applicable requirements of NBIC Part 3, 1.6. This program shall also include all the applicable requirements for the use of the “VR” stamp;

2) Have a contract or agreement with an Authorized Nuclear Inspection Agency that is qualified in accordance with the requirements of ASME QAI-1, *Qualifications for Authorized Inspection* to provide inspection of repaired nuclear pressure relief valves;

3) Successfully complete a survey of the quality assurance program and its implementation. This survey shall be conducted by representatives of the National Board, the Jurisdiction wherein the applicant's repair facilities are located, and the applicant's Authorized Inspection Agency. Further verification of such implementation by the survey team may not be necessary if the applicant holds a valid ASME "NV" certificate and can verify by documentation the capability of implementing the quality assurance program for repair of "NV"-stamped pressure relief valves, covered by the applicant's ASME "NV" certificate.

c) The application of the "NR" *Certificate of Authorization* and stamp shall clearly define the scope of intended activities with respect to the repair of nuclear pressure relief valves.

d) Revisions to the quality assurance program shall be acceptable to the Authorized Nuclear Inspector Supervisor and the National Board before being implemented.

e) The scope of the "VR" *Certificate of Authorization* shall include repair of nuclear pressure relief valves (denoted on the "VR" Certificate as Section III).

f) Verification testing of valves repaired by the applicant shall not be required provided such testing has been successfully completed under the applicant's "VR" certification program for the applicable test fluids.

g) A survey of the applicant for the "VR" *Certificate of Authorization* and endorsement of the repair of nuclear pressure relief valves may be made concurrently.

S6.5 GENERAL RULES

a) Group 1 and Group 2 pressure relief valves which have been repaired in accordance with these rules, shall be stamped with both the "VR" and "NR" stamps. They shall be classified as either "NR" Category 1 or Category 2 as applicable. Group 3 pressure relief valves which have been repaired in accordance with these rules shall be stamped with the "NR" stamp. They shall be classified as either "NR" Category 2 or Category 3 as applicable.

b) The "VR" and "NR" stamps shall be applied only to nuclear safety related pressure relief valves that have been disassembled, inspected, and repaired as necessary, such that the valves' condition and performance are equivalent to the standards for new valves. As a minimum, the information on the valve repair nameplate (see Figure S6.5-a) shall include:

1) The name of the certificate holder;
2) The "VR" and "NR" sybol stamps and certificate numbers;
3) Unique identifier (e.g., repair serial number, shop order number, etc.);
4) Date of repair;
5) Set pressure;
6) Capacity and capacity units (if changed from the original nameplate due to set pressure)

c) All measuring and test equipment used in the repair of pressure relief valves shall be calibrated against certified equipment having known valid relationships to nationally recognized standards.

d) Documentation of the repair of nuclear safety related pressure relief valves shall be recorded on the National Board Form NVR-1, *Report of Repair/ Replacement Activities for Nuclear Pressure Relief Devices*, in accordance with the requirements of NBIC Part 3, 1.6. The original code of construction and capacity certification status shall be identified on the NVR-1 form.

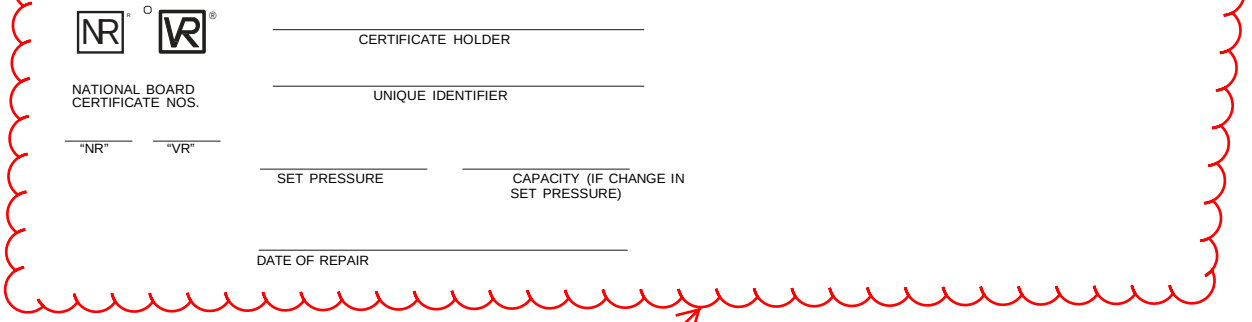
e) When an ASME "V", "UV" or "NV" stamped pressure relief device requires a duplicate nameplate because the original nameplate is illegible or missing, it may be applied using the procedures of NBIC Part 4, 4.7.5 provided concurrence is obtained from the Authorized Nuclear Inspector and Jurisdiction. In this case the nameplate shall be marked "SEC. I", "SEC. III", or "SEC. VIII" to indicate original ASME Code stamping.

f) Repair activities for pressure relief valves shall not include rerating of the device. Set pressure changes within the range of the valve manufacturer's capacity certification and the design pressure of the valve (see NBIC Part 4, 4.7.3) are permitted, provided the new set pressure and capacity rating are reconciled with the design of the system where the device will be used. These changes are not considered to be rerating.

g) Conversions of pressure relief valves as described in NBIC Part 4, 4.2 b) are permitted as part of repair activities.

h) Set pressure changes or conversions of pressure relief valves shall be described in the "Remarks" section of Form NVR-1.

FIGURE ~~4.7.2-b~~S6.5-a
EXAMPLE LAYOUT OF REQUIRED MARKINGS FOR REPAIR OF NUCLEAR PRESSURE RELIEF VALVES



Relocate from from 4.7.2-b

4.7.3 CHANGES TO ORIGINAL PRESSURE RELIEF VALVE NAMEPLATE INFORMATION

a) If the set pressure is changed, the set pressure, capacity, and blowdown, if applicable, on the original nameplate or stamping shall be marked out but left legible. The new capacity shall be based on that for which the valve was originally certified.

b) If the service fluid is changed, the capacity, including units, on the original nameplate or stamping shall be marked out but left legible. The new capacity shall be based on that for which the valve was origi- nally certified, or if a conversion has been made, as described in 4.2 on the capacity certification for the valve as converted.

c) If the Type/Model number is changed, the Type/Model number on the original nameplate or stamping shall be marked out but left legible.

d) If the blowdown is changed, the blowdown, if shown on the original nameplate or stamping, shall be marked out but left legible. The new blowdown may be based on the current ASME Code requirements.

e) Repair organizations shall verify the Type/Model number, inlet size, set pressure, and capacity on the original nameplate or stamping that is not marked out. Incorrect information on the original manufacturer's nameplate or stamping shall be marked out but left legible. Corrected information shall be indicated on the repair nameplate and noted on the document as required by the quality system.

4.7.4 ~~REPLACEMENT OF~~ ILLEGIBLE OR MISSING NAMEPLATES

The VR Certificate Holder shall not perform repairs under the VR Program on any PRV that cannot be positively identified by the manufacturer or through in-house sources. Such identification shall include the verification of the original ASME Stamping. Pressure relief valves that have missing or illegible nameplates and can be positively identified shall be equipped with a nameplate marked "DUPLICATE", which contains all original nameplate data. The duplicate nameplate shall not bear the "NB" Mark or the ASME Certification Mark with the "V", "HV", or "UV" Designator or the supplanted "V", "HV", or "UV" Symbol. Instead, the nameplate shall be stamped "Sec. I", "Sec. IV", or "Sec. VIII", as applicable, to indicate the original stamping. Illegible nameplates, if applicable, shall not be removed.

~~a) Illegible Nameplates~~

~~When the information on the original manufacturer's or assembler's nameplate or stamping is illegible, but traceability can be confirmed, the nameplate or stamping shall be augmented by a nameplate furnished by the "VR" stamp holder stamped "Duplicate." It shall contain all information that originally appeared on the nameplate or valve, as required by the applicable section of the ASME Code, except the "V," "HV," or "UV" symbol and the National Board mark. The repair organization's nameplate, with the "VR" stamp and other required data specified in 4.7.2, will make the repairer responsible to the owner and the Jurisdiction that the information on the duplicate nameplate is correct.~~

~~b) Missing Nameplates~~

~~When the original valve nameplate is missing, the repair organization is not authorized to perform repairs to the valve under the "VR" program, unless positive identification can be made to that specific valve and verification that the valve was originally stamped with an ASME "V" or UV" symbol or marked with an ASME "HV" symbol. Valves that can be positively identified shall be equipped with a duplicate nameplate,~~

~~as described in this section, in addition to the repairer's "VR"-stamped nameplate. The repairer's respon- sibilities for accurate data, as defined in 4.7.5 a) shall apply.~~

~~c) Marking of Original Code Stamp~~

~~When a duplicate nameplate is affixed to a valve, as required by this section, it shall be marked "Sec. I," "Sec. IV," or "Sec. VIII," as applicable, to indicate the original ASME Code stamping.~~

~~(19) 4.7.5 REPLACEMENT OF ILLEGIBLE OR MISSING NAMEPLATES~~

~~a) Illegible Nameplates~~

~~When the information on the original manufacturer's or assembler's nameplate or stamping is illegible, but traceability can be confirmed, the nameplate or stamping shall be augmented by a nameplate furnished by the "VR" stamp holder stamped "Duplicate." It shall contain all information that originally appeared on the nameplate or valve, as required by the applicable section of the ASME Code, except the ASME Certification Mark and the "V", "UV", or "HV" Designator or the supplanted "V", "UV", or "HV" symbol and the National Board mark. The repair organization's nameplate, with the "VR" stamp and other required data specified in 4.7.2, will make the repairer responsible to the owner and the Jurisdiction that the information on the duplicate nameplate is correct.~~

~~b) Missing Nameplates~~

~~When the original valve nameplate is missing, the repair organization is not authorized to perform repairs to the valve under the "VR" program, unless positive identification can be made to that specific valve and verification that the valve was originally marked with the ASME Certification Mark and the "V", "UV", or "HV" Designator or the supplanted ASME "V" , "UV" or "HV" symbol. Valves that can be positively identified shall be equipped with a duplicate nameplate, as described in this section, in addition to the repairer's "VR"-stamped nameplate. The repairer's responsibilities for accurate data, as defined in 4.7.5(a) (Illegible Nameplates), shall apply.~~

~~c) Marking of Original Code Stamp~~

~~When a duplicate nameplate is affixed to a valve, as required by this section, it shall be marked "Sec. I", "Sec. IV", or "Sec. VIII", as applicable, to indicate the original ASME Code marking.~~

4.8 ACCREDITATION OF "VR" REPAIR ORGANIZATIONS

4.8.1 SCOPE

a) This section provides requirements that must be met for an organization to obtain a National Board *Certificate of Authorization* to use the "VR" Symbol Stamp for repair activities of pressure relief devices constructed in accordance with the requirements of the ASME Code.

b) For administrative requirements to obtain or renew a National Board "VR" *Certificate of Authorization* and "VR" Symbol Stamp, refer to NB-514, *Accreditation of "VR" Repair Organizations*.

4.8.2 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.

2) Have a contract or agreement with an Authorized Nuclear Inspection Agency that is qualified in accordance with the requirements of ASME QAI-1, *Qualifications for Authorized Inspection* to provide inspection of repaired nuclear pressure relief valves;

3) Successfully complete a survey of the quality assurance program and its implementation. This survey shall be conducted by representatives of the National Board, the Jurisdiction wherein the applicant's repair facilities are located, and the applicant's Authorized Inspection Agency. Further verification of such implementation by the survey team may not be necessary if the applicant holds a valid ASME "NV" certificate and can verify by documentation the capability of implementing the quality assurance program for repair of "NV"-stamped pressure relief valves, covered by the applicant's ASME "NV" certificate.

c) The application of the "NR" *Certificate of Authorization* and stamp shall clearly define the scope of intended activities with respect to the repair of nuclear pressure relief valves.

d) Revisions to the quality assurance program shall be acceptable to the Authorized Nuclear Inspector Supervisor and the National Board before being implemented.

e) The scope of the "VR" *Certificate of Authorization* shall include repair of nuclear pressure relief valves (denoted on the "VR" Certificate as Section III).

f) Verification testing of valves repaired by the applicant shall not be required provided such testing has been successfully completed under the applicant's "VR" certification program for the applicable test fluids.

g) A survey of the applicant for the "VR" *Certificate of Authorization* and endorsement of the repair of nuclear pressure relief valves may be made concurrently.

S6.5 GENERAL RULES (19)

a) Group 1 and Group 2 pressure relief valves which have been repaired in accordance with these rules, shall be stamped with both the "VR" and "NR" stamps. They shall be classified as either "NR" Category 1 or Category 2 as applicable. Group 3 pressure relief valves which have been repaired in accordance with these rules shall be stamped with the "NR" stamp. They shall be classified as either "NR" Category 2 or Category 3 as applicable.

b) The "VR" and "NR" stamps shall be applied only to nuclear safety related pressure relief valves that have been disassembled, inspected, and repaired as necessary, such that the valves' condition and performance are equivalent to the standards for new valves.

c) All measuring and test equipment used in the repair of pressure relief valves shall be calibrated against certified equipment having known valid relationships to nationally recognized standards.

d) Documentation of the repair of nuclear safety related pressure relief valves shall be recorded on the National Board Form NVR-1, *Report of Repair/ Replacement Activities for Nuclear Pressure Relief Devices*, in accordance with the requirements of NBIC Part 3, 1.6. The original code of construction and capacity certification status shall be identified on the NVR-1 form.

e) When an ASME "V", "UV" or "NV" stamped pressure relief device requires a duplicate nameplate because the original nameplate is illegible or missing, it may be applied using the procedures of NBIC Part 4, ~~4.7.5~~4.7.4 provided concurrence is obtained from the Authorized Nuclear Inspector and Jurisdiction. In this case the nameplate shall be marked "SEC. I", "SEC. III", or "SEC. VIII" to indicate original ASME Code stamping.

f) Repair activities for pressure relief valves shall not include rerating of the device. Set pressure changes within the range of the valve manufacturer's capacity certification and the design pressure of the valve

SUPPLEMENT 7 (19)

RECOMMENDED PROCEDURES FOR TEST ONLY OF PRESSURE RELIEF VALVES

S7.1 INTRODUCTION (19)

a) It is essential that the test only organization establish basic, specific procedures for the testing of pressure relief valves. The purpose of these recommended procedures is to provide the test only organization with guidelines for this important aspect of valve testing. It is realized that there are many types of valves and conditions under which they are tested and, for this reason, the specific items in these recommended procedures may not apply, or they may be inadequate for each of those types or for the detailed test procedures that may be required for each valve.

b) If the valve is to be bench tested, ensure that all sources of pressure have been removed from the valve prior to removal from service. If the valve is to be field tested using system pressure, ensure that all sources of pressure are under the control of the person performing the test.

c) S7.2 contains recommended procedures for the test only of spring-loaded and pilot operated pressure relief valves.

S7.2 PRESSURE RELIEF VALVES (19)

a) Visual inspection

1) This information is to be recorded

a. User (customer) identification number;

b. Complete original pressure relief valve nameplate data, previous "VR" repair nameplate data, previous "T/O" test only nameplate data plus any important information received from customer.

c. If nameplate is missing, illegible or has incorrect information, the pressure relief valve shall not be tested. Relief valve should be sent to "VR" repair shop per paragraph ~~4.7.5~~4.7.4

2) Verify external adjustment seals are installed and match manufacturer and/or "VR" - "T/O" nameplate.

3) Check bonnet for venting on bellows type valves.

4) Check appearance for any unusual damage, missing, or misapplied parts. If sufficient damage or other unusual conditions are detected that may pose a safety risk during testing, set aside for review by the Quality Department.

b) Existing Nameplate

1) An existing "VR" Nameplate, if applicable, shall not be removed from the relief valve.

2) An existing "T/O" Nameplate shall be removed from the relief valve.

c) Relief Valve Data

1) “Set Pressure Definition” shall be obtained from National Board Document # NB-18.

2) Manufacturer’s steam to air correction factor, if applicable, shall be obtained from Manufacturer.

PART 4, SECTION 11
PRESSURE RELIEF DEVICES — INDEX

O

P

Q

R

S

ITEM 19-9 Proposal 1-14-20

PART 4, 3.2.3

3.2.3 INSPECTION REQUIREMENTS FOR INSTALLATION CONDITION

a) Ensure all covers, caps, plugs, and/or lift lever wires utilized for shipping or transport are removed.

~~a~~b) Inlet piping shall be inspected to ensure it meets the requirements of the original code of construction. For pressure relief valves, the inlet pipe shall be checked to ensure the inlet pipe size is not smaller than the device inlet size.

~~b~~c) Discharge piping shall be inspected to ensure it meets the original code of construction. For pressure relief valves, the discharge pipe shall be checked to ensure the discharge pipe size is not smaller than the device outlet size.

~~c~~d) The valve drain piping shall be checked to ensure the piping is open.

~~d~~e) The discharge piping shall be checked to ensure it drains properly.

~~e~~f) The inlet and discharge piping shall be checked to ensure they are not binding or placing excessive stress on the valve body, which can lead to distortion of the valve body and leakage or malfunction.

~~f~~g) The condition and adequacy of the pipe supports shall be inspected. Discharge piping should be supported
independent of the device itself.

~~g~~h) The valve discharge and discharge pipe shall be checked for possible hazards to personnel.

~~h~~i) The installation shall be checked to ensure that there are no intervening isolation valves between the pressure source and the valve inlet or between the valve outlet and its point of discharge. Isolation valves may be permitted in some pressure vessel service. (See 2.5.6 e)), and Jurisdictional requirements. Isolation valves shall not be used for power boilers, heating boilers, or water heaters.

~~i~~j) A change-over valve, which is used to install two pressure relief devices on a single vessel location for the purpose of switching from one device to a spare device, is not considered a block valve if it is arranged such that there is no intermediate position that will isolate both pressure relief devices from the protected system. Change-over valves should be carefully evaluated to ensure they do not have excessive pressure drop that could affect the pressure relief device operation or capacity. These devices are commonly used in pressure vessel service. They may also be used in some boiler applications. It is recommended that the Jurisdiction be contacted to determine their acceptability on boiler applications.

PART 2, 2.5.4

2.5.4 INSPECTION REQUIREMENTS FOR INSTALLATION CONDITION

a) Ensure all covers, caps, plugs, and/or lift lever wires utilized for shipping or transport are removed.

~~a~~b) Inlet piping shall be inspected to ensure it meets the requirements of the original code of construction. For pressure relief valves, the inlet pipe shall be checked to ensure the inlet pipe size is not smaller than the device inlet size.

~~b~~c) Discharge piping shall be inspected to ensure it meets the original code of construction. For pressure relief valves, the discharge pipe shall be checked to ensure the discharge pipe size is not smaller than the device outlet size.

~~c~~d) The valve drain piping shall be checked to ensure the piping is open.

~~d~~e) The discharge piping shall be checked to ensure it drains properly.

~~e~~f) The inlet and discharge piping shall be checked to ensure they are not binding or placing excessive stress on the valve body, which can lead to distortion of the valve body and leakage or malfunction.

~~f~~g) The condition and adequacy of the pipe supports shall be inspected. Discharge piping should be supported
independent of the device itself.

~~g~~h) The valve discharge and discharge pipe shall be checked for possible hazards to personnel.

~~h~~i) The installation shall be checked to ensure that there are no intervening isolation valves between the pressure source and the valve inlet or between the valve outlet and its point of discharge. Isolation valves may be permitted in some pressure vessel service. (See 2.5.6 e)), and Jurisdictional requirements. Isolation valves shall not be used for power boilers, heating boilers, or water heaters.

~~i~~j) A change-over valve, which is used to install two pressure relief devices on a single vessel location for the purpose of switching from one device to a spare device, is not considered a block valve if it is arranged such that there is no intermediate position that will isolate both pressure relief devices from the protected system. Change-over valves should be carefully evaluated to ensure they do not have excessive pressure drop that could affect the pressure relief device operation or capacity. These devices are commonly used in pressure vessel service. They may also be used in some boiler applications. It is recommended that the Jurisdiction be contacted to determine their acceptability on boiler applications.

2.5.6 PACKAGING, SHIPPING, AND TRANSPORTATION

a) The improper packaging, shipment, and transport of pressure relief devices can have detrimental effects on device operation. Pressure relief devices should be treated with the same precautions as instrumentation, with care taken to avoid rough handling or contamination prior to installation.

b) The following practices are recommended:

1)Valves should be securely fastened to pallets in the vertical position to avoid side loads on guiding surfaces, except threaded and socket-weld valves up to 2 in. (50 mm) may be securely packaged and cushioned during transport;
2) Valve inlet and outlet connection, drain connections, and bonnet vents should be protected during shipment and storage to avoid internal contamination of the valve.
~~Ensure all covers and/or plugs are removed prior to installation;~~

NBIC Part 1 Item 19-49

2.9.1 VALVE REQUIREMENTS – GENERAL (19)

a) Only direct spring loaded, pilot operated, or power actuated pressure relief valves designed to relieve steam shall be used for steam service.

b) Pressure relief valves shall be manufactured in accordance with a national or international standard.

c) Deadweight or weighted-lever pressure relief valves shall not be used.

d) For high-temperature water boilers, safety relief valves shall have a closed bonnet, and valve bodies shall not be constructed of cast iron.

e) Pressure relief valves with an inlet connection greater than NPS 3 (DN 80) used for pressure greater than 15 psig (103 kPa), shall have a flange or a welded inlet connection. The dimensions of flanges subjected to boiler pressure shall conform to the applicable standards.

f) When a pressure relief valve is exposed to outdoor elements that may affect operation of the valve, the valve may be shielded with a cover. The cover shall be vented and arranged to permit servicing and normal operation of the valve.

g) All covers, caps, and/or plugs utilized for shipping or transport shall be removed prior to installation or being placed in service.

h) Any wire or restraining device on lifting lever utilized for shipping or transport shall be removed prior to being placed in service.

3.9.1 PRESSURE RELIEF VALVE REQUIREMENTS – GENERAL

The following general requirements pertain to installing, mounting, and connecting pressure relief valves on heating boilers.

a) All covers, caps, and/or plugs utilized for shipping or transport shall be removed prior to installation or being placed in service.

b) Any wire or restraining device on lifting lever utilized for shipping or transport shall be removed prior to being placed in service.

NBIC Part 4 Item 19-49

2.2.1 VALVE REQUIREMENTS – GENERAL (19)

a) Only direct spring loaded, pilot operated, or power actuated pressure relief valves designed to relieve steam shall be used for steam service.

b) Pressure relief valves shall be manufactured in accordance with a national or international standard.

c) Deadweight or weighted-lever pressure relief valves shall not be used.

d) For high-temperature water boilers, safety relief valves shall have a closed bonnet, and valve bodies shall not be constructed of cast iron.

e) Pressure relief valves with an inlet connection greater than NPS 3 (DN 80) used for pressure greater than 15 psig (103 kPa), shall have a flange or a welded inlet connection. The dimensions of flanges subjected to boiler pressure shall conform to the applicable standards.

f) When a pressure relief valve is exposed to outdoor elements that may affect operation of the valve, the valve may be shielded with a cover. The cover shall be vented and arranged to permit servicing and normal operation of the valve.

g) All covers, caps, and/or plugs utilized for shipping or transport shall be removed prior to installation or being placed in service.

h) Any wire or restraining device on lifting lever utilized for shipping or transport shall be removed prior to being placed in service.

2.4.1 PRESSURE RELIEF VALVE REQUIREMENTS – GENERAL

The following general requirements pertain to installing, mounting, and connecting pressure relief valves on heating boilers.

a) All covers, caps, and/or plugs utilized for shipping or transport shall be removed prior to installation or being placed in service.

b) Any wire or restraining device on lifting lever utilized for shipping or transport shall be removed prior to being placed in service.

ITEM 19-54 Proposal 1-14-20

PART 4, Paragraph S7.2

S7.2 PRESSURE RELIEF VALVES

f) Sealing

1) After completion of set pressure test, set pressure restoration (if applicable) and seat tightness testing, any seals removed by the T/O certificate holder for testing and/or adjustment shall be resealed in accordance with the original code of construction with a seal providing a means of identification of the organization performing the set pressure test.

ITEM 19-70 Proposal 10-3-19

Part 4

2.6.3 LOCATION

Pressure relief devices, except those covered by NBIC Part 4, 2.~~1~~ 2 through 2.~~24~~, may be installed at any location in the system provided the pressure in any portion of the system cannot exceed the maximum overpressure permitted by the original code of construction. Pressure drop to the pressure relief device under flowing conditions shall be considered when determining pressure relief device location. The pressure-relief device shall not be isolated from the piping system except as permitted by 2.6.6 e).

Item 19-72
Proposal
01-14-2020

4.6.2 OWNER-USER ASME CODE SECTION VIII STEAM TESTING

When ASME Code Section VIII valves are repaired by the owner for the owner's own use, valves for steam service may be tested on air for set pressure and, if possible, blowdown adjustment, provided the valve manufacturer's corrections for differential in set pressure between steam and air are applied to determine the ~~set~~ test pressure as follows.

The test pressure using air as the test medium shall be the product of the Manufacturer's correction factor for the differential between steam and air multiplied by the set pressure. If a cold differential test pressure is applicable due to superimposed back pressure and/or service temperature, then the manufacturer's correction factor shall be applied to the cold differential test pressure. The test pressure shall be recorded on the valve repair document described in 4.8.5.4 i).

The correction factor between steam and air shall not be included in the cold differential test pressure marked on the valve repair nameplate per 4.7.2 b) 8).

4.7.2 REPAIR NAMEPLATE

When a pressure relief valve is repaired, a metal repair nameplate stamped with the information required below shall be securely attached to the valve adjacent to the original manufacturer's stamping or nameplate. If not installed directly on the valve, the nameplate shall be securely attached to the valve independent of the external adjustment seals in a manner that does not interfere with valve operation and sealed in accordance with the quality system.

a) Prior to attachment of the repair nameplate, the previous repair nameplate, if applicable, shall be removed from the repaired valve.

b) As a minimum, the information on the valve repair nameplate (see Figure 4.7.2-a) shall include:
   1) The name of the repair organization preceded by the words "repaired by";
   2) The "VR" repair symbol stamp and the "VR" certificate number;
   3) Unique identifier (e.g., repair serial number, shop order number, etc.);
   4) Date of repair;
   5) Set pressure;
   6) Capacity and capacity units (if changed from original nameplate due to set pressure or service fluid change);
   7) Type/Model number (if changed from original nameplate by a conversion. See 4.2); and
   8) When an adjustment is made to correct for service conditions of superimposed back pressure and/ or temperature ~~or the differential between popping pressure between steam and air (see 4.6.2)~~, the information on the valve repair nameplate shall include the:
      a. Cold Differential Test Pressure (CDTP); and
      b. Superimposed Back Pressure (BP) (only when applicable).

Item 19-75: Part 4, 2.2.2

Proposed Changes to Part 4:
2.2.2 NUMBER
At least one National Board capacity certified pressure relief valve shall be installed on the boiler. If the boiler has more than 500 ft2 (4~~76~~ m2) of bare tube water heating surface, or if an electric boiler has a power input of more than 3.76 million BTU/hr (1100 kW), two or more National Board capacity certified pressure relief valves shall be installed. For a boiler with combined bare tube and extended water-heating surface exceeding 500 ft2 (47 m2), two or more pressure relief valves are required only if the maximum designed steaming capacity of the boiler exceeds 4,000 lb/hr (1 800 kg/h).

Proposed Part 1 changes are shown in red. Previously approved change to Part 1 under 19-51 is shown highlighted.

2.9.1.1 NUMBER
At least one National Board capacity certified pressure relief valve shall be installed on the boiler. If the boiler has more than 500 ft2. (~~46.5~~47 m2) of bare tube water heating surface, or if an electric boiler has a power input of more than 3.76 million Btu/hr (1,100 kW), two or more National Board capacity certified pressure relief valves shall be installed. For a boiler with combined bare tube and extended water-heating surface exceeding 500 ft2 (47 m2), two or more pressure relief valves are required only if the maximum designed steaming capacity of the boiler exceeds 4,000 lb/hr (1 800 kg/h).

Explanation of Need: Item 19-51 makes this proposed change to Part 1, 2.9.1.1, but the proposal never included changes to the duplicate section in Part 4. This item will ensure that the approved language for Part 1 gets reflected in Part 4. Also corrected conversion to be consistent with what is in ASME and add reference to bare tube water for heating surface.

Background: There is a discrepancy between ASME Section I, PG-67.1, NBIC Part 1, 2.9.1.1, and NBIC Part 4, 2.2.2. ASME requires 2 or more safety valves if over 500 sq. ft. If there is combined bare tube and extended heating surface exceeding 500 sq. ft., 2 or more safety valves are required only if the boiler exceeds 4000 lbs./hr. NBIC requires 2 or more safety valves if over 500 sq. ft. It does not make allowances for extended heating surface and generating capacity up to 4000 lbs./hr.

ITEM 19-76 Proposal 11-7-19

PART 4

3.3.3.4 OUTLINE OF REQUIREMENTS FOR A QUALITY SYSTEM

p) Records Retention

The quality manual shall describe a system for filing, maintaining, and easily retrieving records supporting or substantiating the administration of the Quality System within the scope of the "~~VR~~T/O" *Certificate of Authorization*. The record retention schedule described in the Quality System Manual is to follow the instructions identified in Table 3.3.3.4 p).

NB16-0102

Action Item Request Form

2019 Main Committee Letter Ballot Comments:

Committee Member:	Joel Amato	**Vote Date:**	2019-07-31	**Vote:**	Disapproved	**Uploads:**	
Member Comment:	I disapprove this ballot because I believe the operational test on the completed installation must be witnessed by an inspector.						

Committee Member:	James Pillow	**Vote Date:**	2019-07-31	**Vote:**	Abstention	**Uploads:**	
Member Comment:	I'm sure that those that heard the discussions on this item are not confused, but 1.6.10c) is confusing to me. What boiler/PV component pressure test is not documented on the MDR when 1.6.10a) requires a pressure test of the COMPLETED boiler/PV?						

8.2 CODE REVISIONS OR ADDITIONS

Request for Code revisions or additions shall provide the following:

Existing Text:

2.10.2 PRESSURE TEST

Prior to initial operation, the completed boiler, including pressure piping, water columns, superheaters, economizers, stop valves, etc., shall be pressure tested in accordance with the original code of construction. Any pressure piping and fittings such as water columns, blowoff valves, feedwater regulators, superheaters, economizers, stop valves, etc., which are shipped connected to the boiler as a unit, shall be hydrostatically tested with the boiler and witnessed by an Inspector.

2.10.4 SYSTEM TESTING

Prior to final acceptance, an operational test shall be performed on the complete installation. The test data shall be recorded and the data made available to the jurisdictional authorities as evidence that the installation complies with the provisions of the governing code(s) of construction. This operational test may be used as the final acceptance of the unit.

3.10.1 PRESSURE TEST

Prior to initial operation, the completed boiler, individual module, or assembled module, shall be subjected to a pressure test in accordance with the requirements of the original code of construction.

4.6 TESTING AND ACCEPTANCE

a) The installer shall exercise care during installation to prevent loose weld material, welding rods, small tools, and miscellaneous scrap metal from getting into the vessel. The installer shall inspect the interior of the vessel and its appurtenances where possible prior to making the final closures for the presence of foreign debris.

b) The completed pressure vessel shall be pressure tested in the shop or in the field in accordance with the original code of construction. When required by the Jurisdiction, owner or user, the Inspector shall witness the pressure test of the completed installation, including piping to the pressure gage, pressure relief device, and, if present, level control devices.

4.7.6 TESTING AND ACCEPTANCE

Testing and acceptance shall be in accordance with NBIC Part 1, 4.6

NB16-0102

b) Statement of Need

NB10-1201 Covered reformatting multiple items. Pressure Testing was inconsistent between the three sections and really needs to be addressed

c) Background Information

Consolidation of Testing and Final Acceptance to Section 1 General.

Proposed Wording:

1.6.10 TESTING AND FINAL ACCEPTANCE

~~Boilers, heaters, or pressure vessels may not be placed into service until its installation has been inspected and accepted by the appropriate jurisdictional authorities.~~

a) The completed boiler/ pressure vessel shall be pressure tested in the shop and/or in the field in accordance with the original code of construction and documented on the appropriate Manufacturer's Data Report.

b) The installer shall exercise care during installation to prevent loose weld material, welding rods, small tools, and miscellaneous scrap metal from getting into the vessel. Prior to making the final closure the installer shall inspect the interior of the vessel and its appurtenances for the presence of foreign debris, if present it shall be removed.

c) Subject to the jurisdictional requirements, a leak test may be performed on any components whose pressure test is not documented under the items' Manufacturer's Data Report. This leak test should not exceed 90% of the lowest pressure relief device setpoint. The test data shall be recorded, and the data made available as required.

d) Prior to final acceptance, an operational test shall be performed on the completed installation. The test shall include operating controls, limit controls and safety devices and witnessed as required by the Jurisdiction. The test data shall be recorded, and the data made available to the Jurisdictional Authorities as evidence that the installation complies with provisions of the governing code(s) of construction.

2.10.2 PRESSURE TEST

See NBIC Part 1, Section 1.6.10, *TESTING AND FINAL ACCEPTANCE*

~~Prior to initial operation, the completed boiler, including pressure piping, water columns, superheaters, economizers, stop valves, etc., shall be pressure tested in accordance with the original code of construction. Any pressure piping and fittings such as water columns, blowoff valves, feedwater regulators, superheaters, economizers, stop valves, etc., which are shipped connected to the boiler as a unit, shall be hydrostatically tested with the boiler and witnessed by an Inspector.~~

2.10.4 SYSTEM TESTING

See NBIC Part 1, Section 1.6.10, *TESTING AND FINAL ACCEPTANCE*

~~Prior to final acceptance, an operational test shall be performed on the complete installation. The test data shall be recorded and the data made available to the jurisdictional authorities as evidence that the installation complies with the provisions of the governing code(s) of construction. This operational test may be used as the final acceptance of the unit.~~

3.10.1 PRESSURE TEST

See NBIC Part 1, Section 1.6.10, *TESTING AND FINAL ACCEPTANCE*

~~Prior to initial operation, the completed boiler, individual module, or assembled module, shall be subjected to a pressure test in accordance with the requirements of the original code of construction.~~

4.6 TESTING AND ACCEPTANCE

See NBIC Part 1, Section 1.6.10, *TESTING AND FINAL ACCEPTANCE*

~~a) The installer shall exercise care during installation to prevent loose weld material, welding rods, small tools, and miscellaneous scrap metal from getting into the vessel. The installer shall inspect the interior of the vessel and its appurtenances where possible prior to making the final closures for the presence of foreign debris.~~

~~b) The completed pressure vessel shall be pressure tested in the shop or in the field in accordance with the original code of construction. When required by the Jurisdiction, owner or user, the Inspector shall witness the pressure test of the completed installation, including piping to the pressure gage, pressure relief device, and, if present, level control devices.~~

4.7.6 TESTING AND ACCEPTANCE

See NBIC Part 1, Section 1.6.10, *TESTING AND FINAL ACCEPTANCE*

~~Testing and acceptance shall be in accordance with NBIC Part 1, 4.6~~

NB16-0102

Old wording that has been submitted as a letter ballot to the MC:

a) The completed boiler/ pressure vessel shall be pressure tested in the shop and/or in the field in accordance with the original code of construction.

b) The installer shall exercise care during installation to prevent loose weld material, welding rods, small tools, and miscellaneous scrap metal from getting into the vessel. Prior to making the final closure. The installer shall inspect the interior of the vessel and its appurtenances where possible prior to making the final closures for the presence of foreign debris.

c) Subject to the jurisdictional requirements, Prior to final acceptance, an operational pressure test, with the approval of the jurisdiction if required, shall may be performed on any components whose pressure test is not documented under the items' Manufacturer's Data Report. This pressure test should not exceed 90% of the lowest pressure relief device setpoint. The test data shall be recorded and the data made available as required. This operational test may be used as the final acceptance of the unit.

Comments for Ballot: NB16-01-02	
Welch,Paul voted: Approve 10/19/2016 1:50:39 PM	I recommend approval with a minor change to the proposed wording in para b. second sentence to read: Prior to final acceptance, an operational test, with the approval of the Jurisdiction, shall be performed...
Pillow,James voted: Approve 10/6/2016 8:00:39 AM	I approve the proposal, but suggest a minor editorial change in last sentence of first paragraph as follows. Prior to making the final closures, the installer shall inspect the interior of the vessel and its appurtenances where possible for the presence of foreign debris.
Webb,Michael voted: Disapprove 10/5/2016 3:01:27 PM	At this time, I will vote to "disapprove" this item. My understanding of this action item was to; generally consolidate the pressure testing requirements of the various Part 1, Sections into a more general practice to be described in Part 1, Section 1-General Guidelines. In my read whether intended or my misunderstanding, the product of the SC-Installation effort may have offered the ASME code-required pressure testing to be circumvented as presented in the SC-proposed paragraph "b)". To add, I would propose for consideration the item as presented in the attachment or otherwise presented be inserted as: Part 1, Section 1, 1.4.1 b) with the current 1.4.1 b) re-introduced to become 1.4.1 c). As a note to the attachment: the text in red represents the text implying the operational test may satisfy final acceptance of the unit.–M. Webb, 10-5-16 Reference Document: NB16-0102-letter ballot Part 1 Section 1 G. Guidelines proposed 1.4.1. b. 10-5-16.pdf
Troutt,Robby voted: Disapprove 10/5/2016 8:09:44 AM	My disapproval is based on the lack of reference to a jurisdictional inspection prior to the operational test in paragraph (b). Some jurisdictions do not allow an operational test prior to the initial inspection.
Sekely,Jim voted: Approve 10/3/2016 1:07:21 PM	1.?? b): Change who's to whose

Action Item Request Form

Item Number:	18-2 E. Wiggins 1-10-18
General Description:	Add verbiage regarding commissioning fired boilers & fired pressure vessels with a calibrated combustion analyzer.
Subgroup:	SG Installation

Statement of Need

Task Group: E. Wiggins (PM), D. Patten, P. Schuelke, M. Wadkinson

With the addition of requiring Carbon Monoxide (CO) detector(s) / alarm(s) the concern that the combustion equipment needs to be commissioned and potentially maintained of air/fuel ratios to meet emission requirements / limits of the manufacturer and as imposed by EPA, Area Air Quality Management District and Jurisdiction, as required.

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.

Task Group Notes:

7-17-18 TG – (EW, DP, MW, GH, Matt Downs & Bryan Ahee) reviewed the action item and following verbiage is going to be proposed:

~~1.X.X or~~ Part of 1.6.~~9~~ 10.x Testing and Final Acceptance

All fuel fired equipment combustion air / fuel ratios shall be adjusted and values documented during commissioning to meet emission requirements / limits of the manufacturer and Jurisdiction, as required.

Item 19-77: Request for Revision to NBIC Part 1, 1.4.5.1.1 6), 10), and 20)

Purpose	Cast aluminum boilers have been incorporated in ASME Section IV for a number of years now and it's time they be recognized in the NBIC.
Scope:	Part: Installation; Section: 1 ; Paragraph: 1.4.5.1.1 items 6, 10 and 20
Background:	The installation report and guide were developed prior to cast aluminum boilers becoming an official part of ASME Section IV. It's suggested the guide item numbers and associated areas of the installation report be revised to incorporate cast aluminum boilers.
Proposed Revision:	See below for the proposed revision.

1.4.5.1.1 GUIDE FOR COMPLETING NATIONAL BOARD BOILER INSTALLATION REPORT

1) INSTALLATION: Indicate the type and date of installation — new, reinstalled, or second hand.

2) INSTALLER: Enter the installer's name and physical address.

3) OWNER-USER: Enter the name and mailing address of the owner-user of the boiler.

4) OBJECT LOCATION: Enter the name of the company or business and physical address where the installation was made.

5) JURISDICTION NO.: Enter the Jurisdiction number if assigned at the time of installation.

6) NATIONAL BOARD NO.: Enter the assigned National Board number.
Note:
Cast-~~iron~~ boilers do not require National Board registration.

7) MANUFACTURER: Enter the boiler manufacturer's name.

8) MFG. SERIAL NO.: Enter the assigned boiler manufacturer's serial number.

9) YEAR BUILT: Enter the year the boiler was manufactured.

10) BOILER TYPE: Enter the type of boiler, e.g., watertube, firetube, cast ~~iron~~, electric, etc.

11) BOILER USE: Enter the service for which or for how the boiler will be used, e.g., heating (steam or water), potable water, etc.

12) FUEL: Enter the type of fuel, e.g., natural gas, diesel, wood, etc. If more than one fuel type, enter the types for which the boiler is equipped.

13) METHOD OF FIRING: Enter the method of firing, e.g., automatic, hand, stoker, etc.

14) Btu/KW INPUT: Enter the Btu/hr or kW input of the boiler.

15) Btu/KW OUTPUT: Enter the Btu/hr or kW output of the boiler.

16) OPERATING PSI: Enter the allowed operating pressure.

17) ASME CODE STAMP(S): Check the ASME Code stamp shown on the code nameplate or stamping of other certification mark (specify).

18) STAMPED MAWP: Enter the maximum allowable working pressure shown on the nameplate or stamping.

19) HEATING SURFACE SQ. FT.: Enter the boiler heating surface shown on the stamping or nameplate.
Note:
This entry is not required for electric boilers.

20) CAST BOILER ~~IRON~~: Enter the total number of sections for cast ~~iron~~ boilers.
Note:
Not all cast boilers are sectional. Mono-block cast boilers should be described as having one (1) section.

Item 19-80

Subject: Conflicting statements in Part 1 and Part 2 about boiler controls

NBIC Location: Part 2, 2.2.10.6 l) 1)

Explanation of Need: Requirements in this section need to be consistent with Part 1, 2.8.4 a) to avoid confusion.

Background Information:
2.8.4 PRESSURE CONTROL (From NBIC Part 1)
Each automatically fired steam boiler shall be protected from overpressure by two pressure operated controls.
a) Each individual steam boiler or each system of commonly connected steam boilers shall have a control that will cut off the fuel supply when the steam pressure reaches an operating limit, which shall be less than the maximum allowable working pressure.

2.2.10.6 CONTROLS (From NBIC Part 2)
l) Check that the following controls/devices are provided:
1) Each automatically fired steam boiler is protected from overpressure by not less than two pressure operated controls, one of which may be an operating control.

Proposed Revision:
l) Check that the following controls/devices are provided:

1) Each automatically fired steam boiler is protected from overpressure by not less than two pressure operated controls~~, one of which may be an operating control.~~.

When required by the code of construction or the jurisdiction, the high pressure limit control shall be of the manual reset type.

2) Each automatically fired hot-water boiler or hot-water boiler system is protected from over-temperature by not less than two temperature operating controls, one of which may be an operating control.

When required by the code of construction or the jurisdiction, the high temperature limit control shall be of the manual reset type.

3) Each hot-water boiler is fitted with a thermometer that will at all times, indicate the water temperature at or near the boiler outlet.

SUPPLEMENT 10
INSPECTION OF STATIONARY HIGH-PRESSURE (3,000-15,000 psi) (21-103 MPa) COMPOSITE PRESSURE VESSELS

S10.1 SCOPE

This supplement provides specific requirements and guidelines for inspection of high-pressure composite pressure vessels, hereafter referred to as vessels. This supplement is applicable to pressure vessels with a design pressure that exceeds 3,000 psi (21 MPa) but not greater than 15,000 psi (103 MPa), and is applicable to the following four types of pressure vessels:

a) Metallic vessel with a hoop Fiber Reinforced Plastic (FRP) wrap over the cylindrical part of the vessel (both load sharing).

b) Fully wrapped FRP vessel with a non-load sharing metallic liner.

c) Fully wrapped FRP vessel with a non-load sharing non-metallic liner.

d) Fully wrapped FRP vessel with load sharing metallic liner.

This supplement is intended for inspection of ASME Section X, Class III, vessels and ASME Section VIII, Division 3, Composite Reinforced Pressure Vessels (CRPVs). However, it may be used for inspection of similar vessels manufactured to other construction codes with approval of the jurisdiction in which the vessels are installed.

S10.2 GENERAL

a) High-pressure composite vessels are used for the storage of fluids at pressures up to 15,000 psi (103 MPa). Composite vessels consist of the FRP laminate with load sharing or non-load sharing metallic shells/liners, or nonmetallic liners. The FRP laminate with load sharing metallic liners form the pressure retaining system. The FRP laminate is the pressure-retaining material for composite vessels with non-load sharing metallic and nonmetallic liners. The purpose of the non-load sharing metallic and the nonmetallic liners is to minimize the permeation of fluids through the vessel wall.

b) Fluids stored in vessels are considered to be non corrosive to the materials used for vessel construction. The laminate is susceptible to damage from:

   1) External chemical attack.

   2) External mechanical damage (i.e. abrasion, impact, cuts, dents, etc.).

   3) Structural damage (i.e. over pressurization, distortion, bulging, etc.).

   4) Environmental degradation [i.e. ultraviolet (if there is no pigmented coating or protective layer), ice, etc.].

   5) Fire or excessive heat.

S10.3 INSPECTOR QUALIFICATIONS

a) The ~~The~~ Inspector referenced in this supplement is a National Board Commissioned Inspector complying with the requirements of NB-263. RCI-1 *Rules for Commissioned Inspector*.

b) The inspector shall be familiar with vessel construction and qualified by training and experience as described in NBIC Part 2, S4.5 to conduct such inspections. The inspector shall have a thorough understanding of all required inspections, tests, test apparatus, inspection procedures, and inspection

techniques and equipment applicable to the types of vessels to be inspected. The inspector shall have basic knowledge of the vessel material types and properties. Refer to Part 2, S4.2 and S4.5

S10.4 INSPECTION FREQUENCY

a) Initial Inspection

The vessel shall be given an external visual examination by the Inspector or the Authority having jurisdiction where the vessel is installed and during the initial filling operation. The examination shall check for any damage during installation prior to initial filling and for any leaks or damage during and at the conclusion of filling.

b) Subsequent Filling Inspections

Before each refilling of the vessel, the manager of the facility shall visually examine the vessel exterior for damage or leaks. Refilling operations shall be suspended if any damage or leaks are detected and the vessel shall be emptied and subsequently inspected by the Inspector to determine if the vessel shall remain in service.

c) Periodic Inspection

Within 30 days of the anniversary of the initial operation of the vessel during each year of its service life, the vessel shall be externally examined by the Inspector or the Authority having jurisdiction where the vessel is installed. Internal inspections shall only be required if any of the conditions of S10.9 a) are met. These examinations are in addition to the periodic acoustic emission examination requirements of S10.5 c).

S10.5 INSERVICE INSPECTION

a) NBIC Part 2, Section 1, of this part shall apply to inspection of high-pressure vessels, except as modified herein. This supplement covers vessels, and is not intended to cover piping and ductwork, although some of the information in this supplement may be used for the inspection of piping and ductwork.

b) The inspection and testing for exposed load sharing metallic portions of vessels shall be in accordance with NBIC Part 2, Section 2.3.

c) All composite vessels shall have an initial acoustic emission examination per S10.10 ~~after the first three years from the date of manufacture. Thereafter, vessels shall have~~ at a maximum examination interval of five years which may be more frequent based on the results of any external inspection per S10.8 or internal inspections per S10.9.

All vessels shall be subject to the periodic inspection frequency given in S10.4.

S10.6 ASSESSMENT OF INSTALLATION

a) The visual examination of the vessel requires that all exposed surfaces of the vessel are examined to identify any degradation, defects, mechanical damage, or environmental damage on the surface of the vessel.

The causes of damage to vessels are:

1) abrasion damage;

2) cut damage;

3) impact damage;

4) structural damage;

5) chemical or environmental exposure damage or degradation; and

6) heat or fire damage.

The types of damage found are:

1) cracks;

2) discolored areas;

3) gouges and impact damage;

4) leaks;

5) fiber exposure;

6) blisters;

7) delaminations;

8) surface degradation; and

9) broken supports.

b) The visual examination of the vessel requires that the identity of the vessel shall be verified. This shall include the construction code (ASME) to which the vessel was constructed, vessel serial number, maximum allowable operating pressure, date of manufacture, vessel manufacturer, date of expiration of the service life of the vessel, and any other pertinent information shown on the vessel or available from vessel documents. The overall condition of the vessel shall be noted.

S10.7 VISUAL EXAMINATION

a) Acceptable Damage

Acceptable damage or degradation is minor, normally found in service, and considered to be cosmetic. This level of damage or degradation does not reduce the structural integrity of the vessel. This level of damage or degradation should not have any adverse effect on the continued safe use of the vessel. This level of damage or degradation does not require any repair to be performed at the time of in-service inspection. When there is an external, non load bearing, sacrificial layer of filaments on the vessel, any damage or degradation should be limited to this layer. Damage or degradation of the structural wall shall not exceed the limits specified in Tables S10.7-a or S10.7-b.

b) Rejectable Damage (Condemned—Not Repairable)

Rejectable damage or degradation is so severe that structural integrity of the vessel is sufficiently reduced so that the vessel is considered unfit for continued service and shall be condemned and removed from service. No repair is authorized for vessels with rejectable damage or degradation.

c) Acceptance Criteria for Repairable Damage

Certain, specific types of damage can be identified by the external in-service visual examination. Indications of certain types and sizes may not significantly reduce the structural integrity of the vessel and may be acceptable so the vessel can be left in service. Other types and larger sizes of damages may reduce the structural integrity of the vessel and the vessel shall be condemned and removed from service. Tables S10.7-a or S10.7-b are a summary of the acceptance/rejection criteria for the indications that are found by external examination of the vessel.

d) Fitness for service

1) If a visual examination reveals that a vessel does not meet all criteria of Table S10.7-a or S10.7-b satisfactorily, it shall be taken out of service immediately, and either be condemned or a fitness for service examination be conducted by the original vessel manufacturer or legal successor who must also hold a National Board "R" certificate. When the vessel is taken out of service, its contents shall be immediately safely vented or transferred to another storage vessel per the owner's written safety procedures.

2) If a fitness for service examination is to be conducted, the original vessel manufacturer shall be contacted as soon as possible after the rejectable defects have been found. The manufacturer shall then determine the vessel fitness-for-service by applicable techniques, (e.g., acoustic emission testing, ultrasonic testing, and/or other feasible methods). The manufacturer shall have documentation that the evaluation method(s) used is satisfactory for determining the condition of the vessel. Repairs to the outer protective layer may be made by a "R" certificate holder other than the original manufacturer following the original manufacturer's instructions.

3) Determination of fitness for service is restricted to original manufacturer or legal successor.

TABLE S10.7-a

VISUAL ACCEPTANCE/REJECTION CRITERIA FOR COMPOSITE PRESSURE VESSELS (U.S. CUSTOMARY UNITS)

Type of Degradation or Damage	Description of Degradation or Damage	Acceptable Level of Degradation or Damage	Rejectable Level of Degradation or Damage
Abrasion	Abrasion is damage to the filaments caused by wearing or rubbing of the surface by friction.	Less than 0.050 in. depth in the pressure bearing thickness.	≥ 0.050 in. depth in the pressure bearing thickness.
Cuts	Linear indications flaws caused by an impact with a sharp object.	Less than 0.050 in. depth in the pressure bearing thickness.	≥ 0.050 in. depth in the pressure bearing thickness.
Impact Damage	Damage to the vessel caused by striking the vessel with an object or by being dropped. This may be indicated by discoloration of the composite or broken filaments and/or cracking.	Slight damage that causes a frosted appearance or hairline cracking of the resin in the impact area.	Any permanent deformation of the vessel or damaged filaments.
Delamination	Lifting or separation of the filaments due to impact, a cut, or fabrication error.	Minor delamination of the exterior coating less than a depth of 0.050 in.	Any loose filament ends showing on the surface at a depth ≥ 0.050 in. Any bulging due to interior delaminations.
Heat or Fire Damage	Discoloration, charring or distortion of the composite due to temperatures beyond the curing temperature of the composite.	Merely soiled by soot or other debris, such that the cylinder can be washed with no residue.	Any evidence of thermal degradation or discoloration or distortion.
Structural Damage – bulging, distortion, depressions	Change in shape of the vessel due to severe impact or dropping.	None	Any visible distortion, bulging, or depression.

Type of Degradation or Damage	Description of Degradation or Damage	Acceptable Level of Degradation or Damage	Rejectable Level of Degradation or Damage
Chemical attack	Environmental exposure that causes a change in the composite or failure of the filaments.	Any attack that can be cleaned off and that leaves no residue or evidence of permanent damage.	Any permanent discoloration or loss or softening of material under the exterior coat.
Cracks	Sharp, linear indications	None	None
Scratches/Gouges	Sharp, linear indications caused by mechanical damage.	Less than 0.050 in. depth in the pressure bearing thickness No structural fibers cut or broken.	≥ 0.050 in. depth in the pressure bearing thickness or structural fibers cut or broken.
Soot	A deposit on the composite caused by thermal or environmental exposure.	Soot that washes off and leaves no residue.	Any permanent marking that will not wash off the surface under the exterior coating.
Over pressurization	Excessive pressure due to operational malfunction.	~~None reported~~ Pressure between MAWP and test pressure, with approval of the manufacturer	Any report of pressurization beyond the ~~MAWP~~ test pressure or any indication of distortion.
Corrosion	Degradation of the composite due to exposure to specific corrosive environments.	None visible in excess of manufacturer's specification	Any surface damage to structural material identified as corrosion beyond the manufacturer's specification. (See Note 2)
Dents	A depression in the exterior of the vessel caused by impact or dropping.	< 1/16 in. in depth	Any dents with a depth ≥ 1/16 in. Or with a diameter greater than 2 inches.
Reported collision, accident, or fire	Damage to the vessel caused by unanticipated excursion from normally expected operating conditions.	None reported	Any indication or report of impact or heat damage.
Environmental Damage or Weathering	Ultraviolet or other environmental attack under the exterior coating..	None	Any discoloration that can not be washed off. (See Note 2)
Damage to a protective or sacrificial layer	Abrasion, cuts, chemical attack, scratches/gouges, corrosion, environmental damage, or crazing that are limited only to the protective or sacrificial layer.	The depth of any damage to the protective or sacrificial layer that does not exceed the thickness of the protective or sacrificial layer plus 0.050 inch.	The depth of any damage to the protective or sacrificial layer that exceeds the thickness of the protective or sacrificial layer plus 0.050 inch.
Crazing	Hairline surface cracks only in the composite resin.	Light hairline cracks only in the resin.	Any damage to the filaments.

Note 1:

SUPPL. 10

Only damage beyond the sacrificial or coated layer should be considered, and that any damage to sacrificial or coated layers should be repaired by suitable techniques (i.e. epoxy filler). Refer to Manufacturer's Data Report for sacrificial layer thickness.

Note 2:

Washing off UV scale will accelerate attack into lower composite layers. For this reason, if there is superficial UV damage the affected area should be cleaned and painted with a UV tolerant paint. If broken, frayed, or separated fibers to the non sacrificial layer greater than a depth of 0.050 in., are discovered during the cleaning process then the vessel shall be condemned.

TABLE S10.7-b

VISUAL ACCEPTANCE/REJECTION CRITERIA FOR COMPOSITE PRESSURE VESSELS (SI UNITS)

Type of Degradation or Damage	Description of Degradation or Damage	Acceptable Level of Degradation or Damage	Rejectable Level of Degradation or Damage
Abrasion	Abrasion is damage to the filaments caused by wearing or rubbing of the surface by friction.	Less than 1.3 mm. depth in the pressure bearing thickness.	≥ 1.3 mm depth in the pressure bearing thickness.
Cuts	Linear indications flaws caused by an impact with a sharp object.	Less than 1.3 mm. depth in the pressure bearing thickness.	≥1.3 mm depth in the pressure bearing thickness.
Impact Damage	Damage to the vessel caused by striking the vessel with an object or by being dropped. This may be indicated by discoloration of the composite or broken filaments and/or cracking.	Slight damage that causes a frosted appearance or hairline cracking of the resin in the impact area.	Any permanent deformation of the vessel or damaged filaments.
Delamination	Lifting or separation of the filaments due to impact, a cut, or fabrication error.	Minor delamination of the exterior coating less than a depth of 1.3 mm.	Any loose filament ends showing on the surface at a depth ≥ 0.050 in. Any bulging due to interior delaminations.
Heat or Fire Damage	Discoloration, charring or distortion of the composite due to temperatures beyond the curing temperature of the composite.	Merely soiled by soot or other debris, such that the cylinder can be washed with no residue.	Any evidence of thermal degradation or discoloration or distortion.
Structural Damage – bulging, distortion, depressions	Change in shape of the vessel due to sever impact or dropping.	None	Any visible distortion, bulging, or depression.
Chemical attack	Environmental exposure that causes a change in the composite or failure of the filaments.	Any attack that can be cleaned off and that leaves no residue or evidence of permanent damage.	Any permanent discoloration or loss or softening of material under the exterior coat.
Cracks	Sharp, linear indications	None	None
Scratches/Gouges	Sharp, linear indications caused by mechanical damage.	Less than 1.3 mm depth in the pressure bearing thickness No structural fibers cut or broken.	≥ 1.3 mm depth in the pressure bearing thickness or structural fibers cut or broken.

Type of Degradation or Damage	Description of Degradation or Damage	Acceptable Level of Degradation or Damage	Rejectable Level of Degradation or Damage
Soot	A deposit on the composite caused by thermal or environmental exposure.	Soot that washes off and leaves no residue.	Any permanent marking that will not wash off the surface under the exterior coating.
Over pressurization	Excessive pressure due to operational malfunction.	~~None reported~~ Pressure between MAWP and test pressure, with approval of the manufacturer	Any report of pressurization beyond the ~~MAWP~~ Test Pressure or any indication of distortion.
Corrosion	Degradation of the composite due to exposure to specific corrosive environments.	None visible in excess of manufacturer's specification	Any surface damage to structural material identified as corrosion beyond the manufactuere's specificaton.
Dents	A depression in the exterior of the vessel caused by impact or dropping.	< 1.6 mm depth	Any dents with a depth ≥ 1.6 mm Or with a diameter greater than 51 mm.
Reported collision, accident, or fire	Damage to the vessel caused by unanticipated excursion from normally expected operating conditions.	None reported	Any indication or report of impact or heat damage.
Environmental Damage or Weathering	Ultraviolet or other environmental attack under the exterior coating.	None	Any discoloration that can not be washed off. (See Note 2)
Damage to a protective or sacrificial layer	Abrasion, cuts, chemical attack, scratches/gouges, corrosion, environmental damage, or crazing that are limited only to the protective or sacrificial layer.	The depth of any damage to the protective or sacrificial layer that does not exceed the thickness of the protective or sacrificial layer plus 1.3 mm.	The depth of any damage to the protective or sacrificial layer that exceeds the thickness of the protective or sacrificial layer plus1.3 mm.
Crazing	Hairline surface cracks only in the composite resin.	Light hairline cracks only in the resin.	Any damage to the filaments.

Note 1:

Only damage beyond the sacrificial or coated layer should be considered, and that any damage to sacrificial or coated layers should be repaired by suitable techniques (e.g., epoxy filler). Refer to Manufacturer's Data Report for sacrificial layer thickness.

Note 2:

Washing off UV scale will accelerate attack into lower composite layers.. For this reason, if there is superficial UV damage the affected area should be cleaned and painted with a UV tolerant paint. If broken, frayed, or separated fibers to the non sacrificial layer greater than a depth of 1.3 mm, are discovered during the cleaning process then the vessel shall be condemned.

S10.8 EXTERNAL INSPECTION

a) Vessel Service Life

Vessels have been designed and manufactured for a limited lifetime; this is indicated on the vessel

marking. This marking shall first be checked to ensure that such vessels are within their designated service lifetime.

b) Identification of External Damage

The external surface shall be inspected for damage to the laminate. Damage is classified into two levels as shown in Table S10.7-a or Table S10.7-b of this supplement. The acceptance/rejection criteria shown in Table S10.7-a or Table S10.7-b of this supplement shall be followed, as a minimum.

The external surface of the vessel is subject to mechanical, thermal, and environmental damage. The external surface of a vessel may show damage from impacts, gouging, abrasion, scratching, temperature excursions, etc. Areas of the surface that are exposed to sunlight may be degraded by ultraviolet light which results in change in the color of the surface and may make the fibers more visible. This discoloration does not indicate a loss in physical properties of the fibers. Overheating may also cause a change in color. The size (area or length and depth) and location of all external damage shall be noted. Vessel support structures and attachments shall be examined for damage such as cracks, deformation, or structural failure.

c) Types of External Damage

1) General

Several types of damage to the exterior of vessels have been identified. Examples of specific type of damage are described below. The acceptance/rejection criteria for each type of damage are described in Table S10.7-a or Table S10.7-b of this supplement.

2) Abrasion Damage

Abrasion damage is caused by grinding or rubbing away of the exterior of the vessel. Minor abrasion damage to the protective outer coating or paint will not reduce the structural integrity of the vessel. Abrasion that results in flat spots on the surface of the vessel may indicate loss of composite fiber overwrap thickness.

3) Damage from Cuts

Cuts or gouges are caused by contact with sharp objects in such a way as to cut into the composite overwrap, reducing its thickness at that point.

4) Impact Damage

Impact damage may appear as hairline cracks in the resin, delamination, or cuts of the composite fiber overwrap.

5) Delamination

Delamination is a separation of layers of fibers of the composite overwrap due to impact or excessive localized loading. It may also appear as a discoloration or a blister beneath the surface of the fiber.

Note: This does not apply to layers intentionally separated by the manufacturer.

6) Heat or Fire Damage

Heat or fire damage may be evident by discoloration, charring or burning of the composite fiber overwrap, labels, or paint. If there is any suspicion of damage, the vessel shall be qualified fit for service using an acoustic emission examination.

7) Structural Damage

Structural damage will be evidenced by bulging, distortion, or depressions on the surface of the vessel.

8) Chemical Attack

Some chemicals are known to cause damage to composite materials. Environmental exposure or direct contact with solvents, acids, bases, alcohols, and general corrosives can cause damage to vessels. Long-term contact with water can also contribute to corrosive damage, although may not be a problem by itself. Chemicals can dissolve, corrode, remove, or destroy vessel materials. Chemical attack can result in a significant loss of strength in the composite material. Chemical attack can appear as discoloration and in more extreme cases the composite overwrap can feel soft when touched. If there is any suspicion of damage, the vessel shall be re-qualified using acoustic emission examination.

S10.9 INTERNAL EXAMINATION

a) Requirements for Internal Visual Examination

Internal visual examination is normally not required. When vessels have been filled only with pure fluids, corrosion of the interior of the liner should not occur. Internal visual examination of the tanks shall only be carried out when:

1) There is evidence that any commodity except a pure fluid has been introduced into the tank. In particular, any evidence that water, moisture, compressor cleaning solvents, or other corrosive agents have been introduced into the vessel shall require an internal visual examination.

2) There is evidence of structural damage to the vessel, such as denting or bulging.

3) The vessel valve is removed for maintenance or other reason. Internal examination in this case is limited to examination of the threads and sealing surface. When an internal visual examination is conducted, the following procedures shall be followed.

b) Identification of Internal Damage

1) Vessels with Metallic Liners

For vessels with metallic liners, the objective of the internal visual examination is primarily to detect the presence of any corrosion or corrosion cracks.

The internal surface of the vessel shall be examined with adequate illumination to identify any degradation or defects present. Any foreign matter or corrosion products shall be removed from the interior of the vessel to facilitate inspection. Any chemical solutions used in the interior of the vessel shall be selected to ensure that they do not adversely affect the liner or composite overwrap materials. After cleaning the vessel shall be thoroughly dried before it is examined.

All interior surfaces of the vessel shall be examined for any color differences, stains, wetness, roughness, or cracks. The location of any degradation shall be noted.

Any vessel showing significant internal corrosion, dents or cracks shall be removed from service.

2) Vessels with Non-metallic Liners or No Liners

Vessels with non-metallic liners may show corrosion on the plastic liner or metal boss ends. Vessels with non-metallic liners or no liners may also show internal degradation in the form of cracks, pitting, exposed laminate, or porosity.

The internal surface of vessels shall be examined with adequate illumination to identify any degradation or defects present. Any foreign matter or corrosion products shall be removed from the interior of the vessel to facilitate examination. Chemical solutions used in the interior of the vessel shall be selected to ensure they do not adversely affect the liner or composite overwrap materials. After cleaning the vessel shall be thoroughly dried before it is examined.

c) The Inspector shall look for cracks, porosity, indentations, exposed fibers, blisters, and any other indication of degradation of the liner and/or laminate. Deterioration of the liner may include softening of the matrix or exposed fibers.

S10.10 ACOUSTIC EMISSION EXAMINATION

S10.10.1 USE AND TEST OBJECTIVES

All high-pressure composite pressure vessels shall be subject to an acoustic emission (AE) examination to detect damage that may occur while the vessel is in service. This method may be used in conjunction with the normal filling procedure.

S10.10.2 AE TECHNICIAN REQUIREMENTS

The acoustic emission technician conducting the examination required per S10.10.1 and in accordance with S10.10 shall be certified per the guidelines of ASNT SNT-TC-1A or CP-189 AE Level II or III. A technician performing this test shall have training in and experience with measuring C_e and C_f in composites and identifying wave modes.

S10.10.3 TEST PROCEDURE

AE transducers shall be acoustically coupled to the vessel under test and connected to waveform recording equipment. Waveforms shall be recorded and stored on digital media as the vessel is pressurized. All analysis shall be done on the waveforms. The waveforms of interest are the E (Extensional Mode) and F (Flexural Mode) plate waves.

Prior to pressurization, the velocities of the earliest arriving frequency in the E wave and the latest arriving frequency in the F wave shall be measured in the circumferential direction in order to characterize the material and set the sample time (the length of the wave window).

The E and F waves shall be digitized and stored for analysis. The test pressure shall be recorded simultaneously with the AE events. Permanent storage of the waveforms is required for the life of the vessel.

S10.10.4 EQUIPMENT

a) Testing System

A testing system shall consist of:

1) sensors;

2) preamplifiers;

3) high pass and low pass filters;

4) amplifier;

5) A/D (analog-to-digital) converters;

6) a computer program for the collection of data;

7) computer and monitor for the display of data; and

8) a computer program for analysis of data.

Examination of the waveforms event by event shall always be possible and the waveforms for each event shall correspond precisely with the pressure and time data during the test. The computer program shall be capable of detecting the first arrival channel. This is critical to the acceptance criteria below.

Sensors and recording equipment shall be checked for a current calibration sticker or a current certificate of calibration.

b) Sensor Calibration

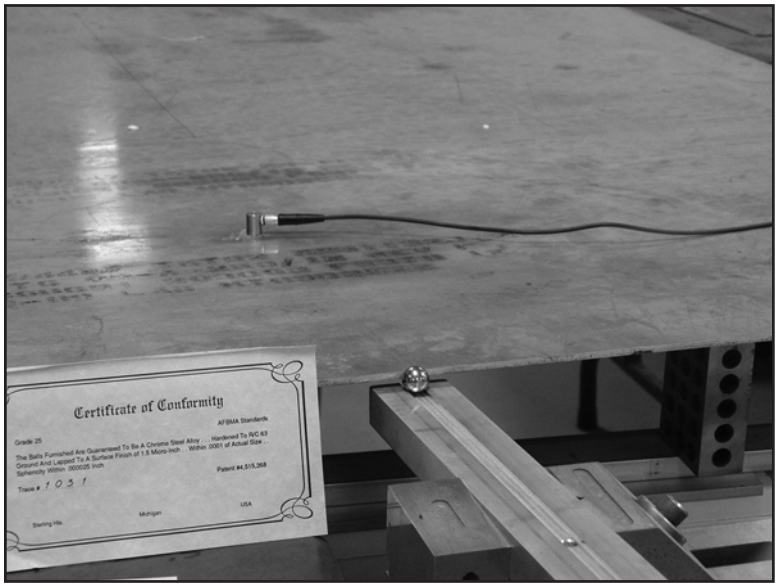
Sensors shall have a flat frequency response from 50 kHz to 400 kHz. Deviation from flat response (signal coloration) shall be corrected by using a sensitivity curve obtained with a Michelson interferometer calibration system similar to the apparatus used by NIST (National Institute for Standards and Technology). Sensors shall have a diameter no greater than 0.5 in. (13 mm) for the active part of the sensor face. The aperture effect shall be taken into account. Sensor sensitivity shall be at least 0.1 V/nm.

c) Scaling Fiber Break Energy

The wave energy shall be computed by the formula:

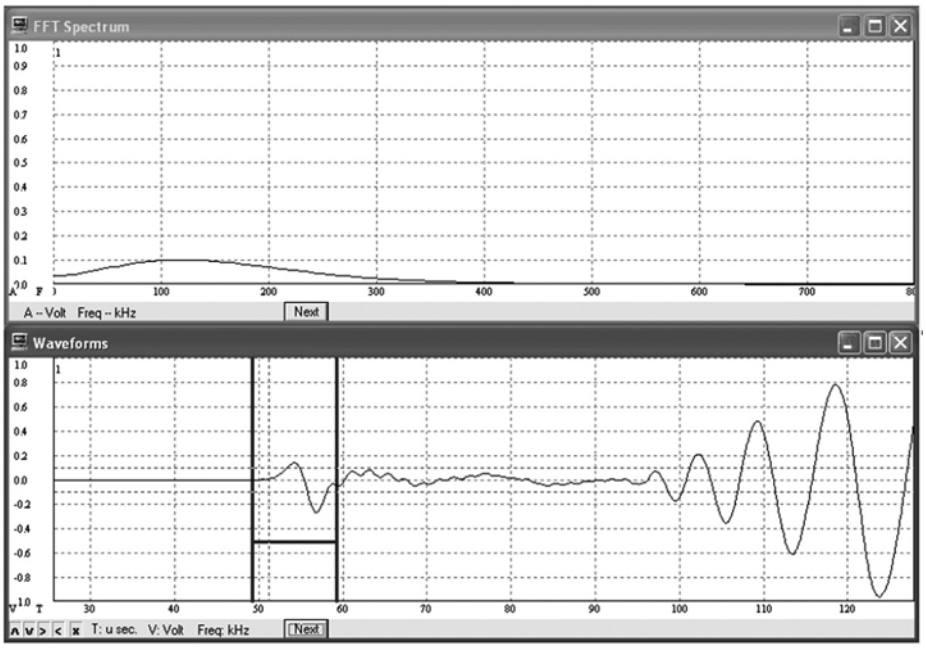
$$u = \int v^2 \, dt / z$$

FIGURE S10.10.4-a
ROLLING BALL IMPACT CALIBRATION SETUP



SUPPL. 10

FIGURE S10.10.4-b
FRONT END WAVEFORM



which is the formula for computing energy in the AE signal, where V is the voltage in volts (V) and Z is the input impedance in ohms (Ω). A rolling ball impactor shall be used to create an acoustical impulse in an aluminum plate. The measured energy in the wave shall be used to scale the fiber break energy. This scaling is illustrated later on.

The impact setup, an example of which is shown in Figure S10.10.4-a, shall be arranged as follows. The steel ball shall be ½ inch (13 mm) in diameter. The steel ball is a type typically used in machine shops for measuring taper and is commercially available. The ball shall be made of chrome steel alloy hardened to R/C 63, ground and lapped to a surface finish of 1.5 micro-inch (0.0000381 mm), within 0.0001 inch (0.0025 mm) of actual size and sphericity within 0.000025 inch (0.00064 mm). The plate shall be made of 7075 T6 aluminum, be at least 4 ft x 4 ft (1200 mm X 1200 mm) in size, the larger the better to avoid reflections, be 1/8 inch (3.2 mm) in thickness and be simply supported by steel blocks. The inclined plane shall be aluminum with a machined square groove 3/8 inch (9.5 mm) wide which supports the ball and guides it to the impact point. The top surface of the inclined plane shall be positioned next to the edge of the plate and stationed below the lower edge of the plate such that the ball impacts with equal parts of the ball projecting above and below the plane of the plate. A mechanical release mechanism shall be used to release the ball down the plane.

The ball roll length shall be 12 inch (305 mm) and the inclined plane angle shall be 6 degrees. The impact produces an impulse that propagates to sensors coupled to the surface of the plate 12 inches (305 mm) away from the edge. The sensors shall be coupled to the plate with vacuum grease. The energy of the leading edge of the impulse, known as the wave front, shall be measured. The vertical position of the ball impact point shall be adjusted gradually in order to “peak up” the acoustical signal, much as is done in ultrasonic testing where the angle is varied slightly to peak up the response. The center frequency of the first cycle of the E wave shall be confirmed as 125 kHz ± 10 kHz. See Figure S10.10.4-b. The energy value in joules of the first half cycle of the E wave shall be used to scale the fiber break energy in criterion 2, as illustrated there. This shall be an “end to end” calibration, meaning that the energy shall be measured using the complete AE instrumentation (sensor, cables, preamplifiers, amplifiers, filters and digitizer) that are to be used in the actual testing situation.

Front end of waveform created by rolling ball impact calibration setup described herein. Fast Fourier transform (FFT) shows center frequency of first cycle is approximately 125kHz. The energy linearity of the complete AE instrumentation (sensor, cables, preamplifiers, amplifiers, filters and digitizer) shall be measured by using different roll lengths of 8, 12 and 16 inches (203, 305, and 406 mm). The start of the E wave shall be from the first cycle of the waveform recognizable as the front end of the E wave to the end of the E wave which shall be taken as 10 microsecond (μs) later. (The time was calculated from the dispersion curves for the specified aluminum plate.) A linear regression shall be applied to the energy data and a goodness of fit $R^2 > 0.9$ shall be obtained.

d) Preamplifiers and Amplifiers - See ASME Section V, Article 11.

e) Filters

A high pass filter of 20 kHz shall be used. A low pass filter shall be applied to prevent digital aliasing that occurs if frequencies higher than the Nyquist frequency (half the sampling rate) are in the signal.

f) A/D

The sampling speed and memory depth (wave window length) are dictated by the test requirements and calculated as follows: Vessel length = L inches (meters). Use C_E = 0.2 in./μs (5080 m/s) and C_F = 0.05 in./μs (1270 m/s), the speeds of the first arriving frequency in the E wave and last arriving frequency in the F wave, respectively, as a guide. The actual dispersion curves for the material shall be used if available.

L / C_E = T1 μs. This is when the first part of the direct E wave will arrive.

L / C_F = T2 μs. This is when the last part of the direct F wave will arrive.

(T2 – T1) x.1.5 is the minimum waveform window time and allows for pretrigger time.

The recording shall be quiescent before front end of the E wave arrives. This is called a “clean front end”. Clean is defined in S10.10.6 b) 2) below.

The sampling rate, or sampling speed, shall be such that aliasing does not occur.

The recording system (consisting of all amplifiers, filters and digitizers beyond the sensor) shall be calibrated by using a 20 cycle long tone burst with 0.1 V amplitude at 100, 200, 300, and 400 kHz. The system shall display an energy of $uu = \frac{vv^{!}\,NNNN}{ZZZ}$ joules at each frequency, where V=0.1 volts, N = 20, Z is the preamplifier input impedance in ohms (Ω) and T is the period of the cycle in seconds (s).

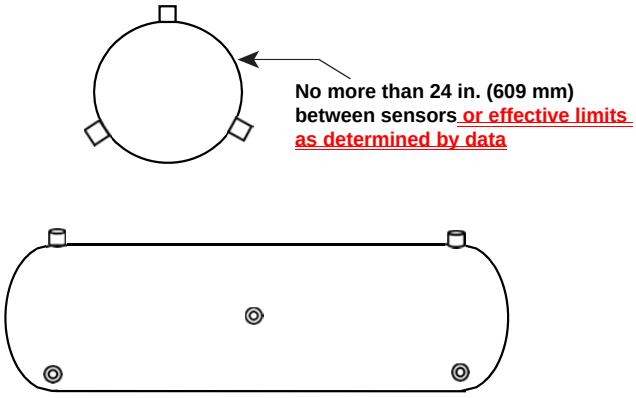
S10.10.5 SENSOR PLACEMENT

At least two sensors shall be used in any AE test regardless of vessel size so that electromagnetic interference (EMI) is easily detected by simultaneity of arrival. Sensors shall be placed at equal distances around the circumference of the vessel on the cylindrical portion of the vessel adjacent to the tangent point of the dome such that the distance between sensors does not exceed the greater of 24 in. (610 mm), or the effective sensing distance established by signal meaurement. Adjacent rings of sensors shall be offset by ½ a cycle. For example, if the first ring of sensors is placed at 0, 120, and 240 degrees, the second ring of sensors is placed at 60, 180, and 300 degrees. This pattern shall be continued along the vessel length at evenly spaced intervals, such intervals not to exceed the greater of 24 in. (610 mm), or the effective sensing distance established by signal measurement, until the other end of the vessel is reached. See Figure S10.10.4. The diameter referred to is the external diameter of a vessel.

Maximum distance between sensors in the axial and circumferential directions shall not exceed 24 inches (609 mm) unless it is demonstrated that the essential data can still be obtained using a greater distance and the authority having the jurisdiction concurs.

This spacing allows for capturing the higher frequency components of the acoustic emission impulses and high channel count wave recording systems are readily available.

FIGURE S10.10.5
SENSOR SPACING AND PATTERN



S10.10.6 TEST PROCEDURE

Couple sensors to vessel and connect to the testing equipment per ASME Section V Article 11. Connect pressure transducer to the recorder. Conduct sensor performance checks prior to test to verify proper operation and good coupling to the vessel. The E and F waveforms shall be observed by breaking pencil lead at approximately 8 in. (200 mm) and 16 in. (410 mm) from a sensor along the fiber direction. All calibration data shall be recorded.

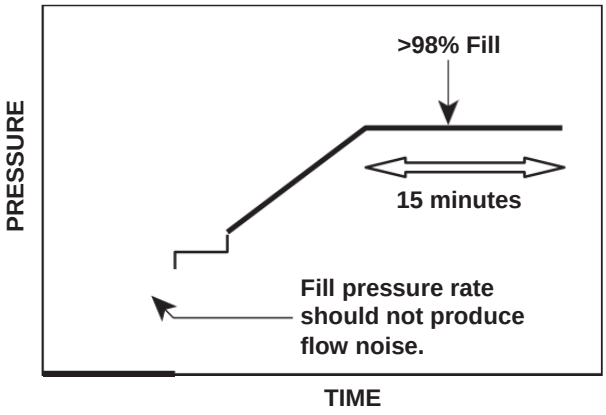
Recording threshold shall be 60 dB ref 1 μV at the transducer.

Performance checks shall be carried out by pencil lead breaks (Pentel 0.3 mm, 2H) six inches (150 mm) from each transducer in the axial direction of the cylinder and a break at the center of each group of four sensors.

Pressurize vessel to >98% of normal fill pressure and monitor AE during pressurization and for 15 minutes after fill pressure is reached. See Figure S10.10.5 for a schematic of the pressurization scheme. If at any time during fill the fill rate is too high in that it causes flow noise, decrease fill rate until flow noise disappears. Record events during pressurization and for 15 minutes after fill pressure is reached and save the data. Then conduct a post-test performance check and save data. Test temperature shall be between 50°F (10°C) and 120°F (49°C).

A threshold of 60 dBAE ref 1 μV at the sensor shall be used during all phases of testing.

FIGURE S10.10.6
TYPICAL PRESSURIZATION PLAN WHEN FILLING VESSELS



AE shall be monitored for 15 min after operating fill pressure is reached.

S10.10.7 ACCEPT/REJECT CRITERIA

a) Stability Criterion

Theory of AE Monitoring of high-pressure composite pressure vessels for stability– A stable vessel will exhibit cumulative curves with exponentially decaying curvature. The shape of the cumulative events curve is similar for pressure vessels made of fiberglass, aramid and carbon fiber that exhibit a fiber dominated failure mode. This is essentially a test that demonstrates the composite is not progressing to failure at the hold pressure.

b) Analysis Procedure

Data will include matrix splits, matrix cracks, fiber breaks, and matrix chirps due to fracture surface fretting, and fiber/matrix debonding. Extraneous noise, identified by waveform characteristics, may also be included in the data.

1) Filter data to eliminate any external noise such as electromagnetic interference (EMI), mechanical rubbing, flow noise, etc. Identify noise events by their shape, spectral characteristics, or other information known about the test such as a temporally associated disturbance due to the pressurization system or test fixturing. EMI is characterized by a lack of any mechanical wave propagation characteristics, particularly a lack of dispersion being apparent. EMI can be further identified by simultaneity of arrival on more than one channel. The two criteria shall be considered together to ensure it's not simply an event that happened to be centered between the sensors. Mechanical rubbing frequencies are usually very low and can be determined by experiment. There should be no flow noise. If the vessel, or a fitting, leaks, this will compromise the data as AE is very sensitive to leaks. Leak noise is characterized by waves that look uniform across the entire length of the waveform window. If a leak occurs during the load hold, the test must be redone. Flow noise is characterized by waves that fill the waveform window.

2) Use only events that have clean front ends and in which first arrival channel can be determined. Clean means having a pre-trigger energy of less than 0.01×10^{-10} joules. Energy is computed by the integral of the voltage squared over time.

3) Plot first arrival cumulative events versus time. Plots shall always show the pressure data.

4) Apply exponential fits by channel for pressure hold time and display both data and fit. The values are determined by the fit $y = ae^{Bt} + C$.

The B value is the shape factor of the cumulative curves. C is an intercept and A is a scale factor. The time t shall be equal intervals during the hold with events binned by time interval. Record exponents and goodness of fit (R^2). Plot energy decay curves. One third or one fourth of hold time shall be used for event energy binning (cumulative energy). The formula is $y = ae^{Bt}$.

The sequence of energy values must monotonically decrease.

This is similar to using other energy criteria, such as Historic Index. A sequence that is not properly decreasing will be indicated by a low R^2 value.

5) Save all plots (all channels) to report document.

6) Record exponents and R^2 values.

7) Vessel B Values

a. Vessel B values shall be tracked and compiled in order to develop a statistically significant database.

b. B is the critical value that measures the frequency of occurrence of events during pressure hold.

c. Not every vessel will have the exact same B value.

d. Data on B values should cluster.

S10.10.7.1 THE CRITERIA GIVEN BELOW APPLY TO EACH INDIVIDUAL SENSOR ON THE VESSEL

a) The stability criteria as described above shall be met. (Also see ASME Section X Mandatory Appendix 8.) Any vessel that does not meet the stability criteria must be removed from service. The criteria are:

1) Cumulative Event Decay Rate $-0.1 < B < -0.0001$, $R^2 \geq 0.80$

2) Cumulative Energy Decay Rate $-0.2 < B < -0.001$, $R^2 \geq 0.80$

If these criteria are not met, the vessel does not pass. The vessel may be retested. An AE Level III examiner must review the data from the initial testing and the subsequent loading test before the vessel can be passed. Retest loadings shall follow the original pressurization rates and pressures and use a threshold of 60 dBAE. If the vessel fails the criteria again, the vessel shall not be certified by the Inspector as meeting the provisions of this section.

b) Events that occur at the higher loads during pressurization having significant energy in the frequency band f > 300 kHz are due to fiber bundle, or partial bundle, breaks. These should not be present at operating pressure in a vessel that has been tested to a much higher pressures and is now operated at the much lower service pressure. For fiber bundles to break in the upper twenty percent of load during the test cycle or while holding at operating pressure, the vessel has a severe stress concentration and shall be removed from service.

S10.10.8 FIBER BREAKAGE CRITERION

a) Analysis Procedure

In order to determine if fiber bundle breakage has occurred during the filling operation the frequency

spectra of the direct E and F waves shall be examined and the energies in certain frequency ranges shall be computed as given below.

b) Definitions

Energies (U) in the ranges are defined as:

50 – 400 kHz: U_0

100 – 200 kHz: U_1

250 – 400 kHz: U_2

The criteria for determining if high frequency spectrum events have occurred is given by the following formulas:

$U_0/(UF_{BB)} \geq 10\%$

$U_2/(U_1 + U_2) \geq 15\%$

$U_2/U_0 \geq 10\%$

U_{FBB} is the energy of a fiber bundle break calculated using the average breaking strength from the manufacturer's data or independent test data. The manufacturer's data shall be used if available. The formula that shall be used for calculating average fiber break energy in joules (J) is

$$UU_{\blacksquare}\cdot\cdot = \frac{EE * AA * ll * \varepsilon\varepsilon^{\blacksquare}}{2}$$

where E is the Young's modulus of the fiber in pascals (Pa), ε is the strain to failure of the fiber, A is area of the fiber in square meters (m^2), and l is the ineffective fiber length in meters (m) for the fiber and matrix combination. If the ineffective length is not readily available, four times the fiber diameter shall be used. Set $U_{FBB} = 100 \times U_{FB}$, where U_{FB} has been calculated and scaled by the rolling ball impact energy as in the examples below. If these criteria are met, fiber bundle break damage has occurred during the test and the vessel shall be removed from service.

c) Example of Fiber Break Energy Calculation Suppose d = 7 μm, *E* = 69.6 GPa and ε = 0.01 (average breaking strain) for some carbon fiber. Using $A = \pi d^2/4$ and $l = 4d$,

$$UU_{\blacksquare}\cdot\cdot = \frac{EE * AA * ll * \varepsilon\varepsilon^{\blacksquare}}{2}$$

$$UU_{\blacksquare}\cdot\cdot = \frac{EE69.6 * 10^{\blacksquare} PPPP * \pi\pi * \frac{(7 * 10^{\blacksquare\blacksquare} mm)^{\blacksquare}}{4} * 28 * 10^{\blacksquare\blacksquare} mm * (0.01)^{\blacksquare}}{2}$$

$$UU_{\blacksquare}\cdot\cdot = 3.75 * 10^{\blacksquare\blacksquare} jj$$

d) Example of Scaling Calculation

Suppose that the rolling ball impact (RBI) acoustical energy measured by a particular high fidelity AE transducer is $U^{AE}_{RBI} = 5 \times 10^{-10}$ J and the impact energy $U_{RBI} = 1.9 \times 10^{-3}$ J (due to gravity). Suppose d = 7 μm, *E* = 69.6 GPa and ε = 0.01 (average breaking strain) for some carbon fiber. Using $A = \pi d^2/4$ and $l = 4d$, $U_{FB} = 3\text{x}10^{-8}$ J. A carbon fiber with a break energy of $U_{FB} = 3\text{x}10^{-8}$ J would correspond to a wave energy.

$$U^{AE}{}_{FB} = U_{FB} \times U_{AE_{RBI}} / U_{RBI}$$

$$U^{AE}{}_{FB} = 3\times10^{-8}\text{J} \times 5 \times 10^{-10}\text{ J} / 1.9 \times 10^{-3}\text{ J}$$

$$U^{AE}{}_{FB} = 7.9 \times 10^{-15}\text{ J}.$$

This is the number that is used to calculate the value of U_{FBB} that is used in the fiber break criterion in the second acceptance criterion and the energy acceptance criterion in the third criterion below.

e) Amplifier Gain Correction

All energies shall be corrected for gain. (20 dB gain increases apparent energy 100 times and 40 dB gain 10,000 times.)

Fiber break waves may look similar to matrix event waves in time space but in frequency space the difference is clear. A fiber break is a very fast source, while a matrix crack evolves much more slowly due to greater than ten to one difference in their tensile moduli. The speed of the fiber break produces the high frequencies, much higher than a matrix crack event can produce. Frequencies higher than 2 MHz have been observed in proximity to a fiber break, however these very high frequencies are attenuated rapidly as the wave propagates. Practically speaking, the observation of frequencies above 300 kHz, combined with certain other characteristics of the frequency spectrum and pressure level, is enough to confirm a fiber break. It should also be noted that it is fiber bundle breaks that are usually detected in structural testing and not the breaking of individual fibers. The energies of individual fiber breaks are very small, about 3×10^{-8} Joules for T-300 carbon fibers for example.

S10.10.9 FRICTION BETWEEN FRACTURE SURFACES

Friction between fracture surfaces plays a very important role in understanding AE in fatigue testing. It is an indicator of the presence of damage because it is produced by the frictional rubbing between existing and newly created fracture surfaces. Even the presence of fiber bundle breakage can be detected by examining the waveforms produced by frictional acoustic emission or FRAE. Increasing FRAE intensity throughout a pressure cycle means more and more damage has occurred.

Therefore, for a vessel to be acceptable no AE event shall have an energy greater than (F) x U_{FB} at anytime during the test. F is the acoustic emission allowance factor. The smaller the allowance factor, the more conservative the test. An F = 10^4 shall be used in this testing. It is the equivalent of three plus fiber tows, each tow consisting of 3,000 fibers, breaking simultaneously near a given transducer.

S10.10.10 BACKGROUND ENERGY

Background energy of any channel shall not exceed 10 times the quiescent background energy of that channel. After fill pressure is reached, any oscillation in background energy with a factor of two excursions between minima and maxima shows that the vessel is struggling to handle the pressure. Pressure shall be reduced immediately and the vessel removed from service.

S10.11 DOCUMENT RETENTION

a) The vessel owner shall retain a copy of the Manufacturer's Data Report for the life of the vessel.

b) After satisfactory completion of the periodic in-service inspection, vessels shall be permanently marked or labeled with date of the inspection, signature of the Inspector, and date of the next periodic in-service inspection.

c) The vessel owner shall retain a copy of the in-service inspection report for the life of the vessel.

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

S14.1 Scope

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

S14.2 General

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

b) Fatigue testing of out of life vessels is a crucial part of the life extension process. It is used to validate the mechanical behavior of the vessels and to develop the numerical values for the allowables in the MAE pass/fail criteria for the particular design, material and construction.

S 14.3 Life Extension Procedure

a) New vessel fatigue life testing data shall be obtained from the Manufacturer's Design Report (MDR) and the number of cycles in a lifetime shall be determined from the MDR. The type of vessel under consideration for life extension shall have been shown through testing to be capable of sustaining at least three lifetimes of cycles to developed fill pressure followed by a subsequent burst test at a pressure greater than minimum design burst pressure.

b) An evaluation of the service the vessel has seen should take into account any operational conditions that may have differed from those used in the design testing and analysis. Such conditions include for example exposure to more severe weather than expected, more cycles

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

c) Data and records for all vessels considered for life extension shall be kept and made readily available to inspectors or examination personnel. This includes an operating log, number of operating cycles since the previous examination, total number of operating cycles, examinations, examination techniques and results, maximum operating pressure and any unexpected pressures, temperatures, temperature cycles, damage events or other significant events that were outside the intended operating parameters or conditions.

d) A life extension test program shall be carried out for each type of vessel under consideration. Type of vessel means the particular manufacturer, materials (fiber and resin), water volume and design. If the type of vessel passes all requirements, then that type shall be eligible for life extension testing. If such a vessel passes the life extension MAE test its lifetime can be extended for one additional lifetime in five-year increments. In order to maintain life extension a vessel must be requalified every five years using the MAE test.

S14.4 Life Extension Test Program

a) The type of vessel under consideration for LE shall be noted. Manufacturer, place of manufacture and manufacturing date shall be recorded. The vessel dimensions shall be recorded. The specific fiber, matrix and winding pattern shall be recorded. If the fiber, matrix and winding pattern are not available from the manufacturer, then a vessel of the type under consideration shall be used to verify the winding pattern (hoop and helical angles and number of plies) through destructive testing.

b) Ten out-of-life vessels of the particular type shall be tested in the manner described herein. MAE techniques shall be applied to every vessel tested. Analysis of the MAE data is described herein. Two strain gages, one in the 0-degree and one in the 90-degree direction, shall be applied to every vessel pressure tested under this program. The purpose of strain gage data is to compute the 0 and 90 modulus values and to confirm that the modulus values of the material do not vary during the fatigue cycling required herein. Strain data shall be recorded and analyzed as described later on.

c) The LE test program proceeds by Steps. If the Step 1 is not successful, then there is no need to proceed to Step 2, and so forth.

S14.5 Life Extension Test Program Steps

S14.5.1 Step 1

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

a) No BEO greater than 2 times the quiescent energy (see Supplement 10) shall be observed up to test pressure or during pressure holds.

b) No fiber break event energy shall be greater than $24 \times 10^3 \times U_{FB}$ (see Supplement 10) during the second pressurization cycle.

c) No single event shall have an energy greater than $24 \times 10^5 \times U_{FB}$ during the second pressurization cycle.

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

d) At least two sensors shall remain on each vessel all the way to burst in order to establish the BEO pressure for this type of vessel.

e) Plots of stress versus strain shall show linear behavior up to 90% of burst pressure.

f) The burst pressures of all three vessels shall be greater than the minimum design burst pressure.

g) If the burst pressure of any one of the three vessels is not greater than the minimum design burst pressure, then these vessels shall not be eligible for life extension and there is no need to proceed with Step 2 below.

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

S14.5.2 Step 2

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

a) Prior to testing, the vessels shall be inspected for visible damage, i.e., cuts, scrapes, discolored areas, and the vessel appearance shall be documented with photographs.

b) Prior to fatigue testing, MAE testing as specified in Step 1 shall be done in conjunction with the fatigue testing, hereinafter called the MAE test or MAE testing, in order to determine the suitability of the vessels for fatigue testing, i.e., that they pass the MAE test.

c) Next, the vessels shall be subjected to fatigue cycles. Pressure shall be 100 psi +0, -50% to at least 1.05 x working pressure. Vessels shall survive one and one-half (1.5) additional lifetimes. If they survive then they shall be tested by an MAE test as was done prior to fatigue cycling.

d) Provided they pass the MAE test, they shall be burst tested. At least two sensors shall remain on each vessel all the way to burst in order to establish that the BEO (background energy oscillation) pressure for the fatigued vessels is consistent, i.e., is the same percentage of ultimate, with that of the vessels tested in Step 1.

e) Plots of stress versus strain shall show linear behavior up to 90% of burst pressure.

f) The burst pressures at the end of the fatigue testing shall be greater than or equal to the minimum design burst. If the burst pressure of any one of the three vessels is not greater than the minimum design burst pressure, then these vessels shall not be eligible for life extension.

S14.5.3 Step 3

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

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

b) Two vessels shall be subjected to an ISO 11119.2 drop test and then subjected to the MAE test.

If they pass the MAE test, then one vessel shall be burst tested. At least two sensors shall remain on the vessel all the way to burst in order to establish that the BEO (background energy oscillation) pressure for the fatigued vessels is consistent, i.e., is the same percentage of ultimate, with that of the vessels tested in Step 1.

c) Plots of stress versus strain shall show linear behavior up to 90% of burst pressure.

d) If the burst pressure is not greater than the minimum design burst pressure, then these vessels shall not be eligible for life extension.

e) If the first vessel passes the burst test, the other dropped vessel shall be fatigue cycled and subsequently subjected to the MAE test and, if it passes, shall be burst tested under the same conditions as before. If the vessel fails during fatigue cycling, i.e., bursts or leaks, then these vessels shall not be eligible for life extension.

f) If the modulus changes by more than 10%, then these vessels shall not be eligible for life extension. The strain gages should be mounted in a location that is away from the impact zone.

g) The burst pressure at the end of the fatigue testing of the dropped vessel shall be greater than or equal to the minimum design burst. The vessels shall have MAE testing applied during burst testing as before and the BEO shall be consistent with the previously established percent of burst ±10%.

S14.5.4 Step 4

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

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

b) Two vessels shall be subjected to an ISO 11119.2 cut test and then subjected to the MAE test. If they pass, then one shall be burst tested under all the conditions and procedures delineated in Step 2. If the burst pressure is not greater than the minimum design burst pressure, then these vessels shall not be eligible for life extension.

c) If the cut vessel passes, then the other cut vessel shall be fatigue cycled as described in Step 2 and subsequently subjected to the MAE test and then burst tested with at least two MAE sensors remaining on and monitoring the vessel as before. If it does not survive fatigue cycling, then these vessels shall not be eligible for life extension.

d) The burst pressure at the end of the fatigue testing of the cut vessel shall be greater than or equal to the minimum burst pressure specified by ISO 11119.2.

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

NB16-1402 background from PM Mike Gorman:

- The FRP subgroup asked me to developing this code due to my experience testing the fatigue life of the composite pressure vessels, known as SCBA (Self-Contained Breathing Apparatus) used by fire departments.
- All vessels tested had seen full service lives prior to testing for 2 additional lifetimes.
- Additional lifetime = 1,000 pressure cycles is equivalent to one year of service (a bit of overkill).
- *A testing protocol was developed in which MAE (Modal AE) was used to sort good from bad vessels.*
- *The protocol was eventually accepted by the US Dept. of Transportation (DOT) for life extension.*
- The NBIC draft code was presented to the FRP subgroup and reviewed line by line.
- Background data and analysis were also presented to the committee and submitted to NBIC for historical records.
- The FRP committee members approved the life extension code.

Action Item Request Form

CODE REVISIONS OR ADDITIONS

Request for Code revisions or additions shall provide the following:

a) Proposed Revisions or Additions

Item Number: 19-22.

b) Existing Text:

None

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

No existing text to instruct inspectors on rating return-flue (Scotch Marine) historical boilers. Add section S2.10.3.1 and table for constant values. Update S2.10.6 Nomenclature

c) Background Information

An extensive review of all code and pre-code equations has been made:

1.) ASME equations from 1914-1971 editions are simple but the steps to determine the choice of equations is complex in nature, and examples exist where engineers did not correctly interpret the steps or equations. Design criteria may not match construction on pre-code boilers, and construction may hide details needed for a field inspector to choose the appropriate equation. These equations typically grant the highest calculated MAWP which may or not be appropriate for pre-code boilers with unknown material or non-compliant designs.

2.) The Canadian Interprovincial Regulations define a set of simple equations, but do not consider tensile strength. These equations were first enforced in 1910, then deprecated in favour of ASME wording in the 1920's, presumably in efforts to harmonize aspects of the two standards.

49.—Internally Fired Furnaces or Parts of Boilers (other than Ordinary Fire Tubes) Subjected to Compression.

The furnace plates in plain circular internally fired furnaces, not exceeding 42 inches in diameter if not found sufficiently strong, must be stayed as flat surfaces, allowing in the calculations for such seventy-five per cent. (75%) of the value of the resistance to collapse, as found by the following formula, the pitch of the stays being computed by the rule for flat surfaces, but the pitch shall in no case exceed eight inches on the furnace plate. For furnaces over forty-two inches in diameter, no allowance for value of resistance to collapse shall be made. Care must be taken not to reduce the efficiency of the riveted joint when applying these stays.

$$B = \frac{C \times T^2}{(L_1 + 1)\,Dr}$$

Where—

Dr = Outside diameter of furnace in inches.

T = Thickness of plate in inches.

L_1 = Length of furnace in feet, or length between rings.

C = Constant according to the following circumstances:

B = Working pressure per square inch, which must not exceed that found by the limiting formula, as follows:

50

$$B = \frac{10000 \times T}{Dr}$$

Furnaces with butt joints and rivet holes punched small and reamed out in place.

112500 where the longitudinal seams are double riveted, and fitted with single butt straps.

100000 where the longitudinal seam is single riveted, and fitted with single butt strap.

112500 where the longitudinal seam is single riveted, and fitted with double butt straps, or where seam is welded.

Furnaces with lap joints and rivet holes punched small and reamed out in place.

96000 where the longitudinal seams are double riveted.

87500 where the longitudinal seams are single riveted.

3.) The British Board of Trade rule (circa 1880) is a precursor to the Canadian regulations. The equation is of the same form, but assumed different materials. It is only appropriate for wrought iron boilerplate. It is clear that this equation was heavily researched and heavily enforced because other formulas were "dangerously weak".

"Circular furnaces with the longitudinal joints welded or made with a butt strap:

$$\frac{\text{90,000} \times \text{the square of the thickness of the plate in inches.}}{(\text{Length in feet} + 1) \times \text{diameter in inches}} = \text{the working}$$

pressure per square inch, provided it does not exceed that found by the following formula:

$$\frac{\text{8,000} \times \text{thickness in inches}}{\text{diameter in inches.}} = \text{Working pressure per square inch.}$$

The second formula limits the crushing stress to 4000 lbs. per sectional square inch.

The length is to be measured between the rings if the furnace is made with rings.

If the longitudinal joints instead of being butted are lap jointed in the ordinary way then 70,000 is to be used instead of 90,000, excepting only where the lap is bevelled and so made as to give the flues the form of a true circle, when 80,000 may be used.

When the material or the workmanship is not of the best quality, the constants given above must be reduced, that is to say, the 90,000 will become 80,000; the 80,000 will become 70,000; the 70,000 will become 60,000; when tke material and the workmanship are not of the best quality, such constants will require to be further reduced, according to circumstances and the judgment of the surveyor, as in the case of old boilers. One of the conditions of best workmanship is that the joints are either

double rivetted with single butt straps, or single rivetted with double butt straps, and the holes drilled after the bending is done and when in place, and the plates afterwards taken apart, the burr on the holes taken off, and the holes slightly countersunk from the outside *

* The following examples will serve to show the application of the constants for the different cases that may arise:

Furnaces with butt joints and drilled rivet holes.	90,000 where the longitudinal seams are welded. 90,000 where the longitudinal seams are double rivetted and fitted with single butt straps. 80,000 where the longitudinal seams are single rivetted and fitted with single butt straps. 90,000 where the longitudinal seams are single rivetted and fitted with double butt straps.
Furnaces with butt joints and punched rivet holes.	85,000 where the longitudinal seams are double rivetted and fitted with single butt straps. 75,000 where the longitudinal seams are single rivetted and fitted with single butt straps. 85,000 where the longitudinal seams are single rivetted and fitted with double butt straps.
Furnaces with lapped joints and drilled rivet holes.	80,000 where the longitudinal seams are double rivetted and bevelled. 75,000 " " " " " " " and not bevelled. 70,000 " " " " " single " and bevelled. 65,000 " " " " " " and not bevelled.
Furnaces with lapped joints and punched rivet holes.	75,000 where the longitudinal seams are double rivetted and bevelled. 70,000 " " " " " " " and not bevelled. 65,000 " " " " " single " and bevelled. 60,000 " " " " " " " and not bevelled.

In the case of upright fire-boxes of donkey or similar boilers, 10 per cent. should be deducted from the constants given above, applicable to the respective classes of work.

4.) Lloyds Rule (circa 1870) is a precursor to the British Board of Trade rules, derived from research by Sir William Fairbairn. It was deemed incorrect by the British Board of Trade for determining collapsing pressure of large cylinders. For the firetube dimensions it was intended for, this equation applied a 4.5:1 factor of safety. Thus, this equation is not a suitable candidate.

5.) Modern ASME equations assume modern materials and welded construction. Compensation for the length of the tube is inappropriate for riveted construction.

6.) Other research and equations, generally from the mid 1800's through early 1900's, were investigated and documented but not evaluated because it is clear that the equations predate any current knowledge or definition of safety factors. Note that in the USA there was no known accepted standard equation for external pressures on cylindrical surfaces. In fact, one extensive study in 1896 did not provide any equation for USA boilers.

This proposal derives an equation based on the Canadian and British Board of Trade regulations. With both forms of the equation, it is possible to derive a new equation that requires material tensile strength. The calculated MAWP results are generally more conservative than ASME equations, which may be acceptable when ASME design criteria may not be met, and when thickness readings are based from sampling of deteriorated plate, not new construction with uncorroded, new, material.

S2.10.3.1 Cylindrical Components Under External Pressure

The MAWP of unstayed plain circular cylindrical components not exceeding 42 inches in diameter and under external pressure shall be determined by the strength of the weakest course computed from the minimum thickness of the plate, the tensile strength of the plate, the type of longitudinal joint, outside diameter of the weakest course, and the length of the firetube, using the following formulas:

$$P_1 = \frac{C_1 \times t^2 \times TS}{\left(\frac{f}{12} + 1\right) \times d_o}$$

$$P_2 = \frac{t \times TS}{C_2 \times d_o}$$

$$P = min(P_1, P_2)$$

C_1, C_2 = constants, see table

Constant Values		
C_1	**Longitudinal Joint**	
	1-row lap seam	1.85
	2-row lap seam	1.95
	1-row butt strap, single butt strap	2.1
	1-row butt strap, double butt strap	2.2
	2-row butt strap, single butt strap	2.2
	2-row butt strap, double butt strap	2.3
	Forge welded	2.3
C_2		5.0

Example 1: vertical boiler with an unstayed steel firebox with an outside diameter of 34 inches, height of 24 inches, thickness of 0.4 inches calculates as follows, 1-row lap seam is calculated as follows:

$$P_1 = \frac{1.85 \times 0.4^2 \times 55000}{\left(\frac{24}{12} + 1\right) \times 34} = 160\ PSI$$

$$P_2 = \frac{0.4 \times 55000}{5.0 \times 34} = 129\ PSI$$

$$P = min(160, 129) = 129\text{psi}$$

S2.10.6 NOMENCLATURE

p = maximum pitch measured (inches or mm) between straight lines, (horizontal, vertical, or inclined) passing through the centers of staybolts in different rows.

l = the pitch of stays in one row, passing through the center of staybolts, these lines may be horizontal, vertical, or inclined and measured in inches or mm.

w = the distance between two rows of staybolts, inches or mm.

h = the hypotenuse of a square or rectangle, defined as either $\sqrt{2p^2}$ or, $\sqrt{l^2 + w^2}$ inches or mm.

d = minimum diameter of corroded staybolt, inches or mm

R = inside radius of the weakest course of shell or drum, in inches or mm. TS= ultimate tensile strength of shell plates, psi (MPa)

t = minimum thickness of shell plate in the weakest course, inches or mm. P = calculated MAWP psi (MPa).

S = maximum allowable stress value, psi (MPa).

d_o = outside diameter of firetube; if tapered use the largest outside diameter
f = length of firetube, inches, measured between circumferential joints

C = 2.1 for welded stays or stays screwed through plates not over 7/16 in. (11 mm) in thickness with ends riveted over.

C = 2.2 for welded stays or stays screwed through plates over 7/16 in. (11 mm) in thickness with ends riveted over.

C = 2.5 for stays screwed through plates and fitted with single nuts outside of plate, or with inside and outside nuts, omitting washers.

C = 2.8 for stays with heads not less than 1.3 times the diameter of the stays screwed through plates, or made a taper fit and having the heads formed on the stays before installing them and not riveted over, said heads being made to have true bearing on the plate.

C = 3.2 for stays fitted with inside and outside nuts and outside washers where the diameter of washers is not less than 0.4p and thickness not less than t.

Note: The ends of stays fitted with nuts shall not be exposed to the direct radiant heat of the fire.

E = the efficiency of the longitudinal riveted joint.

See Table S2.10.6 for efficiencies (E), which are the average for the different types of riveted joints.

Item 19-78

Subject: Detailed Requirements for Inservice Inspection of Cast Iron Boilers.

NBIC Location: Part 2, 2.2.12.1 a)

Explanation of Need: The only reference to cast iron material in ASME Section I is PMB-5.4 that allows heads or parts of miniature boilers, when not exposed to direct action of the fire, may be made of cast iron or malleable iron provided it complies with a specification permitted by Section I. Heads and parts do not make up the complete boiler. ASME Section VIII Div. 1, UCI-2 states that cast iron boilers shall not be used in direct firing applications or in unfired steam boilers.

Background Information: The language to include "or high" pressure steam was added in the 2007Ed/2007Add of the NBIC Part 2. Unfortunately, there are no historical records or interpretations supporting the need for the revision in 2007. Both the 2004/2006 and 2007/2007 NBIC paragraphs have been provided for reference.

Proposed Revision:

2.2.12.1 CAST-IRON BOILERS

a) Cast-iron boilers are used in a variety of applications to produce low ~~or high~~ pressure steam and hot-water heat. Cast-iron boilers should only be used in applications that allow for nearly 100% return of condensate or water and are not typically used in process-type service. These boilers are designed to operate with minimum scale, mud, or sludge, which could occur if makeup water is added to this system.

Item 19-93
January 7, 2020
Part 2, 5.3.2

Proposed

5.3.2 FORMS

a) REPLACEMENT OF STAMPED DATA FORM (NB-136), see Pg. ~~82~~86

b) FORM NB-4 NEW BUSINESS OR DISCONTINUANCE OF BUSINESS, see Pg. ~~84~~88

c) FORM NB-5 BOILER OR PRESSURE VESSEL DATA REPORT, see Pg. ~~85~~89

d) FORM NB-6 BOILER-FIRED PRESSURE VESSELS REPORT OF INSPECTION, see Pg. ~~87~~91

e) FORM NB-7 PRESSURE VESSELS REPORT OF INSPECTION, see Pg. ~~88~~92

f) FORM NB-403 REPORT OF FITNESS FOR SERVICE ASSESSMENT, see Pg. ~~90~~94

ASME BPV Liaison Report

NBIC Standards Committee

January 16, 2020

ASME BPV Liaison Report

CA-1 Conformity Assessment Requirements

- *Ongoing work to recognize alternate methods of applying the ASME Mark, to identify Certificate numbers on Data Plates, and to incorporate Nuclear CA requirements*
- *Items approved for next edition: CAP-21 criteria for reapplication of the ASME Mark; CAP-22 criteria for use of additional AIAs; incorporation of AIA accreditation requirements (from QAI-1); clarification of permitted activities prior to issue of a Certificate of Authorization; and update of PRD and PRT program references*

Parts Fabrication Certificate

- *Program continues to gain participation; 73 certificates issued*
- *Planned transition for Scope Statements to include multiple Code Sections*
- *Proposal for PRT Designator to reference the Code Section of the part*

ASME BPV Liaison Report

QAI-1 Qualifications for Authorized Inspection

- *Work continues on a major reorganization of the QAI-1 Standard*
- *Proposal to incorporate QAI-1 Foreword Principles into the Standard has been dropped from further consideration*
- *Proposal to establish eye examination requirements for Inspectors*
- *Ongoing work to establish a QAI Conference Committee, with representation from each accredited AIA*
- *Proposal for AIA notification to ASME of unresolved Code or Program nonconformances*

Field Site Task Group

- *Field Site definition developed; accepted by CA-1 Committee*
- *Intermediate locations recognized via Temporary Location authorization letter; all code activities permitted except stamping and data reports*
- *Follow-up actions planned with BPV Book Sections*

ASME BPV Liaison Report

Additional Developments

- *Work continues on ASME Section XIII; 2021 publication planned in conjunction with construction book changes*
- *Work continues in resolution of revised scope for ASME VIII-1*
- *TOMC Task Group developing uniform AI/ANI inspection requirements, for incorporation in BPV Book Sections*
- *Resource Development Group being established for CA*
- *Rollout of redesigned ASME website and replacement of CA Connect*
- *Next ASME BPV Code meetings scheduled for February 2-7, 2020, in Las Vegas, NV*

Questions / Discussion

AWS Liaison Report
January, 2020

The following listed actions are currently in process within the American Welding Society.

- The B2 committee has agreed to systematically update all published SWPS's to bring them in line with the advancements realized by the Welding Community over the last 20 years or so. This effort is to include:
  - Deletion of the reference to "S" numbers recently deleted by ASME
  - Deleting the Metric Conversion Table opting to reference the actual metric equivalent adjacent to the listed Imperial value.
  - Adding a paragraph or so to address "Repairs".
  - Offering additional Tungsten Classifications (as applicable).
  - Updating and or deleting the Welding Symbols from Figure 1
  - Additional items as determined by the SWPS Sub Committee (correct typos, inadvertent omissions etc.)
  - Although minor word engineering may come into play, no change in philosophy or application will be permitted
- The NBIC needs to understand that these changes will not affect previous versions of the same SWPS. Those version are still very valid and readily useable and unless you have a specific need to replace them; I would not.
- The following SWPS's have been adopted by the AWS B2 committee and were balloted to this committee and adopted late last year under Item # 18-102.

B2.1-1-016: 2018	B2.1-1-019: 2018	B2.1-1-021: 2018	B2.1-1-023: 2018	B2.1-1-027:2018
B2.1-1-017: 2018	B2.1-1-020: 2018	B2.1-1-022: 2018	B2.1-1-026: 2018	

- This group of SWPS's have been adopted by the AWS B2 and are to be balloted to this committee under Item 20-4.

B2.1-1-201: 2019	B2.1-1-203: 2019	B2.1-1-205: 2019	B2.1-1-207: 2019	B2.1-1-209:2019
B2.1-1-202: 2019	B2.1-1-204: 2019	B2.1-1-206: 2019	B2.1-1-208: 2019	

The long-range plan for the updated SWPSs is to group them into an ANSI approved "Stabilized Maintenance Program" exempting them from the traditional ANSI 5/10-year re-affirmation balloting requirement. The plan was successfully balloted at the TAC and Standards Committee level in 2019.

The AWS Certification Committee recently developed an Endorsement to the CWI Program for the qualification of welders following the guidelines developed by the Certification Committee with Technical assistance from Walt Sperko and myself.

I have accepted a 3 year appointment to chair the B2D Sub-Committee (SWPS Committee) effective 1/1/2020

As in the past, as newly developed SWPS's are approved by the various committees, they will be offered to the NBIC for adoption.

Regards,

Jim Sekely