Date Distributed:

THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS

NATIONAL BOARD INSPECTION CODE COMMITTEE

AGENDA

Meeting of July 16th, 2020
Louisville, KY

The National Board of Boiler & Pressure Vessel Inspectors
1055 Crupper Avenue
Columbus, Ohio 43229-1183
Phone: (614)888-8320
FAX: (614)847-1828

1. **Call to Order**
   8:00 AM

2. **Introduction of Members and Visitors**

3. **Check for a Quorum**

4. **Awards/Special Recognition**

   Mr. Paul Edwards – 25 Years on Main Committee
   Mr. Brian Morelock – 5 Years on Main Committee
   Mr. Rob Troutt – 5 Years on Main Committee

5. **Announcements**

   Breakfast will be provided on the day of the meeting from 7:00 to 8:00AM at The English Grill on the 2nd Floor of the Brown Hotel. Lunch will be provided from 11:30AM to 12:30PM at The English Grill.

   This is the last meeting at which items can be approved for inclusion in the 2021 NBIC.

6. **Adoption of the Agenda**

7. **Approval of the Minutes of the January 16th, 2020 Meeting**

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

8. **Review of Rosters**

   a. **Membership Nominations**

      Subcommittee Members:

      - Mr. Joe Brockman – AIA
      - Mr. Brian Boseo – General Interest
        - Mr. Boseo had a recent employment change that affected his interest category. NBIC procedures require that he be re-nominated to his position on Subcommittee Repairs & Alterations.

   b. **Membership Reappointments**
      - Mr. Jim Sekely – Main Committee
      - Mr. Donnie LeSage – Subcommittee Inspection
      - Mr. James Roberts – Subcommittee Inspection
      - Mr. Jason Safarz – Subcommittee Inspection
      - Mr. Rick Sturm – Subcommittee Repairs & Alterations
      - Mr. Raymond McCaffrey – Subcommittee Pressure Relief Devices

c. Officer Positions

9. Items Approved for 2021 NBIC

See Attachment Page 1 for a full list of items approved for inclusion in the 2021 NBIC.

10. Report of Subcommittees

a. Subcommittee Pressure Relief Devices

i. Interpretations

Item Number: 20-19	**NBIC Location: Part 4, 3.3.3.4 & 4.8.5.4**	**Attachment page 3**

General Description: Purpose of NBIC Part 4, Sec. 4.8.5.4, n) 2) & 3.3.3.4, l) 2) system review

Task Group: None Assigned

Explanation of Need: There appears to be a difference of opinion among VR & T/O Certificate Holders regarding the intent of the "review of the system in order to maintain the manual current with these rules and the applicable sections of the ASME Code." If I am wrong about my interpretation, I want to know. Thank you.
NOTE: the reference to NBIC in 3.3.3.4, l) 2) at the end of the sentence should be deleted. It is held over from NB-528 and therefore superfluous.

July 2020 Meeting Action:

ii. Action Items – Old Business

Item Number: NB12-0901	**NBIC Location: Part 4**	**Attachment Page 4**

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, J. Wolf **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, J. Simms, C. Beair **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 11
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: 17-115	NBIC Location: Part 4, Section 2	Attachment Page 19
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 37

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: 18-73	NBIC Location: Part 4, 2.3 and Part 1, S5.7.6	Attachment Page 38

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 45

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	Attachment Page 50

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	Attachment Page 51

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: 19-37	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: 19-71	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: 19-83	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.

iii. New Items:

Item Number: 20-9	NBIC Location: Part 4, 9.1	Attachment Page 208

General Description: Define "Verify" in the NBIC Glossary

Subgroup: Repairs and Alterations

Task Group: N. Carter (PM)

Explanation of Need: Defining "Verify" in the NBIC Part 1, 2, 3, and 4 to align with the definition in NB-263, RCI-1, Rules for Commissioned Inspectors.

b. Subcommittee Installation

i. Interpretations

ii. Action Items – Old Business

Item Number: NB11-1901	NBIC Location: Part 1	Attachment Page 53

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: 18-2	NBIC Location: Part 1	Attachment Page 61

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	Attachment Page 63

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.

Item Number: 19-81	NBIC Location: Part 1, Table 3.7.9.1-b	Attachment Page 76

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.

iii. Action Items – New Business

Item Number: 20-9	NBIC Location: Part 1, 9.1	Attachment Page 208

General Description: Define "Verify" in the NBIC Glossary

Subgroup: Repairs and Alterations

Task Group: N. Carter (PM)

Explanation of Need: Defining "Verify" in the NBIC Part 1, 2, 3, and 4 to align with the definition in NB-263, RCI-1, Rules for Commissioned Inspectors.

Item Number: 20-13	NBIC Location: Part 1, 3.7.9.1	Attachment Page 77

General Description: Expansion Tank Maximum Operating Pressure

Subgroup: SG Installation

Task Group: None assigned.

Explanation of Need: Table 3.7.9.1-b - 30 psig matches note (a) of Table HG-709.2 of ASME Sect IV. 3.7.9.1 a) 2) The "except for prepressurized tanks" phrase is misplaced and belongs with the provisions for draining tanks. See last sentence in HG-709.2 on p. 62 and first sentence in that same section just prior to the formulas on pg. 63.

July 2020 Meeting Action:

Item Number: 20-27	NBIC Location: Part 1, 1.6.9 & S6.3	No Attachment

General Description: Carbon Monoxide Detector/Alarm NBIC 2019

Subgroup: SG Installation

Task Group: None assigned.

Explanation of Need: These codes are being enforced by some jurisdictions on existing installations. Inspectors need to know what codes we need to enforce. Do the detectors have specific levels of CO when an alarm is to go off? Is there a requirement for an audible alarm or decibel level of the alarm? Where in the boiler room should the alarm/monitor be mounted?

July 2020 Meeting Action:

Item Number: 20-30	NBIC Location: Part 1	No Attachment

General Description: Review of installation requirements for Motors

Subgroup: SG Installation

Task Group: J. Brockman (PM).

Explanation of Need: Incorporation of applicable CSD-1 Requirements.

July 2020 Meeting Action:

Item Number: 20-31	NBIC Location: Part 1	No Attachment

General Description: Overcurrent Protection

Subgroup: SG Installation

Task Group: M. Washington (PM).

Explanation of Need: Incorporation of applicable CSD-1 requirements.

July 2020 Meeting Action:

Item Number: 20-32	NBIC Location: Part 1	No Attachment

General Description: Electric Boilers

Subgroup: SG Installation

Task Group: T. Creacy (PM).

Explanation of Need: Incorporation of applicable CSD-1 requirements.

July 2020 Meeting Action:

Item Number: 20-33	NBIC Location: Part 1	No Attachment

General Description: Flow or Temp Sensing Devices forced Circulation Boilers

Subgroup: SG Installation
Task Group: M. Downs (PM).

Explanation of Need: Incorporation of applicable CSD-1 requirements.

July 2020 Meeting Action:

Item Number: 20-34	NBIC Location: Part 1	No Attachment

General Description: Venting of gas train components

Subgroup: SG Installation
Task Group: P. Jennings (PM).

Explanation of Need: Incorporation of applicable CSD-1 requirements.

July 2020 Meeting Action:

Item Number: 20-35	NBIC Location: Part 1	No Attachment

General Description: Installation requirements for Fuel Oil Trains

Subgroup: SG Installation
Task Group: G. Tompkins (PM).

Explanation of Need: Incorporation of applicable CSD-1 requirements.

July 2020 Meeting Action:

Item Number: 20-36	NBIC Location: Part 1	No Attachment

General Description: Review Installation requirements for Bonding & Grounding

Subgroup: SG Installation

Task Group: R. Smith (PM).

Explanation of Need: Incorporation of applicable CSD-1 requirements.

July 2020 Meeting Action:

Item Number: 20-37	NBIC Location: Part 1	No Attachment

General Description: Electrical Requirements

Subgroup: SG Installation

Task Group: D. Patten (PM).

Explanation of Need: Incorporation of applicable CSD-1 requirements.

July 2020 Meeting Action:

Item Number: 20-38	NBIC Location: Part 1	No Attachment

General Description: General Requirements for Wiring

Subgroup: SG Installation

Task Group: R. Spiker (PM).

Explanation of Need: Incorporation of applicable CSD-1 requirements.

July 2020 Meeting Action:

Item Number: 20-39	NBIC Location: Part 1	No Attachment

General Description: Modular Boilers

Subgroup: SG Installation

Task Group: T. Clark (PM).

Explanation of Need: Incorporation of applicable CSD-1 requirements.

July 2020 Meeting Action:

Item Number: 20-40	NBIC Location: Part 1	No Attachment

General Description: Gas Train Requirements

Subgroup: SG Installation

Task Group: R. Adams (PM).

Explanation of Need: Incorporation of applicable CSD-1 requirements.

July 2020 Meeting Action:

Item Number: 20-41	NBIC Location: Part 1	Attachment Page 78

General Description: Safety and Safety Relief Valves for Steam and Hot Water Heating Boilers.

Subgroup: SG Installation

Task Group: E. Wiggins (PM).

Explanation of Need: Incorporation of applicable CSD-1 requirements.

July 2020 Meeting Action:

Item Number: 20-42	NBIC Location: Part 1	No Attachment

General Description: Pressure Controls for Steam Boilers

Subgroup: SG Installation

Task Group: R. Austin (PM).

Explanation of Need: Incorporation of applicable CSD-1 requirements.

July 2020 Meeting Action:

Item Number: 20-43	NBIC Location: Part 1	No Attachment

General Description: Safety Relief valve for Hot Water Supply Boilers

Subgroup: SG Installation

Task Group: W. Anderson (PM).

Explanation of Need: Incorporation of applicable CSD-1 requirements.

July 2020 Meeting Action:

Item Number: 20-44	NBIC Location: Part 1	No Attachment
General Description: CW Vacuum Boilers **Subgroup:** SG Installation **Task Group:** K. Watson (PM). **Explanation of Need:** Incorporation of applicable CSD-1 requirements. **July 2020 Meeting Action:**		

Item Number: 20-45	NBIC Location: Part 1	No Attachment
General Description: Temperature Control for Hot Water Boilers **Subgroup:** SG Installation **Task Group:** M. Wadkinson (PM). **Explanation of Need:** Incorporation of applicable CSD-1 requirements. **July 2020 Meeting Action:**		

c. Subcommittee Inspection

i. Interpretations

ii. Action Items – Old Business

Item Number: NB16-1402	NBIC Location: Part 2, New Supplement	Attachment Page 79
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. **Update:** Item was balloted to SC Inspection and received several negative votes. A few FRP members should be present at the July Inspection meeting to comment on the item.		

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	Attachment Page 84

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	Attachment Page 87

General Description: Remote Visual Inspection Requirements

Subgroup: Inspection

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

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	Attachment Page 89

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: 19-22	NBIC Location: Part 2, S2	Attachment Page 90

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.

Item Number: 19-84	NBIC Location: Part 2, S2.10.7	Attachment Page 96

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)	Attachment Page 102

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	Attachment Page 105

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.

iii. New Items:

Item Number: 20-5	NBIC Location: Part 2, 4.1 – 4.4	No Attachment

General Description: Add language in NBIC Pt2/Pt3 to minimize CSEs by allowing remote NDE.

Subgroup: Inspection

Task Group: None assigned

Explanation of Need: In order to minimize higher-risk work, specifically Confined Space Entries, remote NDE methodologies should be specifically allowed by the NBIC, at the discretion of the people performing the inspections.

Item Number: 20-9	NBIC Location: Part 2, 9.1	Attachment Page 208

General Description: Define "Verify" in the NBIC Glossary

Subgroup: Repairs and Alterations

Task Group: N. Carter (PM)

Explanation of Need: Defining "Verify" in the NBIC Part 1, 2, 3, and 4 to align with the definition in NB-263, RCI-1, Rules for Commissioned Inspectors.

Item Number: 20-26	NBIC Location: Part 2, S2	No Attachment

General Description: Concern for Historical Boiler Inspections Nationwide

Subgroup: Inspection

Task Group: None assigned

Explanation of Need: Currently Jurisdictions are not uniform in adoption of how and when inspections are performed.

Item Number: 20-46	NBIC Location: Part 2, 5.3.2	No Attachment

General Description: Updates to Forms NB-5, NB-6, & NB-7

Subgroup: Inspection

Task Group: None assigned

Explanation of Need: On the current forms NB-5, NB-6, & NB-7 there are fields that are already on the ASME Manufactures Data Report making them repetitive. Other fields that ask for in- depth technical information would be hard if not impossible for an inspector to determine and are irrelevant to the inspection process.

d. Subcommittee Repairs & Alterations

i. Interpretations

Item Number: 19-26	NBIC Location: Part 3, 3.3.2	Attachment Page 106

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: 20-3	NBIC Location: Part 3, Section 3 & 4	Attachment Page 108

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.

ii. New Interpretation Requests:

Item Number: 20-11	NBIC Location: Part 3, 3.3.3	Attachment Page 110

General Description: Scope of Repairs

Subgroup: Repairs and Alterations

Task Group: None assigned.

Explanation of Need:
NBIC Part 3 lists several examples of repair but nowhere limits the scope or amount of these examples that can be utilized when performing repairs. This creates some uncertainty when performing some types of repairs, such as replacing the tubesheets of a fixed tubesheet type heat exchanger as listed in 3.3.3 e). According to ASME BPV Code Section VIII Division 1 Part UHX, Section 13, the length of the tubes is a design parameter and therefore replacing the tubesheet in accordance with its original design might require the replacement of the tubes as well to maintain the original design length.

Item Number: 20-14	NBIC Location: Part 3, 3.3.3 & 5.12.4.1	Attachment Page 111

General Description: Mechanical Repair with no welding

Subgroup: Repairs and Alterations

Task Group: None assigned.

Explanation of Need:
ASME Section VIII, Division 3 Code stamped "Parts" are being replaced with new ASME Code stamped "Parts" without any documentation. The original ASME Data Report listed the original "Part" serial number and will no longer be accurate if the original "Part" is replaced.

Item Number: 20-17	NBIC Location: Part 3, 3.3.3	Attachment Page 113

General Description: Weld build of wasted areas with different material

Subgroup: Repairs and Alterations

Task Group: None assigned.

Explanation of Need:
It is common practice to weld build the wasted area of a component with original material and then to overlap with a corrosion resistant material to prevent future wasting of the component. It would be more efficient to simply restore the wasted area with the corrosion resistant material, provided that it meets or exceeds the strength requirements of the original material.

Item Number: 20-21	NBIC Location: Part 3, 4.4.1 e)	Attachment Page 114

General Description: Combination of NDE methods

Subgroup: Repairs and Alterations

Task Group: None assigned.

Explanation of Need:
Clarification on the intent of 4.4.1 e) 1-5 when using VT and another NDE method but on separate welds.

Item Number: 20-23	NBIC Location: Part 3, 3.4.5.1 b)	Attachment Page 115

General Description: Alteration of ASME Section VIII Div.2 vessels

Subgroup: Repairs and Alterations

Task Group: None assigned.

Explanation of Need:
Many Div.2 vessels which are in need of repair are of sufficient age whereby all of the original paperwork was paper work. Even with the best efforts such documents can become damaged or lost by the flooding event associated with the gulf coast hurricane events and or the types of refinery fires that are all too common. In a good deal of cases these vessels simply need a new B-16.5 weld neck flange or a gasket surface weld metal build up in order to allow continued leak free surface but due to some documents being unavailable the owner is left to choose between making no repair or making a repair which is not compatible with the NBIC.

Item Number: 20-24	NBIC Location: Part 3, 3.3.5.1 a) & 3.4.5.1 a)	Attachment Page 116

General Description: Certification of repair or alteration plans

Subgroup: Repairs and Alterations
Task Group: None assigned.

Explanation of Need:
3.4.5.1 b) allows for the UDS to be revised if a proposed alteration plan is not compatible with the original. this revised UDS must be certified by an engineer as must the Alteration plan, there currently does not appear to be a separation of the two certifying activity's which is not in the spirit of Div.2 requiring different engineers for the UDS and MDR.

Item Number: 20-29	NBIC Location: Part 3, 3.4.4	Attachment Page 117

General Description: PV Cycles of operations change as an alteration

Subgroup: Repairs and Alterations

Task Group: None assigned.

Explanation of Need:
Isostatic Presses in particular (but found in other pressure vessels also) are restricted by the data report to a finite number of cycles. Operators of these vessels routinely use curves to modify what is considered a cycle and extend the life of the vessel. These vessels represent a substantial risk of failure and this practice is very difficult for the inservice inspector to successfully track and audit to ensure the integrity of these vessels are maintained as this is a grey area in the current code as written.

iii. Action Items – Old Business

Item Number: NB15-1405	NBIC Location: Part 3, 1.2	Attachment Page 119

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 121

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.

Update: This item is currently being balloted to Main Committee.

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: 17-167	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: 18-66	NBIC Location: Part 3, Section 5	Attachment Page 124

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.

Update: This item is currently being letter balloted to Main Committee.

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: 18-100	NBIC Location: Part 3, 3.3.2	Attachment Page 195

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: 19-16	NBIC Location: Part 3, 3.3.2 e)	Attachment Page 199

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: 19-60	NBIC Location: Part 3, 1.5.1	No Attachment

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: 19-73	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: 19-79	NBIC Location: Part 3, S3.5.4 h)	No Attachment

General Description: Re-word Part 3, S3.5.4 h) to clarify cementing procedure for plugs

Subgroup: Graphite

Task Group: A. Stupica (PM)

Explanation of Need: Existing language includes unnecessary steps and is clunky to read. Text will be reworded to clarify the full procedure.

January 2020 Meeting Action: No members of the Graphite Task Group were present to present the item.

Item Number: 19-82	NBIC Location: Part 3, 1.5.1 j)	Attachment Page 200

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.

iv. New Items:

Item Number: 20-6	NBIC Location: Part 3, Table 2.3	Attachment Page 201

General Description: Table 2.3 SWPS - Previous Versions accepted

Subgroup: Repairs and Alterations

Task Group: J. Sekely (PM)

Explanation of Need: The use of previous versions of the Designated SWPS is permitted. Previous versions include those reaffirmed, revised, or amended SWPSs regardless of publication date. The AWS reaffirms, amends or revises SWPSs in accordance with ANSI procedures. This Code addition will simplify the maintenance of Table 2.3.

Update: This item is currently being balloted to SC R&A for approval, and to Main Committee for Review and Comment.

Item Number: 20-7	NBIC Location: Part 3, 3.3.2 a)	Attachment Page 208

General Description: Routine repairs of Div.2 & or Div.3 vessels

Subgroup: Repairs and Alterations

Task Group: N. Carter (PM)

Explanation of Need: An interpretation is scheduled to be issued under item number 19-26 asserting that Routine repairs are not to be used on Div.2 or Div.3 vessels. rather than require review of an interpretation which may expire in two years the body of the code should make it clear that Routine repairs are not compatible with div.2 or div.3 vessels.

Item Number: 20-8	NBIC Location: Part 3, 8.1 b)	No Attachment

General Description: Interpretation revision process

Subgroup: Repairs and Alterations

Task Group: K. Moore (PM)

Explanation of Need: Adding language to specify that interpretations of previous NBIC editions are applicable to the most current edition, as long as code requirements have not changed.

Item Number: 20-9	NBIC Location: Part 3, 9.1	Attachment Page 209

General Description: Define "Verify" in the NBIC Glossary

Subgroup: Repairs and Alterations

Task Group: N. Carter (PM)

Explanation of Need: Defining "Verify" in the NBIC Part 1, 2, 3, and 4 to align with the definition in NB-263, RCI-1, Rules for Commissioned Inspectors.

Item Number: 20-10	NBIC Location: Part 3, New Supplement	No Attachment

General Description: Develop a new Supplement to address rules and roles for FFS

Subgroup: Repairs and Alterations

Task Group: J. Siefert (PM)

Explanation of Need: Currently, the NBIC 3.3.4.8 provides for fitness for service for defects left in a pressure retaining item. It is proposed to develop a new Supplement to provide guidance in how to conduct FFS and roles and responsibilities unique to Part 3 concerning defects.

The current FFS form resides in Part 2 and can deal with in-service condition assessment and is loosely tied to defects in Part 3.

Item Number: 20-15	NBIC Location: Part 3, 3.3.2 & 5.7.2	Attachment Page 201

General Description: Stamping requirements for routine repairs

Subgroup: Repairs and Alterations

Task Group: R. Troutt (PM), K. Moore

Explanation of Need: This would offer traceability to the R-Stamp holder responsible for the work.

Item Number: 20-16	NBIC Location: Part 3, 3.4.4	Attachment Page 211

General Description: Rules to address re-cold stretching of vessels built to Appendix 44 rules

Subgroup: Repairs and Alterations

Task Group: None assigned.

Explanation of Need: ASME Section VIII Div.1 Mandatory Appendix 44 paragraph 44-6.2(g) clearly sets out that a vessel built to those rules needs to be re-stretch having had repair welding. it is not clear if ASME are referring to in process (at the original manufactures location) repairs or post construction repairs. However as the NBIC is currently silent this potential issue should be addressed.

Item Number: 20-20	NBIC Location: Part 3, 3.2.2 e)	Attachment Page 213

General Description: Revision to Part 3, 3.2.2 e)

Subgroup: Repairs and Alterations

Task Group: None assigned.

Explanation of Need: The certificate holder should not have to explain or justify why a part was not pressure tested in the manufacturing stage. PG-106.8 of Section I allows the part to be fabricated and shipped as such therefore no explanation should be required.

Item Number: 20-25	NBIC Location: Part 3, S2.13	No Attachment

General Description: Repair Procedure for Fire Boxes

Subgroup: SG Historical

Task Group: M. Wahl (PM), Robin Forbes, T. Dillon, & F. Johnson

Explanation of Need: In NBIC Part 3, S2.13.10.3, S2.13.11 do not define what to do at a riveted joint. On the tubesheet, or firedoor sheet, where it is flanged to rivet to the firebox, the repairs are silent on what to do at the riveted joint.

January 2020 Meeting Action:
Progress Report: Robert Bryce presented this item to the group. He explained the need for new wording to address repair procedures for fire boxes. L. Moedinger noted that this has been addressed in TG Locomotive (Part 3, S1.2.11.5 & Figure S1.2.11.5-c1). After discussion, the group decided to create a task group to create a proposal for the July 2020 meeting.

Item Number: 20-28	NBIC Location: Part 3, 2.2.1	Attachment Page 214

General Description: Qualification of welding procedures by multiple organizations.

Subgroup: Repairs and Alterations
Task Group: None assigned.

Explanation of Need: The attached Section IX proposal has been approved for publication by the ASME board. While Section IX provides basis for these tests, it also requires that the ruling Code of Construction expressly permits this activity.

11. Liaison Activities

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

i. Mr. Paul Edwards to report.

b) American Welding Society (AWS)

i. Mr. Jim Sekely to report.

12. Future Meetings

- January 11th -14th, 2021 – New Orleans, LA
- July 12th-15th, 2021 – Cincinnati, OH

13. Adjournment

Respectfully submitted,

Jonathan Ellis

Jonathan Ellis
NBIC Secretary

Contents

Action Items Approved for Inclusion in the 2021 NBIC

Item Number	Title	Assigned Committee
18-101	Inspection Requirements for PVHOs	Subcommittee Inspection
18-27	Review installation requirements for CO2 vessels	Subcommittee Inspection
18-61	Additional changes to PVHO	Subcommittee Inspection
18-79	Part 2 S12 changes to address shoulds/shalls	Subcommittee Inspection
18-89	Revise NBIC Part 2, paragraph S2.4 to change incorrect reference of “NBIC	Subcommittee Inspection
19-29	Remove NB-136 reference in Replacement of Duplicate Nameplates	Subcommittee Inspection
19-30	Temporary ASME Nameplate removal for external inspection refurbishing.	Subcommittee Inspection
19-33	Scope of 1.1 has Redundant Statements	Subcommittee Inspection
19-65	Changes to the Yankee Dryer Supplement (S5.2.3)	Subcommittee Inspection
19-78	Detailed Requirements for Inservice Inspection of Cast Iron Boilers.	Subcommittee Inspection
19-93	NBIC Forms have the wrong pages identified for reference	Subcommittee Inspection
NB16-1401	Revise and update Suppplement 10 on Inspection of CRPVs	Subcommittee Inspection
17-159	Result of 17-147; review Part 1, 4.7 for references to hot water storage	Subcommittee Installation
18-1	Review 2.8.1 and 2.8.5 for potential duplication paragraphs	Subcommittee Installation
18-26	Review installation requirements for CO2 vessels	Subcommittee Installation
18-44	Remove the modular limits of BTU/Hr., 3gal for oil and 117 kW for	Subcommittee Installation
19-51	NBIC safety valve requirements for boilers up to 4000lb/hr	Subcommittee Installation
19-77	NBIC Part 1, 1.4.5.1.1 Guide for installation report, items 6, 10, and 20	Subcommittee Installation
NB12-0302	Add installation requirements for pressure vessels for human occupancy	Subcommittee Installation
NB16-0102	Result of NB10-1201, address post installation pressure testing	Subcommittee Installation
NB16-0102	Result of NB10-1201, address post installation pressure testing	Subcommittee Installation
NB16-0102	Result of NB10-1201, address post installation pressure testing	Subcommittee Installation
NB16-0102	Result of NB10-1201, address post installation pressure testing	Subcommittee Installation
17-131	Paragraph 2.5.7 a) Preface by "Unless otherwise protected,..."	Subcommittee Pressure Relief Devices
17-131	Paragraph 2.5.7 a) Preface by "Unless otherwise protected,..."	Subcommittee Pressure Relief Devices
17-132	Paragraph 3.2.6 can be put into tabular format.	Subcommittee Pressure Relief Devices
17-132	Paragraph 3.2.6 can be put into tabular format.	Subcommittee Pressure Relief Devices
18-87	Review the use of "Authorized Nuclear Inspection Agency" within the NBIC	Subcommittee Pressure Relief Devices
19-18	Implementation of QC Manual Revisions	Subcommittee Pressure Relief Devices
19-39	Delete Supplement 3 of NBIC Part 4.	Subcommittee Pressure Relief Devices
19-40	Move Fig. 4.7.2-b to Part 4 Supplement 6.	Subcommittee Pressure Relief Devices
19-41	Review Part 4, Paragraph 4.7.5 and simplify	Subcommittee Pressure Relief Devices
19-49	Ensure shipping plugs for PRDs are removed during the installation process	Subcommittee Pressure Relief Devices
19-49	Ensure shipping plugs for PRDs are removed during the installation process	Subcommittee Pressure Relief Devices
19-54	Reconcile Conflict regarding Sealing Adjustments of PRVs in T/O Program	Subcommittee Pressure Relief Devices
19-54	Reconcile Conflict regarding Sealing Adjustments of PRVs in T/O Program	Subcommittee Pressure Relief Devices
19-70	Part 4, 2.6.3 references 2.1 through 2.2. Should be 2.2 through 2.4	Subcommittee Pressure Relief Devices
19-72	Documentation of Steam tested on Air Correction Factor	Subcommittee Pressure Relief Devices
19-72	Documentation of Steam tested on Air Correction Factor	Subcommittee Pressure Relief Devices
19-75	Add PRD reqs for boilers up to 4000lb/hr to Part 4; Item 19-51 added these	Subcommittee Pressure Relief Devices
19-76	Paragraph 3.3.3.4 p) Incorrect Certificate of Authorization Reference	Subcommittee Pressure Relief Devices
19-9	Inspect shipping plug removal for PRDs	Subcommittee Pressure Relief Devices
NB15-0324	create guidelines for presure relief and pilot valve storage and shelf life	Subcommittee Pressure Relief Devices
NB15-0324	create guidelines for presure relief and pilot valve storage and shelf life	Subcommittee Pressure Relief Devices
NB16-0805	Temperature ratings for discharge piping and fittings	Subcommittee Pressure Relief Devices
NB16-0805	Temperature ratings for discharge piping and fittings	Subcommittee Pressure Relief Devices
NB17-0401	Valve drain plug recommendations for shipping	Subcommittee Pressure Relief Devices
17-137	Remove "sand" blasting and replace with "abrasive" in Part 3, S4.18.2	Subcommittee Repairs/Alterations
17-166	Remove nozzle replacement and tube replacement from graphite routine	Subcommittee Repairs/Alterations
18-102	Revise Table 2.3 in Part 3 to add the listed SWPSs that were revised by the	Subcommittee Repairs/Alterations

18-12	Revision to WM6 to allow for external weld metal buildup	Subcommittee Repairs/Alterations
18-13	New Welding Method 7 for dissimilar metal welds	Subcommittee Repairs/Alterations
18-65	Draft rules for “used” material in repairs and/or alterations.	Subcommittee Repairs/Alterations
18-67	Align definition of “Brazing” with ASME Section IX and address non-metallic	Subcommittee Repairs/Alterations
18-67	Align definition of “Brazing” with ASME Section IX and address non-metallic	Subcommittee Repairs/Alterations
18-75	Flush patches in stayed and un-stayed areas of tubesheets	Subcommittee Repairs/Alterations
18-83	Alternative language in Part 3, 3.4.4 e) to clarify that it is the current MRRC	Subcommittee Repairs/Alterations
18-84	Additional subparagraph in Part 3, S1.2.8 about the use of patch bolts being	Subcommittee Repairs/Alterations
18-85	For the SWPS AWS B2.1-1-233:2006, is the root or 1st pass using GTAW-	Subcommittee Repairs/Alterations
18-88	Revise NBIC Part 3, paragraphs S2.6(a) and S2.9 to change incorrect	Subcommittee Repairs/Alterations
18-95	Revision to Part 3, S1.1.4 to account for new rules for riveted construction	Subcommittee Repairs/Alterations
18-98	Revise S2.7.2 of NBIC Part 3, Supplement 2 to refer to existing replacement	Subcommittee Repairs/Alterations
19-11	Clarify Definition of Authorized Nuclear Inspection Agency (ANIA)	Subcommittee Repairs/Alterations
19-11	Clarify Definition of Authorized Nuclear Inspection Agency (ANIA)	Subcommittee Repairs/Alterations
19-12	Paragraph 1.6.3 – revise text to clarify Quality Assurance Program reqs	Subcommittee Repairs/Alterations
19-13	Revise Part 3, 1.6.6.2, 1.6.7.2, and 1.6.8.2 to clarify responsibilities for	Subcommittee Repairs/Alterations
19-15	ASME Section VIII Division 2 Class 1/Class 2 Distinction	Subcommittee Repairs/Alterations
19-19	Part 3 - S4.2 RTP references to "Inspector"	Subcommittee Repairs/Alterations
19-21	Additional Wording to S2.11	Subcommittee Repairs/Alterations
19-24	Supplement 6 to record the "R" number assigned to either R-1 or R-2.	Subcommittee Repairs/Alterations
19-27	Fusible Plug Repair Using Half Coupling Figure	Subcommittee Repairs/Alterations
19-31	Part 3 - Table 2.3 - Thickness Range Corrections	Subcommittee Repairs/Alterations
19-43	ISO/IEC-17025 Edition referenced in NR Section of Part 3	Subcommittee Repairs/Alterations
19-50	Revising Part 3, 3.3.4.3 e) 3) l) to match rules of ASME PCC-2	Subcommittee Repairs/Alterations
19-52	Part 3, Section 4 - 4.2 a) Alternative NDE requirements	Subcommittee Repairs/Alterations
19-53	Revise S2.12 to address Historical Boiler Record Retention	Subcommittee Repairs/Alterations
19-55	Change the maximum test pressure requirement when performing	Subcommittee Repairs/Alterations
19-59	Pressure Tests for Replacement Parts	Subcommittee Repairs/Alterations
19-69	Review verbiage in Part 3, 5.12.5.1 8) and 5.12.5.1.11)	Subcommittee Repairs/Alterations
19-91	Form Registration Log	Subcommittee Repairs/Alterations
19-92	Adding "Document Designation" as the second column title in Table 2.3	Subcommittee Repairs/Alterations
20-4	Update NBIC Part 3, Table 2.3 (2019 Edition) adding the following listed	Subcommittee Repairs/Alterations

PROPOSED INTERPRETATION

Inquiry No.	**20-19**
Source	Alton Cox, JAC Consulting, Inc. alton@jaltoncox.com
Subject	Purpose of NBIC Part 4, Sec. 4.8.5.4, n) 2) & 3.3.3.4, l) 2) system review **Background:** Based on conversations with those affected by this requirement, it is clear that there is widespread misunderstanding regarding the purpose and content of the review required by the above referenced paragraphs. This appears to include not only VR & T/O Certificate Holders, but NB Consultants and members of SC-PRD as well. We need everyone to have the same understanding of this requirement. NOTE: the reference to NBIC in 3.3.3.4, l) 2) at the end of the sentence should be deleted. It is held over from NB-528 and therefore superfluous.
Edition	2019 NBIC; Part 4, 3.3.3.4 l) 2), and 4.8.5.4 n) 2)
Question	Question: Does the "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..." refer to a Documented Review of all the QC Aspects of the VR or T/O Holder's QC Program described in the National Board accepted QC Manual?
Reply	Proposed Reply: Yes. The Review of the VR or T/O Certificate Holder's Quality Program, including all aspects of QC System Implementation, shall be conducted, documented, and any required changes implemented within six months of the receipt of the publication of the new Edition of the ASME Code and/or NBIC.
Committee's Question	
Committee's Reply	
Rationale	

Task Group Item NB12_0901 Repair guidelines for weight-loaded pressure/vacuum vent type pressure relief valve.

S4.1 Introduction ~~Scope~~

a) It is essential that the repair organization establish basic, specific procedures for the repair of ~~weight loaded vents~~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 t~~t~~here are many types of valves and conditions under which they are repaired and~~,~~ ~~,~~ ~~f~~for this reason, the specific items in these recommended procedures 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 ~~other~~ valve.

b) Prior to removal, repair, or disassembly of a pressure relief valve ensure that all sources of pressure have been removed.

c) 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, and S4.4 contains recommended procedures for the repair of weight loaded ~~-~~ vents. Information on packaging, shipping and transportation is included in ~~as~~ S4.5.

S4.2 SPRING-LOADED PRESSURE RELIEF VALVES (No change)

S4.3 PILOT OPERATED PRESSURE RELIEF VALVES (No change)

~~c)~~

S4.4 WEIGHT LOADED VENTS

The procedures ~~-~~provided in S4.4 are general guidelines. ~~ance, and~~ T~~t~~he manufacturer's information, when available, ~~when available,~~ should be used for detailed instructions based on the vent type and design.

CAUTION: Weight loaded vents are often exposed to hazardous media. An SDS (safety data sheet) should be provided to the repair organization prior to the commencement of any work. If the vent has been exposed to hazardous media, it should be fully decontaminated prior

to inspection and disassembly. If the vent has not been fully decontaminated, safety precautions should be taken to adequately protect repair personnel.

a)

1) External inspection

a) a) A

1) All external components weight loaded vents should be inspected for exterior damage and or corrosion. Also, the vents should be inspected for signs of leakage from the pressure and or vacuum side of the vent.

1)2) b) Inspect inlet and outlet flanges. Confirm nameplate information Record manufacturer's nameplate information, such as model, settings, serial number, aset point, flow rate, etc. on the repair traveler. nd other information applicable to the vent type being serviced.

2)3) Record previous repair nameplate information on the repair traveler.

b) 2) Pre-Disassembly Test Set pressure check

a) WWeight loaded vents should may be tested prior to before disassembly to verify check the initial opening of the pressure and/or vacuum setting. of the vent and . Also, the vents should be inspected for signs of leakage from the pressure and/or vacuum port. The test results should be recorded record the test results on the repair traveler r.

1)

a) DisassemblyDisassembly

c)

1) Safety practices and equipment applicable to the work being performed should be considered prior to commencing the repair. Each vent should be disassembled to the extent necessary for thorough examination. Measures should be taken to ensure traceability and segregation between pressure and vacuum components of the vent assembly. Safety practices and equipment applicable to the work being performed should be considered prior to starting work.

1)

2) Pressure Side Disassembly (as applicable)

a. Secure assembly for removal of internal parts.

a.

~~b.~~ Remove pressure weather hood and screen or cover as applicable .[DDB1]

b.

~~c.~~ Remove weights from pressure side pallet, and place in appropriate bin to maintain traceability and segregation from vacuum side parts. Maintain the order in which the weights are stacked if varying sizes, types and/or thickness of weights are used.

c.

~~d.~~ Remove and disassemble pressure pallet assembly, and place in ~~appropriate~~ bin to maintain traceability and segregation from vacuum side parts.~~.~~

d.

e. Remove~~al~~ pressure seat if applicable and guiding components.

3) Vacuum Side Disassembly (as applicable)

a. Secure the vent assembly for removal of internal parts.

~~a.~~b. Remove vacuum cover and screen as applicable.

~~b.~~c. Remove weights from vacuum side pallet, and place in appropriate bin to maintain traceability and segregation from pressure side parts. Maintain the order in which the weights are stacked if varying sizes, types and/or thickness of weights are used.

~~b.~~d. Remove and disassemble vacuum pallet assembly, and place in bin to maintain traceability and segregation from pressure side parts.

~~c.~~e. Remove ~~al of~~ vacuum seat if applicable and guiding components~~.~~ ~~on some manufacturer's designs as required.~~

~~b)~~d) Cleaning

1) Care should be exercised to avoid damage to components (i.e. nameplates, seating/sealing surfaces, delicate components, etc.) caused by the cleaning method used.

~~1)~~2) Cleaning method used for weights is dependent on material of construction. [DDB2]

~~d)~~e) Internal Inspection

1) Vent s~~S~~eats and sealing surfaces should be inspected for signs of corrosion, erosion, pitting, scratches, cuts, or other damage that would create a leak path.

2) Main body, guiding components, and all pressure retaining attachments should be inspected for signs of wear, corrosion, erosion, pitting, cracks, or other damage that could affect proper operation.

3) Nonmetal components including diaphragms, O-rings, and gaskets should be inspected for holes, tears, signs of abnormal wear, or chemical attacks associated with process conditions.

~~e)~~f) Repair

1) ~~Seating Surfaces should be lapped to a smooth flat surface.~~ Vent seats~~Seating Surfaces~~ should be lapped to ensure they are flat ~~so that to a smooth flat surface is achieved.~~

2) Metal and non-metal components that are damaged should be replaced.

~~f)~~g) Assembly

If applicable, before beginning the reassembly process, weigh the pallet assembly including the weights, for pressure and/or vacuum setting[DDB3]. The m~~M~~anufacturer's weight calculations should be used, and the calculated weight for each setting should be recorded on the repair traveler.

1) Vacuum Side Assembly (as applicable)
   a. Secure the vent assembly for safe assembly of internal parts.
   ~~b.~~ Install vacuum seat and guide as required.
   b.
   ~~c.~~ Assemble and install the vacuum pallet assembly into the main ~~-~~vent body.
   c.
   ~~d.~~ Install weights on vacuum side pallet assembly. Stack weights from the largest diameter against the pallet.~~, if applicable.~~
   d.
   e. Install vacuum side cover cap, and screen if applicable.

2) Pressure Side Assembly (as applicable)
   a. Secure the vent for assembly of internal parts.
   b. Install pressure seat if applicable and guides.
   c. Assemble and Install pressure pallet assembly into main body.
   d. Install weights on pressure pallet assembly. Stack weights from the largest diameter against the pallet~~, if applicable.~~.
   e. Install pressure weather hood and screen or cover as applicable.

~~g)~~h) Testing

1) General Information
   a. Test equipment used to perform pressure and/or vacuum testing should be of adequate size to safely secure the vent during testing. ~~,~~

b. All flow meters and pressure/vacuum test gages used should cover the flow rates, and pressure ranges for the vents being tested. ~~,~~Test equipment should be calibrated and traceable to NIST standards.

2) Set Pressure Verification
   a. After final assembly, mount the vent on test stand.
   b. To check settings, increase pressure or vacuum on the test stand.
      1. The pressure setting shall be the test gauge pressure at which an increase in flow rate no longer increases gauge pressure.
      2. The v~~V~~acuum setting shall be the test gauge pressure at which an increase in flow rate no longer decreases gauge pressure.
   c. Pallet assembly weight may need to be adjusted to meet pressure/vacuum setting as required.
   d. If weight adjustments are made the vent should be retested.
   e. Record set pressure/vacuum on repair traveler.

3) Seat Tightness Verification
   a. Slowly increase the tank pressure to a ~~-~~minimum of 75% of vent set pressure.
   b. While maintaining 75% of set pressure for one minute ensure the test leak rate is in accordance with Table 1. This table applies to seat leakage testing for both pressure and vacuum. If the vent fails to meet leak-rate testing, it must be disassembled and repaired. This table complies with the requirements of API 2000.

~~Valve Size mm (in.)~~	~~Test Leak-Rate m^3/h (scfh)~~
~~≤ 150 (6)~~	~~0.014 (0.5)~~
~~200 – 400 (8 - 16)~~	~~0.142 (5.0)~~
~~> 400 (16)~~	~~0.566 (20)~~

   c. Record leak rates on the repair traveler for both pressure and vacuum as applicable.

Table 1: Test Flow Rate Specifications	
Vent Size mm (in.)	**Test Leak-Rate** m^3/h (scfh)
≤ 150 (6)	0.014 (0.5)
200 – 400 (8 - 16)	0.142 (5.0)
> 400 (16)	0.566 (20)

~~d.~~

~~h)~~i) Sealing

Tamper proof seals should be used to prevent tampering of external adjustments after the vent has been serviced and tested.

~~i)~~j) Repair Nameplate

1) Repaired b~~B~~y (organization performing repair)
2) Unique identification number
3) Date of r~~R~~epair
4) Model/Type (if changed)
5) Pressure s~~S~~etting (if applicable)
6) Vacuum s~~S~~etting (if applicable)

~~6)~~

~~S4.4~~S4.5 PACKAGING, SHIPPING AND TRANSPORTATION OF PRESSURE RELIEF DEVICES

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 for spring loaded pressure relief valves and pilot operated pressure relief valves ~~for Direct Spring and Pilot Operated Valves~~:

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 NPS 2 (DN 50) 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.

3) The valve should not be picked up or carried using the lifting lever. Lifting levers should be wired or secured so they cannot be moved while the valve is being shipped or stored. These wires shall be removed before the valve is placed in service.

4) Pilot valve tubing should be protected during shipment and storage to avoid damage and/or breakage.

5) Valves for special services, including but not limited to oxygen, chlorine, and hydrogen peroxide, should be packaged in accordance with the appropriate standards and/or owner procurement requirements.

c) The following practices are recommended for weight loaded vent~~vents~~:

1) Vents should be securely fastened to pallets in the vertical position to avoid side loads on guiding surfaces, or otherwise securely packaged and cushioned during transport.

~~*1)*~~*2)* Weights packaged and shipped separately should be marked or ~~/~~labeled as either pressure, or vacuum prior to shipment. These segregated weights should be installed at the time of field installation, paying close attention as to whether they are pressure or vacuum weights.

~~*2)*~~*3)* All shipping blocks, metal bands, ~~any~~ protective inserts, and inlet/outlet protective covers that may be used for shipment must be removed prior to placing the vent in service.

NB15-0321
AMR suggested edits
6-30-2020

Main Committee Ballot comments:

Mr. Rick Sturm: I have voted against this as I believe that in 3.2.4.4 paragraph 11 and 12 as well as where wording is duplicated in 2.5.5.4 the "should's" should be changed to "Shall" i.e. checking for bends/deflections of pins or bars, markings on pins as well as shall be taken out of service.If someone can provide me with why they can remain a should instead of a shall I would appreciate it.

Mr. Donnie LeSage: I had the same thoughts as Mr. Rick Sturm as I was reading the proposal. I agree with his recommendation to change the Shoulds to Shall.

Mr. Venus Newton: You should be providing clearer guidance on what is meant by "periodic" and periodically means. The code needs to be as specific as we can about how often to perform these tests.

Mr. Rob Troutt: I agree with Mr. Rick Sturm, the word "should" needs to be changed to "Shall".

Mr. Bob Wielgoszinski:
Part 4:

- 3.2.4.4g) 13) add the word "to" before prevent in the 2nd line.
- 3.2.5.2c) reference is made to "3.2.6". I could not locate that paragraph. Is the 1 through 6 below 3.2.5.2c) intended to be 3.2.6?
- 3.2.5.4a) although it does not appear to part of this action, the text says that the system "should" be taken out of service if the pin/bar is stuck closed. Should that be changed to "shall"? Why would we have a system running with a dysfunctional PRD?

Part 2: (NOTE THAT THESE ARE MUCH THE SAME COMMENTS AS FOR PART 4 above)

- 2.5.5.4g)13) add the word "to" before prevent in the 2nd line.
- 2.5.7.2 c) I see no requirements of instruction for freedom of motion inspection in 2.5.8. Was the 1 through 6 below intended to be the instruction?
- 2.5.7.4a) although it does not appear to part of this action, the text says that the system "should" be taken out of service if the pin/bar is stuck closed. Should that be changed to "shall"? Why would we have a system running with a dysfunctional PRD?

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.

~~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).

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.

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)

a~~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~~b) 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~~c) 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~~d) 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.

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Part 4:

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)~~b) 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.~~

Part 1:

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 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)~~b) 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.~~

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PART 4

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~~VALVES

Thermal fluid heaters shall be equipped with one or more pressure relief ~~devices~~ valves unless the option for overpressure protection by system design is utilized (when permitted by the original code of construction). When pressure relief ~~devices~~ valves 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) A lifting lever shall not be used in pressure relief valve(s). 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.

d) Cast iron fittings shall not be used.

e) Copper and copper alloys shall not be used.

~~d~~f) The inlet connection to the valve shall be not less than NPS ½ (DN 15).

2.3.3 LOCATION

Pressure relief ~~devices~~ valves shall be connected to the heater in accordance with the original code of construction.

2.3.4 CAPACITY

The pressure relief ~~device(s)~~valve(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~~ valve 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~~ valve is provided to obtain the required capacity, only one pressure relief ~~device~~ valve set pressure needs to be set at or below the maximum allowable working

pressure. The set pressure of the additional relief ~~devices~~ valves shall be such that the pressure cannot exceed the maximum pressure permitted by the code of construction.

2.3.6 INSTALLATION

Pressure relief valves and the associated discharge piping shall be installed in accordance with the heater Manufacturer's recommendations. The installation of the pressure relief valves required for Thermal Fluid Heaters shall include but not be limited to following requirements:

a) The pressure relief valve shall be provided with discharge piping. ~~When a discharge pipe is used, t~~The cross-sectional area of discharge piping 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~~valves. Discharge piping shall be as short and straight as possible and arranged to avoid undue stress on the pressure relief ~~device~~valve.

b) The pressure relief valve shall be connected to the pressure vessel in accordance with the original code of construction.

~~b~~c) 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~~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 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~~e) 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~~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, such as a catchment tank, for the disposal of fluids being relieved.

~~f~~g) Discharge lines from pressure relief ~~devices~~ valves 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. The possibility of solidification of fluid leakage into the discharge piping system shall be considered.

~~g~~h) The pressure relief discharge ~~should~~ shall be connected to a closed, vented storage tank ~~or blowdown tank~~ with solid piping (no drip pan elbow~~,~~ or other air gap). The storage tank should be located as close to the system as possible, but away from flammable surfaces. Overflow or high level protection should be considered. The capacity of the storage tank should consider the volume of fluid which may be relieved or sized in accordance with the heater manufacturer's recommendation. Storage tanks located outdoors shall be located such that water cannot collect in the vessel. ~~When outdoor discharge is used,~~

~~t~~The following ~~should~~ shall be considered for discharge piping hazards.

~~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~~4) Heat tracing for systems using high freeze point fluids along the discharge line (prevent blockage).

~~h) A 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~~i) Pressure relief valve discharge capacity for liquid service shall be determined from the following equation:

~~W = CKAP √(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 = cp/cv .~~
~~**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 ft3 (m3)~~
~~H = heat of combustion of fuel, Btu/lb (J/kg) or Btu/ft3 (J/m3)~~
~~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.~~

For Liquid
U.S. Customary Units
$W = 2{,}407KA\sqrt{(P - Pd)w}$

SI Units
$W = 5.092\ KA\sqrt{(P - Pd)w}$

Where.
W = Liquid Capacity in lb/hr (kg/hr).
A = Discharge Area of Pressure relief Valve, in^2 (mm^2)
K = coefficient of discharge for valve design
P = (Set pressure + OP + Atmosphere pressure, psia (Mpa)
OP = Overpressure required for Pressure Relief
Valve to reach capacity specified in
code of construction
Pd = Pressure at discharge of valve, psia (Mpa)
w = Specific weight of liquid at inlet condition
lb/ft^3 (kg/m^3)

To convert lb/hr of water to gal/min, multiply the capacity in lb/hr by 1/500.

!!!!!!! (SEE PART 1 PROPOSAL BEGINNING ON NEXT PAGE) !!!!!!!

PART 1

S5.7 OVERPRESSURE PROTECTION

S5.7.1 GENERAL REQUIREMENTS

Thermal fluid heaters shall be provided with overpressure protection in accordance with the code of construction.

S5.7.2 PRESSURE RELIEF ~~DEVICES~~VALVES

Thermal fluid heaters shall be equipped with one or more pressure relief ~~devices~~ valves 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) A lifting lever shall not be used in pressure relief valve(s). 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.

d) Cast iron fittings shall not be used

e) Copper and copper alloys shall not be used

~~d~~f) The inlet connection to the valve shall be not less than NPS ½ (DN 15).

S5.7.3 LOCATION

Pressure relief ~~devices~~ valves shall be connected to the heater in accordance with the original code of construction.

S5.7.4 CAPACITY

The pressure relief ~~device(s)~~valve(s) shall have sufficient capacity to prevent the pressure vessel from exceeding the maximum pressure specified in the vessel code of construction.

S5.7.5 SET PRESSURE

a) When a single relief ~~device~~ valve 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~~ valve is provided to obtain the required capacity, only one pressure relief ~~device~~ valve set pressure needs to be set at or below the maximum allowable working pressure. The set pressure of the additional relief ~~devices~~ valves shall be such that the pressure cannot exceed the maximum pressure permitted by the code of construction.

S5.7.6 INSTALLATION

Pressure relief valves and the associated discharge piping shall be installed in accordance with the heater Manufacturer's recommendations. The installation of the pressure relief valves required for Thermal Fluid Heaters shall include but not be limited to following requirements.

a) The pressure relief valve shall be provided with discharge piping. ~~When a discharge pipe is used, t~~The cross-sectional area of the discharge piping 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~~valves. Discharge piping shall be as short and straight as possible and arranged to avoid undue stress on the pressure relief ~~device~~valve.

b) The pressure relief valve shall be connected to the pressure vessel in accordance with the original code of construction.

~~b~~c) The cross sectional area of the piping between the heater and the relief ~~device~~ valve shall be sized either to avoid restricting the flow to the pressure relief ~~devices~~ valves or made at least equal to the inlet area of the pressure relief ~~devices~~ valves connected to it.

~~c~~d) When two or more required pressure relief ~~devices~~ valves 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~~ valves or made at least equal to the combined inlet areas of the pressure relief ~~devices~~ valves connected to it.

~~d~~e) Unless permitted by the code of construction, there shall be no intervening stop valve between the vessel and its pressure relief ~~device(s)~~valve(s), or between the pressure relief ~~device~~ valve and the point of discharge.

~~e~~f) Pressure relief ~~device~~ valve 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~~g) Discharge lines from pressure relief ~~devices~~ valves 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. The possibility of solidification of fluid leakage into the discharge piping system shall be considered.

h) The pressure relief valve discharge shall be connected to a closed, vented storage tank with solid piping (no drip pan elbow or other air gap). The storage tank should be located as close to the system as possible, but away from flammable surfaces. Overflow or high level protection should be considered. The capacity of the storage tank should consider the volume of fluid which may be relieved or sized in accordance with the heater manufacturer's recommendation. Storage tanks located outdoors shall be located such that water cannot collect in the vessel.

The following shall be considered for discharge piping hazards.

1) Both thermal and chemical reactions (personnel hazard).

2) Combustible materials (fire hazard)

3) Surface drains (pollution and fire hazard)

4) Heat tracing for systems using high freeze point fluids (prevent blockage)

i) Pressure relief valve discharge capacity for liquid service shall be determined from the following equation:

For Liquid
U.S. Customary Units
$W = 2{,}407KA\sqrt{(P - Pd)w}$

SI Units
$W = 5.092\ KA\sqrt{(P - Pd)w}$

Where.
W = Liquid Capacity in lb/hr (kg/hr).
A = Discharge Area of Pressure relief Valve, in^2 (mm^2)
K = coefficient of discharge for valve design
P = (Set pressure + OP + Atmosphere pressure, psia (Mpa)
OP = Overpressure required for Pressure Relief
Valve to reach capacity specified in
code of construction
Pd = Pressure at discharge of valve, psia (Mpa)
w = Specific weight of liquid at inlet condition
lb/ft^3 (kg/m^3)

To convert lb/hr of water to gal/min, multiply the capacity in lb/hr by 1/500.

ITEM 18-80 Proposal 9-30-19

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.~~

S4.2 SPRING-LOADED PRESSURE RELIEF VALVES

Prior to removal of a valve from a system for a repair or any disassembly, ensure that all sources of pressure have been removed from the valve.

a) Visual inspection as received

1) This information is to be recorded:

a. Record user (customer) identification number;

b. Complete original PRV nameplate data, previous repair nameplate data, plus any important information received from customer;

c. Check external adjustment seals for warranty repair;

d. Check bonnet for venting on bellows type valves; and

e. Check appearance for any unusual damage, missing, or misapplied parts.

2) If sufficient damage or other unusual conditions are detected that may pose a safety risk during preliminary testing, then proceed directly to S4.2 c)

3) Valves that are to be repaired in place proceed to S4.2 c) unless preliminary testing has been authorized by the owner.

b) Preliminary test as received

1) Information from the recommended preliminary performance test and subsequent disassembly and inspections will provide a basis for any repair interval change that should be necessary to ensure that the valve will function as intended.

2) Determine set pressure or Cold Differential Test Pressure (CDTP) in accordance with manufacturer's recommendations and appropriate ASME Code Section. Do not allow test pressure to exceed 116% of set pressure unless otherwise specified by the owner. A minimum of three tests is usually required to obtain consistent results.

3) If results do not correlate with field performance, then steps to duplicate field conditions (fluid and temperature) may be necessary.

4) Record preliminary test results and test bench identification data.

c) Disassembly

1) Remove cap and lever assembly, if applicable.
2) Remove release nut assembly, if applicable.
3) Loosen jam nut on adjusting (compression) screw.
4) Record measurement and remove adjusting (compression) screw.
5) Remove bonnet or yoke.
6) Remove spring and washers, and tag (identify) including upper and lower washers, as appropriate.
7) Remove spindle and disk assembly.
8) Remove ring pins.
9) Record measurement and remove adjusting rings, nozzle, and guide, as applicable.
d) Cleaning
1) Wire all small parts together and clean. (Caution: do not use a cleaning method that will damage the parts.)
2) Do not clean in a chemical solution except under acceptable circumstances.
3) Protect seating surfaces and nameplates prior to cleaning.
e) Inspection
1) Check spring for correct range, damage such as erosion, corrosion, cracking, or compression below free height.
2) Check nozzle for cracks (NDE as applicable) or unusual wear.
3) Check disk assembly for cracks (NDE as applicable) or unusual wear.
4) Check spindle for trueness, bearing areas, and thread condition.
5) Check guide for wear and galling.
6) Check adjusting ring(s) for worn threads and wear.
7) Check ring pins for bent or broken pin and thread condition.
8) Check bellows, if provided, for pinholes and corrosion.
9) Check flange gasket facings for wear and cuts.
f) Machining
Machine nozzle and disk as necessary to the manufacturer’s critical dimension charts.
g) Lapping
1) Machine or hand lap disk and nozzle to be sure of flatness.
2) Lap bevel seats to a grey finish; then re-machine disk or plug to the manufacturer’s critical dimension.
h) Bearing Points
Grind all bearing areas with grinding compound to make sure they are round and true.
i) Assembly
1) Install nozzle
2) Install lower ring and guide ring to the measurement from c) 9) above or to manufacturer’s specifications.
3) Install guide
4) Install disc and holder
5) Install spindle
6) Install spring washers
7) Install bonnet
8) Install bonnet bolting
9) Install adjusting screw and lock nut to the measurement from c) 4) above,
10) Install release nut and lock nut, and cap and lever assembly, and
11) Document installation of replacement parts.
j) Testing
Test data shall be recorded. Testing will be done in accordance with manufacturer’s recommendations and appropriate ASME Code section. To preclude unsafe and unstable valve operations or erroneous performance test results, it is recommended that low volume testing equipment (e.g., gas cylinders without
a test vessel, hand pumps, tubing) should be avoided.
k) Sealing
After final adjusting and acceptance by quality control inspection, all external adjustments shall be sealed with a safety seal providing a means of identification of the organization performing the repair.
l) Nameplate

The repairer will place a repair nameplate on each repaired valve. The nameplate shall, as a minimum, meet the requirements of 4.7.1.

S4.3 PILOT OPERATED PRESSURE RELIEF VALVES

a) Visual Inspection as Received
1) This information is to be recorded:
a. Complete nameplate data, plus any other important information received from the customer;
b. User identification number, if applicable;
c. Seals on external adjustments (ensure seals are intact);
d. Identification on seal; and
e. Obvious damage and external condition including missing or misapplied parts.
b) Disassembly
1) Remove pilot and disassemble per manufacturer's maintenance instruction.
2) Disassemble main valve. Where lift adjustments are provided, do not remove the locking device or change the lift unless it is required as part of conversion.
3) Remove the nozzle if recommended by the manufacturer's maintenance instructions and/or when required as part of conversion.
c) Cleaning
1) Pilot — Components of pilot are small and must be handled carefully to prevent damage or loss. Clean parts and nameplates with solvents that will not affect the parent metal and/or polish with 500 grit paper.
2) Main Valve — Clean by appropriate means such as abrasive blast. Finishes of machined surfaces must not be affected. (Caution: Do not use a cleaning method that will damage the parts or nameplates.)
d) Inspection
1) Pilot
a. Check spring for damage such as corrosion, cracks, out of square ends, etc.
b. Inspect all parts for damage. Small burrs or scratches may be removed by polishing. Severely damaged parts should be replaced. (Internal components or pilots should not be repaired by machining as the functions of the pilot could easily be impaired.)
c. Check strainers and filters on inlet and outlet lines.
d. Replace all soft goods per manufacturer's recommendation.
2) Main Valve
a. Check nozzle seating surface for nicks. These can be removed by machining or lapping as required.
b. Check the piston and liner (or other moving member) for galling or excessive wear. The piston should move freely in the liner.
c. Replace soft goods or re-lap disk as required.
d. Where lift adjustments are provided, measure the lift per the manufacturer's specifications.
e) Testing
Test data shall be recorded. Testing will be done in accordance with the manufacturer's recommendation and in accordance with the applicable ASME Code section. To preclude unsafe and unstable valve operations
or erroneous performance test results, it is recommended that low volume testing equipment (e.g., gas cylinders without a test vessel, hand pumps, tubing) should be avoided.
f) Sealing
After final adjustment and acceptance by quality control, all external adjustments shall be sealed by means assuring positive identification of the organization performing the repair.
g) Nameplate
The repairer will place a repair nameplate on each repaired valve. The nameplate, as a minimum, shall meet
the requirements of 4.7.1.

S4.4 PACKAGING, SHIPPING AND TRANSPORTATION OF PRESSURE RELIEF DEVICES

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 NPS 2 (DN 50) 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.
3) The valve should not be picked up or carried using the lifting lever. Lifting levers should be wired or secured so they cannot be moved while the valve is being shipped or stored. These wires shall be removed before the valve is placed in service.
4) Pilot valve tubing should be protected during shipment and storage to avoid damage and/or breakage.
5) Valves for special services, including but not limited to oxygen, chlorine, and hydrogen peroxide, should be packaged in accordance with appropriate standards and/or owner procurement requirements.

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 19-1. Develop specific content and scope of annual field audits.

4.8.6.1 AUDIT REQUIREMENTS

Initial Language

Upon issuance of a *Certificate of Authorization*, provided field repairs are performed, annual audits of the work carried out in the field shall be performed to ensure that the requirements of the Certificate Holder's quality system are met. The audit shall include, but not be limited to performance testing in accordance with 4.6 of valve(s) that were repaired in the field. The audits shall be documented.

Proposed Language

Upon issuance of a *Certificate of Authorization*, provided field repairs are performed, ~~annual~~ audits of the work carried out in the field shall be performed on an annual basis. The intent of these audits is to ensure work in the field is completed in accordance with the ~~to ensure that the requirements of the~~ Certificate Holder's quality system~~.~~ ~~are met.~~ The scope and frequency of these audits shall be established in the quality system. The audit shall include, but not be limited to: ~~performance testing in accordance with 4.6 of valve(s) that were repaired in the field. The audits shall be documented.~~

a) Performance testing in accordance with 4.6 of valve (s) that were repaired in the field

b) Quality system requirements specific to field repair

c) Certificate Holder's applicable ASME Code sections, VR special process (if applicable in the field), and test medias from the Certificate of Authorization.

d) The audits shall be documented

4.9 COMPETENCY, TRAINING AND QUALIFICATION OF PERSONNEL

4.9.1 COMPETENCY OF PERSONNEL

The repair organization shall establish the skills, knowledge, competencies, and method to evaluate competencies required for each position within the organization having direct effect on the quality of pressure relief repair performed in accordance with the Certificate of Authorization.

4.9.21 CONTENTS OF TRAINING PROGRAM

The repair organization shall establish a documented in-house training program to ensure the defined skills, knowledge and competencies are achieved. . This program shall establish training objectives and provide a method of evaluating training effectiveness. As a minimum, training objectives for each positionknowledge level shall include:

a) Applicable ASME Code and NBIC requirements;
a)b) Applicable NBIC requirements;
c) Individual responsibilities of each function described within the organization's quality system;
d) Technical aspects for the applicable position held;
e) Mechanical skills for the applicable position held;
f) Special processes as applicable listed on the Certificate of Authorization.
b) Responsibilities within the organization's quality system; and
c) Knowledge of the technical aspects and mechanical skills for the applicable position held.

4.9.32 INITIAL EVALUATION AND ACCEPTANCE QUALIFICATION OF PERSONNEL

The Each repair organization shall complete an initial evaluation and acceptance of each individual's skills and competency prior to the individual being assigned to work without direct supervision. This evaluation and acceptance shall be documented.establish minimum qualification requirements for those positions within the organization as they directly relate to pressure relief valve repair. Each repair organization shall document the evaluation and acceptance of an individual's qualification for the applicable position.

4.9.43 ANNUAL EVALUATION AND ACCEPTANCE REVIEW OF PERSONNEL QUALIFICATION

The repair organization shall complete an annual evaluation and acceptance of each individual's skills and competency to verify proficiency as well as compliance with the certificate Holder's quality system. This evaluation shall include training records, documented evidence of work performed and on-the-job observations to demonstrate competency. annually review the qualifications of repair personnel to verify proficiency as well as compliance with the Certificate Holder's quality system. This review shall include training records, docu- mented evidence of work performed, and when necessary, monitoring job performance. The review evaluation shall be documented.

Subcommittee Installation

Last Name	First Name	Interest Category	Role	Exp. Date	More
Wadkinson	Melissa	Manufacturers	Chair	08/30/2021	Details
Bock	Jeanne		Secretary	01/30/2099	Details
Austin	Randall	Users	Member	10/30/2022	Details
Creacy	Todd	Authorized Inspection Agencies	Member	01/30/2021	Details
Downs	James	Manufacturers	Member	10/30/2022	Details
Halley	Geoffrey	General Interest	Member	08/30/2021	Details
Konopacki	Stanley	Users	Member	01/30/2023	Details
Patten	Don	Manufacturers	Member	01/30/2023	Details
Richards	H. Michael	General Interest	Member	08/30/2021	Details
Smith	Rex	Authorized Inspection Agencies	Member	01/30/2023	Details
Washington	Milton	Jurisdictional Authorities	Member	01/30/2023	Details
Wiggins	Edward	Jurisdictional Authorities	Member	03/30/2023	Details

NB11-1901

SUPPLEMENT X
INSTALLATION OF HIGH PRESSURE COMPOSITE PRESSURE VESSELS

SX.1 SCOPE

This supplement provides requirements for the installation of high-pressure composite pressure vessels. This supplement is applicable to pressure vessels with an MAWP not exceeding 15,000 psi, and is applicable to the following classes of vessels:

a) Metallic vessel with a Fiber Reinforced Plastic FRP) hoop wrap over the shell part of the vessel both load sharing)

b) Metallic vessel with a full FRP wrap (both load sharing)

c) FRP vessel with a non-load sharing metallic liner

d) FRP vessel with a non-load sharing non-metallic liner

SX.2 SUPPORTS

Design of supports, foundations, and settings shall consider the dead loads, live loads, wind, and seismic loads. Vibration and thermal expansion shall also be considered. The design of supports, foundations, and settings shall be in accordance with ASCE/SEI 7, *Minimum Design Loads for Buildings and Other Structures*. The importance factors used in calculating the seismic and wind loads shall be the

highest value specified for any category in ASCE/SEI 7.

SX.3 CLEARANCES

The pressure vessel installation shall allow sufficient clearance for normal operation, maintenance, and inspection. Stacking of pressure vessels is permitted. The minimum clear space between pressure vessels shall be 1 ft. vertical and 2 ft. horizontal. Vessel nameplates shall be visible after installation for inspection. The location of vessels containing flammable fluids shall comply with NFPA 2. The vessel owner shall document the vessel pressure and pipe diameters used as a basis for compliance with NFPA 2 location requirements.

SX.4 PIPING LOADS

Piping loads on vessel nozzles shall be determined by a formal flexibility analysis per ASME B31.12: paragraph IP-6.1.5(b). The piping loads shall not exceed the maximum nozzle loads defined by the vessel manufacturer.

SX.5 MECHANICAL CONNECTIONS

Mechanical connections shall comply with pressure vessel manufacturer’s instructions, and with requirements of the Jurisdiction. Connections to threaded nozzles shall have primary and secondary seals. The seal design shall include a method for detecting a leak in the primary seal. Seal functionality shall be demonstrated at the initial pressurization of the vessel.

SX.6 PRESSURE INDICATING DEVICES

Each pressure vessel shall be equipped with a pressure gage mounted on the vessel. The dial range shall be from 0 psi to not less than 1.25 times the vessel MAWP. The pressure gage shall have an opening not to exceed 0.0550in (1.4mm) (No. 54 drill size) at the inlet connection. In addition, vessel pressure shall be monitored by a suitable remote pressure indicating device with alarm having an indicating range of 0 psi to not less than 1.25 times the vessel MAWP.

SX.7 PRESSURE RELIEF DEVICES

Each pressure vessel shall be protected by pressure relief devices per the following requirements:

a) Pressure relief devices shall be suitable for the intended service.

b) Pressure relief devices shall be manufactured in accordance with a national or international standard and certified for capacity (or resistance to flow for rupture disk devices) by the National Board.

c) Dead weight or weighted lever pressure relief valves are prohibited.

d) Pressure relief valves shall not be fitted with lifting devices.

e) The pressure relief device shall be installed directly on the pressure vessel with no isolation valves between the vessel and the pressure relief device except:

1) When these isolation valves are so constructed or positively controlled below the minimum required capacity, that closing the maximum number of valves at one time will not reduce the pressure relieving capacity, or

2) Upon specific acceptance of the Jurisdiction, an isolation valve between vessel and its pressure relief device may be provided for vessel inspection and repair only. The isolation valve shall be arranged so it can be locked or sealed open.

f) The discharge from pressure relief device(s) shall be directed upward to prevent any impingement of escaping fluid upon the vessel, adjacent vessels, adjacent structures, or personnel. The discharge must be to outdoors, not under any structure or roof that might permit formation of a “cloud”. The pressure relief device(s) discharge piping shall be designed so that it cannot become plugged by animals, insects, rainwater, or other materials.

g) When a single pressure relieving device is used, it shall be set to operate at a pressure not exceeding the MAWP of the vessel. When the required capacity is provided in more than one pressure relieving device, only one device need be set at or below the MAWP, and the additional device(s) may be set to open at higher pressures but in no case at a pressure higher than 105% of the MAWP. The requirements of RR-130 of ASME Section X shall also apply.

h) The pressure relief device(s) shall have sufficient capacity to ensure the pressure vessel does not exceed the MAWP of that specified in the original code of construction.

i) The owner shall document the basis for selection of the pressure relief device(s) used, including capacity.

j) The owner shall have such analysis available for review by the Jurisdiction.

k) Pressure relief devices and discharge piping shall be supported so that reaction forces are not transmitted to the vessel.

l) Heat detection system: a heat activated system shall be provided so that vessel contents will be vented per f) (above), if any part of the vessel is exposed to a temperature greater than 220°F.

m) Positive methods shall be incorporated to prevent overfilling of the vessel.

SX.8 ASSESSMENT OF INSTALLATION

a) Isolation valve(s) shall be installed directly on each vessel, but not between the vessel and the pressure relief device except as noted in 3.7, e), above.

b) Vessels shall not be buried.

c) Vessels may be installed in a vault subject to a hazard analysis, verified by the manufacturer, owner, user, qualified engineer, or the Jurisdiction, to include as a minimum the following:

1) Ventilation

2) Inlet and outlet openings

3) Access to vessels

4) Clearances

5) Intrusion of ground water

6) Designed for cover loads

7) Explosion control

8) Ignition sources

9) Noncombustible construction

10) Remote monitoring for leaks, smoke, and fire

11) Remote controlled isolation valves

d) Fire and heat detection/suppression provisions shall comply with the requirements of the Jurisdiction and, as a minimum, include relief scenarios in the event of a fire or impending overpressure from heat sources.

e) Installation locations shall provide the following:

1) Guard posts shall be provided to protect the vessels from vehicular damage per NFPA 2. Protection from wind, seismic events shall be provided.

2) Supports and barriers shall be constructed of non-combustible materials.

3) Vessels shall be protected from degradation due to direct sunlight.

4) Access to vessels shall be limited to authorized personnel.

5) Any fence surrounding the vessels shall be provided with a minimum of two gates. The gates shall open outward, and shall be capable of being opened from the inside without a key.

6) Access for initial and periodic visual inspection and NDE of vessels, supports, piping, pressure gages or devices, relief devices and related piping, and other associated equipment.

7) Completed installations shall be validated as required by the Jurisdiction as addressing all of the above, and any requirements of the Jurisdiction, prior to first use. This verification shall be posted in a conspicuous location near the vessel and, when required, on file with the

Jurisdiction. Certificates shall be updated as required by mandated subsequent inspections.

8) Piping installation shall comply with ASME B31.12 or NFPA 2.

9) The vessels shall be electrically bonded and grounded per NFPA 55.

SX.9 LADDERS AND RUNWAYS

See NBIC Part 1, Section 1.6.4 *Ladders and Runways*

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~~ boiler and/or fuel fired pressure vessel combustion air ~~/~~ fuel ratios shall be analyzed, ~~adjusted~~adjusted, and values documented during commissioning to meet emission requirements of the Jurisdiction and/or ~~/~~ limits of the manufacturer ~~and Jurisdiction~~, as required.

May 11th – June 13th Main Committee Letter Ballot Comments:

Mr. Marty Toth: I understand the intent of this and partially support its intent. However, I have concerns with the verbiage, its structure, and assigned placement within Part 1, Section 1.

1) I do not see anything in the proposed verbiage that mentions “calibrated combustion analyzer” as stated in the general description.

2) The proper term should read either “air-fuel” or “fuel-air”, not air/fuel to indicate fuel-to-air ratio. The use of the forward slash indicates an alternative, as used in the proposed for “requirement/limits”.

3) Since this is in conjunction with the requirement in 1.6.9 why not spell out fuel fired boilers and/or fuel fired pressure vessels. The use of “equipment” is vague and can lead to confusion or misinterpretation (though used in several locations throughout the NBIC without definition). We are addressing pressure-retaining items, not a furnace, oven, etc.

4) Within the NBIC we should concentrate on the manufacturer’s “recommendations” and Jurisdictional Authority. At least for package boilers the manufacturer requires a Start-Up Report that indicates various commissioning information item, one of which is combustion reading. If this is what we are referring to why not just state that. I personally do not think we need anything beyond that. Anything beyond that opens up confusion.

NOTE: OGA’s outside of the Jurisdictional Authority that require NOx and CO reports require them on a regular and scheduled basis, not just at start-up/commissioning, we’re talking start-up in the proposed verbiage…right?

Location and Usage – Inspector – inspector	Comments
1.1 Scope Middle of main paragraph. "Otherwise the requirements specified in NBIC part 1 provide guidance for installers, contractor, owners, *inspectors*, and jurisdictions to ensure safe and satisfactory installation of specified pressure-retaining items.	The first part of the paragraph states that the owner-user is responsible for ensuring that the installation meet all the requirements of the Jurisdiction at the point of installation including licensing, registration, or certification of those performing installations. Inspector is little i. Could mean jurisdictional or other.
1.4.1 Responsibility b) The National Board Commissioned *Inspector* providing inservice inspection for the facility in which the pressure-retaining item is installed have the following responsibilities: 1) Verify the Boiler Installation Report (I-1 Report) has been completed and signed by the installer, when required by the jurisdiction, 2) Verify pressure-retaining items comply with the laws and regulations of the Jurisdiction governing the specific type of boiler or pressure vessel 3) Verify any repairs or alteration to pressure-retaining item, which are conducted prior to or during, the initial installation, are in accordance with the NBIC; 4) Request or assign jurisdictional identification number, when required by the Jurisdiction; and 5) Complete and service the first inservice inspection/certificate report to the Jurisdiction when required by the Jurisdiction c) Unless otherwise specifically required by the Jurisdiction, the duties of the inservice *inspector* do not include the installation's compliance to other standards and requirements (e.g., environmental, construction, electrical, undefined industry standards, etc.) for which other regulatory agencies have authority and responsibility to oversee.	Inservice inspector responsibilities under Part 1. Capital I IS endorsement Little I, but references a commission. This should be capitalized
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.*	Capital Inspector so a Commissioned inspector Inservice or shop? (IS vs. R) Do we want to differentiate?

4.6 testing and acceptance (pressure vessels) b. The completed pressure vessel shall be pressure tested in the shop or in the field in accordance to 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….	Is this the AI? It is a commissioned Inspector so Capital I is appropriate, but which one?
Supplement 1 Installation of Yankee Dryers **S1.2 ASSESSMENT OF INSTALLATION** a. The *Inspector* verifies that the owner or user is properly controlling the operating conditions of the dryer. The *Inspector* does this by reviewing the owners comprehensive assessments of the complete installation. f. To maintain produce quality, the dryer surface is periodically refurbished by grinding…. The manufacturer, or another qualified source acceptable to the *Inspector*, instead provided a series of curves that graphically defines these maximum allowable operating parameters…. h. If nonstandard load events (incidents) have occurred during installation, then the *Inspector* should ensure that an appropriate assessment of the structural integrity….	Inservice Inspector Capital I and context fits.
Supplement 2 - Pressure relief valves on the low-pressure side of steam pressure reducing valves **S2.2 PRESSURE RELIEF VALVE CAPACITY** b. By using the formula in NBIC Part 1, S2.3, *Inspectors* may calculate the required relieving capacities of the pressure relief valve(s) installed on the low-pressure side of the reducing valve.	Assume meant for inservice Capital I and context.
Supplement 5 Installation of thermal fluid heaters **S5.8.2 PRESSURE TEST** Prior to initial operation, the completed thermal fluid heater system, including pressure piping, pumps, stop valves, etc. shall be pressure tested in accordance with the manufacturer's recommendations. Hydrostatic testing of the system is not recommended due to possible contamination of the system. All pressure testing should be witnessed by an *Inspector*.	Prior to operation. Capitol I Is this an in-service or shop as it is the system test. AIA typically doesn't test completed systems but in-service don't inspect prior to operation.
Definitions Confined space - … the *Inspector* is a cautioned of the need to comply with…	Any commissioned Inspector.

Dutchman - Generally limited to tube or pipe cross-section replacement. … meeting the service requirements and installation procedures acceptable to the *Inspector*….	Dutchman are repair – shop/repair Not in-service.
National Board Commissioned *Inspector* - An individual who holds a valid and current National Board Commission.	Definition – No distinction between in-service and AIA
Owner-user *Inspector* - An individual who holds a valid and current National Board Commission.	Same definition as an NBIC commissioned inspector. Should we add to the definition? " and is employed by an Owner or User who has an Owner-User Inspection Organization?
Interpretations Multiple references to *Inspector.*	Most appear to reference repairs. Some are older references and difficult to ascertain from the Subject.
Location and Usage **Inspection - inspection**	
1.4 CERTIFICATION, INSPECTION, AND JURISDICTIONAL REQUIREMENTS b) The National Board Commissioned Inspector providing inservice inspection for the facility in which the pressure-retaining item is installed has the following responsibilities: 1) Verify the Boiler Installation Report (I-1 Report) has been completed and signed by the installer, when required by the Jurisdiction; 2) Verify pressure-retaining items comply with the laws and regulations of the Jurisdiction governing the specific type of boiler or pressure vessel; 3) Verify any repairs or alterations to pressure-retaining items, which are conducted prior to, or during, the initial installation, are in accordance with the NBIC; 4) Request or assign jurisdictional identification number, when required by the Jurisdiction; and 5) Complete and submit the first inservice inspection/certificate report to the Jurisdiction when	Inspection – little i but by context should be I. Also should be I, not i.

required by the Jurisdiction.	
1.4.2 EQUIPMENT CERTIFICATION b) Package boilers having external piping disassembled and shipped with the boiler shall have a method for traceability of the disassembled piping that can be verified at the time of installation and inspection. The manufacturer of the package boiler is responsible for determining a method of traceability.	Little i, but unclear.
1.4.4 INSPECTION All boilers, pressure vessels, piping, and other pressure-retaining items shall be inspected and tested after installation and prior to commencing operation. 1.4.5 BOILER INSTALLATION REPORT a) Upon completion, inspection, testing, and acceptance of the installation, the installer shall complete and certify the Boiler Installation Report (I-1) for all power boilers, hot-water heating boilers, steam-heating boilers, hot-water supply boilers, and potable water heaters.	Little i, the installation report is by the installer. Not an Inspector reference.
1.6.4 LADDERS AND RUNWAYS a) All walkways, runways, and platforms shall be: 1) of metal construction or equivalent material; 2) provided between or over the top of boilers, heaters, or vessels that are more than 8 ft. (2.4 m) above the operating floor to afford accessibility for normal operation, maintenance, and inspection;	Little i. Reference to generic inspection activities that may include big I Inspection. (“Generic i” in the following cases)
2.3.3 CLEARANCES	

a) Boiler installations shall allow for normal operation, maintenance, and inspections. There shall be at least 36 in. (915 mm) of clearance on each side of the boiler to enable access for maintenance and/or inspection activities. Boilers operated in battery shall not be installed closer than 48 in. (1220 mm) from each other. The front or rear of any boiler shall not be located nearer than 36 in. (915 mm) from any wall or structure. e) Boilers with a bottom opening used for inspection or maintenance shall have at least 12 in. (305 mm) of unobstructed clearance.	Generic i.
2.7.5 BLOWOFF q) Where necessary to install a blowoff tank underground, it shall be enclosed in a concrete or brick pit with a removable cover so that inspection of the entire shell and heads of the tank can be made.	Generic i.
2.10 TESTING AND ACCEPTANCE 2.10.1 GENERAL a) Care shall be exercised during installation to prevent loose weld material, welding rods, small tools, and miscellaneous scrap metal from getting into the boiler. Where possible, an inspection of the interior of the boiler and its appurtenances shall be made for the presence of foreign debris prior to making the final closure.	Generic i.
2.10.6 BOILER INSTALLATION REPORT a) Upon completion, inspection, and acceptance of the installation, the installer shall complete and certify the Boiler Installation Report I-1. See NBIC Part 1, 1.4.5.1.	Not an Inspector. Little i. ?

3.3.4 CLEARANCES c) Heating boilers shall be located so that adequate space is provided for proper operation, maintenance, and inspection of equipment and appurtenances, which shall include the removal of tubes if applicable.	Generic i.
3.7.4 FEEDWATER, MAKEUP WATER, AND WATER SUPPLY a) Steam Boilers Feedwater or water treatment shall be introduced into a boiler through the return piping system. Alternatively, feedwater or water treatment shall be introduced through an independent connection. The water flow from the independent connection shall not discharge directly against parts of the boiler exposed to direct radiant heat from the fire. Feedwater or water treatment shall not be introduced through openings or connections provided for inspection or cleaning, safety valve, water column, water-gage glass, or pressure gage. The feedwater pipe shall be provided with a check valve, or a backflow preventer containing a check valve, near the boiler and a stop valve or cock between the check valve and the boiler, or between the check valve and the return pipe system. b) Hot-Water Boilers Makeup water may be introduced into a boiler through the piping system or through an independent connection. The water flow from the independent connection shall not discharge directly against parts of the boiler exposed to direct radiant heat from the fire. Makeup water shall not be introduced through openings or connections provided exclusively for inspection or cleaning, safety relief valve, pressure gage, or temperature gage. The makeup water pipe shall be provided with a check valve, or a backflow preventer containing a check valve, near the boiler and a stop valve or cock between the check valve and the boiler, or between the check valve and the piping system.	Generic i

3.10.3 BOILER INSTALLATION REPORT a) Upon completion, inspection, and acceptance of the installation, the installer shall complete and certify the Boiler Installation Report I-1. See NBIC Part 1, 1.4.5.1. 4.3.2 CLEARANCES a) All pressure vessel installations must allow sufficient clearance for normal operation, maintenance, and inspection (internal and external).	Not the in-service inspector prior to first "inspection"
4.5.6 INSTALLATION AND DISCHARGE PIPING REQUIREMENTS e) There shall be no intervening stop valves…except under the following conditions: 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	Generic i.

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. h) Pressure relief devices shall be installed so they are readily accessible for inspection, repair, or replacement.	
4.7.2 CLEARANCE AND ACCEPTABILITY a) The required nameplate (marking or stamping) should be exposed and accessible. b) The openings when required should be accessible to allow for entry for inspection and maintenance.	Generic i.
5.3.6 INLET AND DISCHARGE PIPING REQUIREMENTS e) There shall be no intervening stop valves … except under the following conditions: 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	Generic i.

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 i) Pressure relief devices shall be installed so they are accessible for inspection, repair, or replacement. 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.	
5.4 EXAMINATION, INSPECTION, AND TESTING The owner shall ensure that all examinations, inspections, and tests required by the code of construction have been performed prior to operation.	As it is required by the code of construction, should this be a capitol I? Why both examinations and inspections.
S3.2.1 GENERAL REQUIREMENTS (ENCLOSED AND UNENCLOSED AREAS) a) LCDSVs shall not be located within 10 feet (3,050 mm) of elevators, unprotected platform ledges, or other areas where falling would result in dropping distances exceeding half the container height. b) LCDSVs shall be installed with sufficient clearance for filling, operation, maintenance, inspection, and replacement.	Generic i
S5.3.4 CLEARANCES	Generic i

a) Thermal fluid heater installations shall allow for normal operation, maintenance, and inspections. There shall be at least 18 in. (460 mm) of clearance on each side of the thermal fluid heater to enable access for maintenance and/or inspection activities. Thermal fluid heaters operated in battery shall not be installed closer than 18 in. (460 mm) from each other. The front or rear of any thermal fluid heater shall not be located nearer than 36 in. (915 mm) from any wall or structure. c) Heaters with a bottom opening used for inspection or maintenance shall have at least 18 in. (460 mm) of unobstructed clearance.	
S5.8.1 GENERAL a) Care shall be exercised during installation to prevent loose weld material, welding rods, small tools, and miscellaneous scrap metal from getting into the thermal fluid system. Where possible, an inspection of the interior of the thermal fluid heater and its appurtenances shall be made for the presence of foreign debris prior to making the final closure.	Generic i
S5.8.6 INSTALLATION REPORT a) Upon completion, inspection, and acceptance of the installation, the installer should complete and certify the Boiler Installation Report I-1. See 1.4.5.1.	Generic i?
S7.3.1 RECEIVING AND INITIAL INSPECTION OF GRAPHITE PRESSURE EQUIPMENT Graphite equipment should be thoroughly inspected and tested as it is received in order to identify any in transit damage. Whenever possible, this inspection should be made before the exchanger is removed from the carrier. To verify the unit has arrived in an undamaged condition, a pressure test may be performed. The bolt torques and spring heights should be verified prior to a pressure test. This pressure test shall not exceed the MAWP of the vessel….	This is not a Inspector responsibility?

PART 1, SECTION 8 INSTALLATION — PREPARATION OF TECHNICAL INQUIRIES TO THE NATIONAL BOARD INSPECTION CODE COMMITTEE SKIPPED INSPECTION IN THIS SECTION	
Authorized Inspection Agency (AIA) **Inservice**: An Authorized Inspection Agency is either: a) a jurisdictional authority as defined in the National Board Constitution; or b) an entity that is accredited by the National Board meeting NB-369, Accreditation of Authorized Inspection Agencies Performing Inservice Inspection Activities; NB-371, Accreditation of Owner-User Inspection Organizations (OUIO); or NB-390, Qualifications and duties for Federal Inspection Agencies (FIAs) Performing Inservice Inspection Activities. **New Construction**: An Authorized Inspection Agency is one that is accredited by the National Board meeting the qualification and duties of NB-360, Criteria for Acceptance of Authorized Inspection Agencies for New Construction. **Authorized Nuclear Inspection Agency** — An Authorized Inspection Agency intending to perform nuclear inspection activities and employing nuclear Inspectors / Supervisors	
Inspection — A process of review to ensure engineering design, materials, assembly, examination, and testing requirements have been met and are compliant with the code.	Capitol I Inspection.
Jurisdiction — The National Board member Jurisdiction where the organization is located. Alternatively,	

where the Jurisdiction elects not to perform the review or where there is no Jurisdiction or where the Jurisdiction is the organization's Authorized Inspection Agency, The National Board of Boiler and Pressure Vessel Inspectors will represent the Jurisdiction. At the Jurisdiction's discretion, the Jurisdiction may choose to be a member of the review team if the Jurisdiction chooses not to be the team leader.	
NBIC — The National Board Inspection Code published by The National Board of Boiler and Pressure Vessel Inspectors.	
Owner-User Inspection Organization — An owner or user of pressure-retaining items that maintains an established inspection program, whose organization and inspection procedures meet the requirements of the National Board rules and are acceptable to the jurisdiction or jurisdictional authority wherein the owner or user is located.	
Some in Interpretations	
Index **Inservice Inspection** (Introduction), (1.4.1), (8.1), (9.1) **Inspection** (Foreword), (Introduction), (1.4), (1.4.1), (1.4.2), (1.4.4), (1.4.5), (1.6.4), (2.3.3), (2.7.5), (2.10.1), (2.10.6), (3.3.4), (3.7.4), (3.10.3), (4.3.2), (4.5.6), (4.7.2), (5.3.6), (5.4), (S1.2), (S3.2.1), (S5.3.4), (S5.8.1), (S5.8.6), (7.1), (8.4), (9.1) **Owner-User Inspection Organization**	

(Introduction), (9.1)	

Item 19-81

Correction to value in Table 3.7.9.1-b

Background Information: 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 Nonpressurized 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.

Proposed Change:

TABLE 3.7.9.1-b

EXPANSION TANK CAPACITIES FOR FORCED HOT-WATER SYSTEMS

Based on average operating water temperature 195°F [91°C], fill pressure 12 psig [83 kPa], and maximum operating pressure 29 psig [200 kPa]		
Tank Capacities, gallon (l)		
System Volume	**Pressurized Diaphragm Type**	**Nonpressurized Type**
100 (379)	9 (34)	~~18 (68)~~15 (57)
200 (757)	17 (64)	30 (114)
300 (1136)	25 (95)	45 (170)
400 (1514)	33 (125)	60 (227)
500 (1893)	42 (159)	75 (284)
1,000 (3785)	83 (314)	150 (568)
2,000 (7571)	165 (625)	300 (1136)

Item 20-13
Expansion Tank Maximum Operating Pressure
Part 1, 3.7.9.1 a) 2) and Table 3.7.9.1-b
Submitted by: Luis Ponce – lponce@nationalboard.org

Explanation of Need:
Table 3.7.9.1-b - 30 psig matches note (a) of Table HG-709.2 of ASME Sect IV. 3.7.9.1 a) 2) The "except for prepressurized tanks" phrase is misplaced and belongs with the provisions for draining tanks. See last sentence in HG-709.2 on p. 62 and first sentence in that same section just prior to the formulas on pg. 63.

Background Information:
Prior to the 2007 Edition/2010 Addenda the table value was 30 psig. For whatever reason, it was changed to 29 psig in this issue. Prior to the 2007 Edition/2007 Addenda the paragraph read correctly.

Proposed Change:

3.7.9.1 EXPANSION TANKS AND PIPING FOR STEAM HEATING, HOT-WATER HEATING AND HOT-WATER SUPPLY BOILERS

a) Expansion Tanks for Hot-Water Heating and Hot-Water Supply Boilers

All hot-water heating systems incorporating hot-water tanks or fluid relief columns shall be so installed as to prevent freezing under normal operating conditions.

1) Heating Systems With Open Expansion Tank

An indoor overflow from the upper portion of the expansion tank shall be provided in addition to an open vent, the indoor overflow shall be carried within the building to a suitable plumbing fixture or drain.

2) Closed Heating Systems

An expansion tank shall be installed that will be consistent with the volume and capacity of the system. If the system is designed for a working pressure of 30 psig (200 kPa) or less, the tank shall be suitably designed for a minimum hydrostatic test pressure of 75 psig (520 kPa). Expansion tanks for systems designed to operate above 30 psig (200 kPa) shall be constructed in accordance with an acceptable code of construction. Provisions shall be made for draining the tank without emptying the system, except for prepressurized tanks. ~~. Except for prepressurized tanks, t~~The minimum capacity of the closed-type expansion tank should be determined from NBIC Part 1, Tables 3.7.9.1-a and 3.7.9.1-b or from the following formula where the necessary information is available:

TABLE 3.7.9.1-b
EXPANSION TANK CAPACITIES FOR FORCED HOT-WATER SYSTEMS

Based on average operating water temperature 195°F [91°C], fill pressure 12 psig [83 kPa], and maximum operating pressure ~~29~~ 30 psig [200 kPa]		
Tank Capacities, gallon (l)		
System Volume	**Pressurized Diaphragm Type**	**Nonpressurized Type**

Item Number: 20-41

ASME CSD-1 2018 Edition

CW-510 Requirements for Steam and Hot-Water Heating Boilers

The safety and safety relief valves of all steam and hot-water heating boilers shall conform to the ASME Boiler and Pressure Vessel Code, Section I or Section IV, as applicable.

NBIC Part I 2019 Edition

2.9.1 (b) Pressure relief valve shall be manufactured in accordance with a national or international standard.

Proposed change: Pressure relief valve shall be manufactured in accordance with a national or international standard and be certified for capacity or flow resistance by the National Board.

(Note: certified for capacity or flow resistance by the NB is referenced in 4.5.1(a))

3.9.1 (only mentions installation of PRV)

Proposed change: (a)Pressure relief valve shall be manufactured in accordance with a national or international standard and be certified for capacity or flow resistance by the National Board.

(b) The following general requirements pertain to installing, mounting and connecting pressure relief valves on heating boilers.

(Note: certified for capacity or flow resistance by the NB is referenced in 4.5.1(a))

Note: 3.9 says: See NBIC Part 1, 3.2 for the scope of pressure retaining items covered by these requirements. (3.2 is definitions)

Proposed change: See NBIC Part 1, 3.1 for the scope of pressure retaining items covered by these requirements.

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.

1.6 CHANGE OF SERVICE

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

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

1.7 SCRAPPING PRESSURE RETAINING ITEMS

The owner or user shall deface the code nameplate(s) of any pressure retaining item that is scrapped. The removal or defacement of the Code nameplate(s) should be verified by the Inspector, and the National Board form NB-XXX shall be completed and submitted to the National Board and Jurisdiction, if required.

ADD DEFINITION:

SCRAPPED – Permanent removal from service by owner's or user's procedures.

Scrapping of Pressure Retaining Items

In accordance with provisions of the National Board Inspection Code

1.Submitted to:

Name of Jurisdiction

Address

Phone Number

2. Submitted by:

(Name of Owner/User)

Address

Phone Number

3. Manufactured by:
(name and address)

4. Location of Installation:
(address)

5. Manufacturer's Data Report: ☐ YES ☐ NO

6. Item Registered with National Board: ☐ YES ☐ NO NB Number: _____

7. Item Identification:

Year Built: _____ Mfr. Serial No.: _____

Type: _____ Jurisdiction no.: _____

Dimensions: _____ MAWP: _____

8. Date of removal or defacement of the Code nameplate(s) _____

9. I certify that to the best of my knowledge and belief the statements in this report are correct, and with provisions of the National Board Inspection Code.

Name of Owner or User: _____

Signature: _____ Date: _____

Instructions for Completing the Form NB-XXX, *Scrapping of Pressure Retaining Items Form*

Items 1-9 shall be completed by the owner, user, or "R" Stamp Holder making the request.

1) The name, address, and phone number of the Jurisdiction, Authorized Inspection Agency (when there is no Jurisdiction) the form is being submitted to for approval.
2) Enter the name and address of your company or organization.
3) Enter the name and address of the manufacturer shown on the name plate.
4) Enter the name and address of the location where the pressure-retaining item is installed. If this is the same as number 2, check the box "same as # 4."
5) Manufacturer's Data Report Attached-check the appropriate box.
6) Is the pressure-retaining item registered with the National Board? Check the appropriate box. If yes, provide the National Board Registration Number.
7) Provide as much information as known to help identify the pressure-retaining item.
8) Enter date the removal or defacement of the Code nameplate.
9) Enter the name and signature of the owner, user, or "R" Stamp Holder (and "R" Stamp number if applicable).

Note: Once completed the requester shall file a copy with the Jurisdiction where the pressure retaining item is installed, the National Board (if registered with the National Board), and the owner or user of the vessel if the request was made by an "R" Stamp Holder, and upon request to the Authorized Inspection Agency who witnessed the removal or defacement of the nameplate.

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1.4.1 PERSONAL SAFETY REQUIREMENTS FOR ENTERING CONFINED SPACES

a) No pressure-retaining item shall be entered until it has been properly prepared for inspection. The owner or user and Inspector shall jointly determine that pressure-retaining items may be entered safely. This shall include:

1) Recognized hazards associated with entry into the object have been identified by the owner or user and are brought to the attention of the Inspector, along with acceptable means or methods for eliminating or minimizing each of the hazards;

2) Coordination of entry into the object by the Inspector and owner or user representative(s) working in or near the object;

3) Personal protective equipment required to enter an object shall be used. This may include, among other items, protective outer clothing, gloves, respiratory protection, eye protection, foot protection, and safety harnesses. The Inspector shall have the proper training governing the selection and use of any personal protective clothing and equipment necessary to safely perform each inspection. Particular attention shall be afforded respiratory protection if the testing of the atmosphere of the object reveals any hazards

4) Completing and posting of confined space entry permits, as applicable; and

5) An effective energy isolation program (lock out and/or tag out) is in place and in effect that will prevent the unexpected energizing, start-up, or release of stored energy.

b) The Inspector shall determine that a safe atmosphere exists before entering the pressure-retaining item. The atmosphere shall be verified by the owner or user as directed by the Inspector.

1) The oxygen content of the breathable atmosphere shall be between 19.5% and 23.5%.
2) If any flammable or combustible materials are present in the atmosphere they shall not exceed 10% of their Lower Explosive Limit (LEL) or Lower Flammable Limit (LFL).
3) The Inspector shall not enter an area if toxic, flammable or inert gases, vapors or dusts are present and above acceptable limits

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c) Remote visual inspection is an acceptable alternative to confined space entry provided the requirements of 4.2.1 c) are met and where allowed by the jurisdiction.

1.4.2 EQUIPMENT OPERATION

The Inspector shall not operate owner or user equipment. Operation shall be conducted only by competent owner or user employees familiar with the equipment and qualified to perform such tasks.

PART 2, SECTION 4 INSPECTION — EXAMINATIONS, TEST METHODS, AND EVALUATIONS

4.1 SCOPE

This section describes acceptable examination and test methods that are available to the Inspector during inspection of pressure-retaining items. This section also describes evaluation of test results and assessment methodologies.

4.2 NONDESTRUCTIVE EXAMINATION METHODS (NDE)

a) Listed below is a variety of nondestructive examination methods that may be employed to assess the condition of pressure-retaining items. The skill, experience, and integrity of the personnel performing these examinations are essential to obtain meaningful results. The Inspector should review the methods and procedures to be employed to ensure compliance with jurisdictional requirements.

b) Generally, some form of surface preparation will be required prior to use of these examination methods. When there is doubt as to the extent of a defect or detrimental condition found in a pressure-retaining item, the Inspector is cautioned to seek competent technical advice and supplemental NDE.

c) Personnel performing examination and test methods shall have proper training and certification, as required by the owner and acceptable to the Inspector and Jurisdiction, if required.

4.2.1 VISUAL

a) Visual examination is the basic method used when conducting an inservice inspection of pressure-retaining items. Additional examination and test methods may be required at the discretion of the Inspector to provide additional information to assess the condition of the pressure-retaining item.

b) Visual examination is an inspection method to ascertain the surface condition of the pressure-retaining item. The Inspector should be aware of recognizing various surface features and comparing these features with damage mechanisms listed in NBIC Part 2, Section 3 that could indicate exposure of the pressure-retaining item to harmful corrosion or elevated temperature service.

c) ~~In some cases the Inspector may have limited or no access while performing an inspection of the pressure-retaining item. Subject to approval of the Jurisdiction, remote camera or fiber optic devices may be considered acceptable methods to view and record the surface condition of the pressure-retaining item.~~

c) Remote Visual Inspection is an acceptable method of visual examination if the process is agreed upon by the owner and acceptable to the Inspector and Jurisdiction.

i) For Remote Visual Inspection, plans are reviewed and approved by the Inspector.

ii) The Inspector shall be present at time of data collection.

iii) The Inspector will be provided a dedicated monitor that has a resolution at least equal to that obtainable by direct observation, care should be taken to minimize glare on the viewing screen.

iv) The Inspector shall have direct communication with the operator of the remote visual camera.

v) For Remote Visual Inspections, the final report is acceptable to the Inspector / Jurisdiction and all raw data is available to the Inspector / Jurisdiction as needed.

vi) For Remote Visual Inspections, the inspection procedure shall reference a validated qualification of the equipment, including verification that the equipment is safe for use in the environment it will be operating in. Equipment validation will refer to ASME BPVC Section V. As a minimum the equipment shall meet:

a. 1/32" simulated defect identification
b. Minimum light intensity of 100 fc
c. Not less than 30deg offset to the surface to be examined
d. Resolution at least equal to that obtainable by direct observation

2.3.6.5 INSPECTION OF PRESSURE VESSELS FOR HUMAN OCCUPANCY (PVHO'S)

d) Inspection of parts and appurtenances (e.g., piping systems, pressure gage, bottom drain)

1) As stated above, cast iron is not allowed on PVHOs and shall be replaced with parts fabricated with other suitable materials, in accordance with ASME Code Section II.

2) If valves or fittings are in place, check to ensure that these are complete and functional.

3) The Inspector shall note the pressure indicated by the gage and compare it with other gages on the same system. If the pressure gage is not mounted on the vessel itself, it should be ascertained that the gage is installed on the system in such a manner that it correctly indicates actual pressure in the vessel. Lines leading to chamber primary depth gages should connect only to the depth gage.

4) The Inspector shall verify that the vessel is provided with a drain opening.

5) The system should have a pressure gage designed for ~~at least~~ the most severe condition of ~~coincident~~ pressure in normal operation. This gage should be clearly visible to the person adjusting the setting of the pressure control valve. The graduation on the pressure gage shall be graduated to not less than 1.5 times the pressure at which the lowest safety/relief valve is set.~~MAWP of the vessel.~~

6) Provisions should be made to calibrate pressure gages or to have them checked against a standard test gage.

7) Any vents and exhausts should be piped at least 10 ft. (3.0 m) from any air intake.

8) Low points should be fitted with drains.

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_0 = 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.

Action Item Request Form

CODE REVISIONS OR ADDITIONS

Request for Code revisions or additions shall provide the following:

a) Proposed Revisions or Additions

Current text is incomplete with respect to inspecting riveted joints for failure. This proposal suggests adding more text, found in historic inspection documents, to further assist and direct the field inspector for assessing the condition of a riveted joint.

Existing Text:

S2.10.7 LIMITATIONS

a) The maximum allowable working pressure shall be the lesser of that calculated in accordance with NBIC Part 2, S2.10, or the MAWP established by the original manufacturer.

b) The shell or drum of a boiler in which a "lap seam crack" extending parallel to the longitudinal joint and located either between or adjacent to rivet holes, when discovered along a longitudinal riveted joint for either butt or lap joint, shall be permanently discontinued for use under steam pressure, unless it is repaired with jurisdictional approval.

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

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

c) Background Information

Review of the NBIC shows that failure indicators of riveted seams have not been identified or itemized. This proposal addresses this oversite.

Referenced standards, related discussion follow proposed wording.

Proposed wording

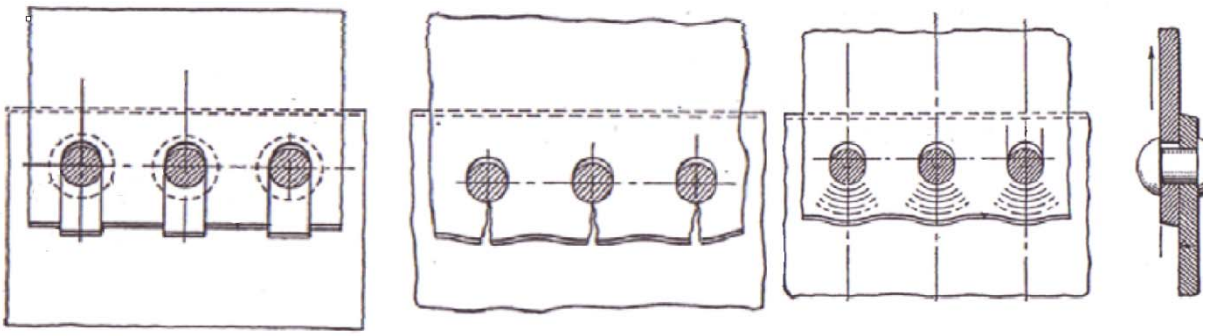
S2.10.2.3 INSPECTION OF RIVETED SEAMS

A riveted joint in a vessel subjected to pressure may fail in a number of different ways, depending on the type and relative proportions of the joint. Methods of failure may be classified as follows:

a.) Rivets may shear off.
b.) The plate may tear along the centerline of the row of rivets.
c.) The plate may shear in front of the rivets.
d.) The plate may tear from the outer edge of the rivet hole to the caulking edge.
e.) The plate may crush in front of the rivets.

Figure S2.10.2.3 illustrates visual indicators of (c), (d), (e). Inspection shall visually inspect for cracked or stressed plate material along a riveted joint. Indications of failure shall be monitored or repaired, at the discretion of the jurisdiction.

FIGURE S2.10.2.3



Note: Good engineering practice requires that the lap of plate outside rivet holes, measured from the outer edge of the rivet holes to the edge of the plate must be at least equal to the diameter of the rivet hole.

Referenced text:

Steam Boiler Design, Part 2, Great Britain, 1922:

20. Methods of Failure of Riveted Joint.—A riveted joint in a vessel subjected to pressure may fail in a number of different ways, depending on the type and relative proportions of the joint; but the simplest methods of failure may be illustrated by taking a single-riveted lap joint as an example. With such a joint, the methods of failure may be classified as follows:

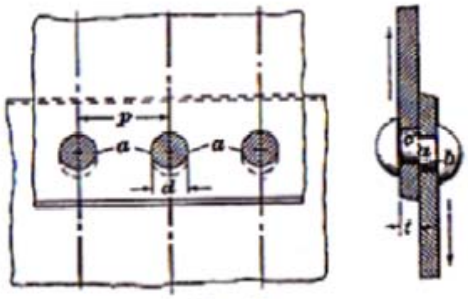


FIG. 19

1. The rivets may shear off, as shown in Fig. 19.

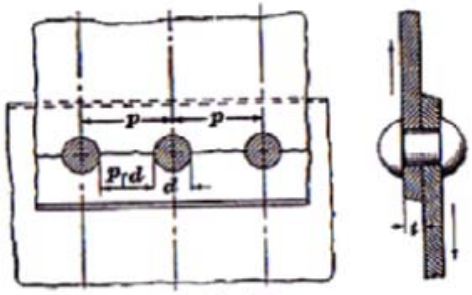


FIG. 20

2. The plate may tear along the center line of the row of rivets, as shown in Fig. 20.

3. The plate may crush in front of the rivets, as shown in Fig. 21.

4. The plate may shear in front of the rivets, as shown in Fig. 22 (*a*).

5. The plate may tear from the outer edge of the rivet hole to the calking edge, as shown in Fig. 22 (*b*).

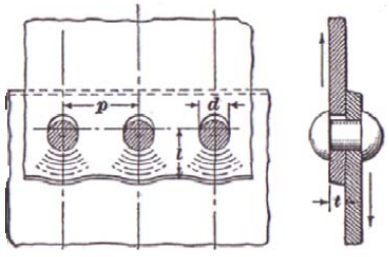


FIG. 21

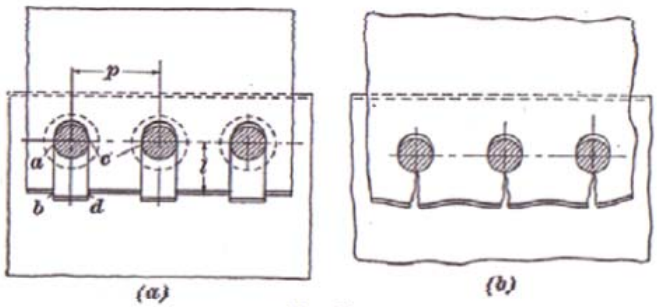


FIG. 22

The provided Note is also important, because a design that does not adhere to this rule may need a different joint efficiency value than what is provided in TABLE S2.10.6. This rule has existed but is not necessarily followed in pre-code boilers.

ASME, 1914:

183 On longitudinal joints, the distance from the centers of rivet holes to the edges of the plates, except rivet holes in the ends of butt straps, shall be not less than one and one-half times the diameter of the rivet holes.

Canadian Interprovincial Standard, 1931:

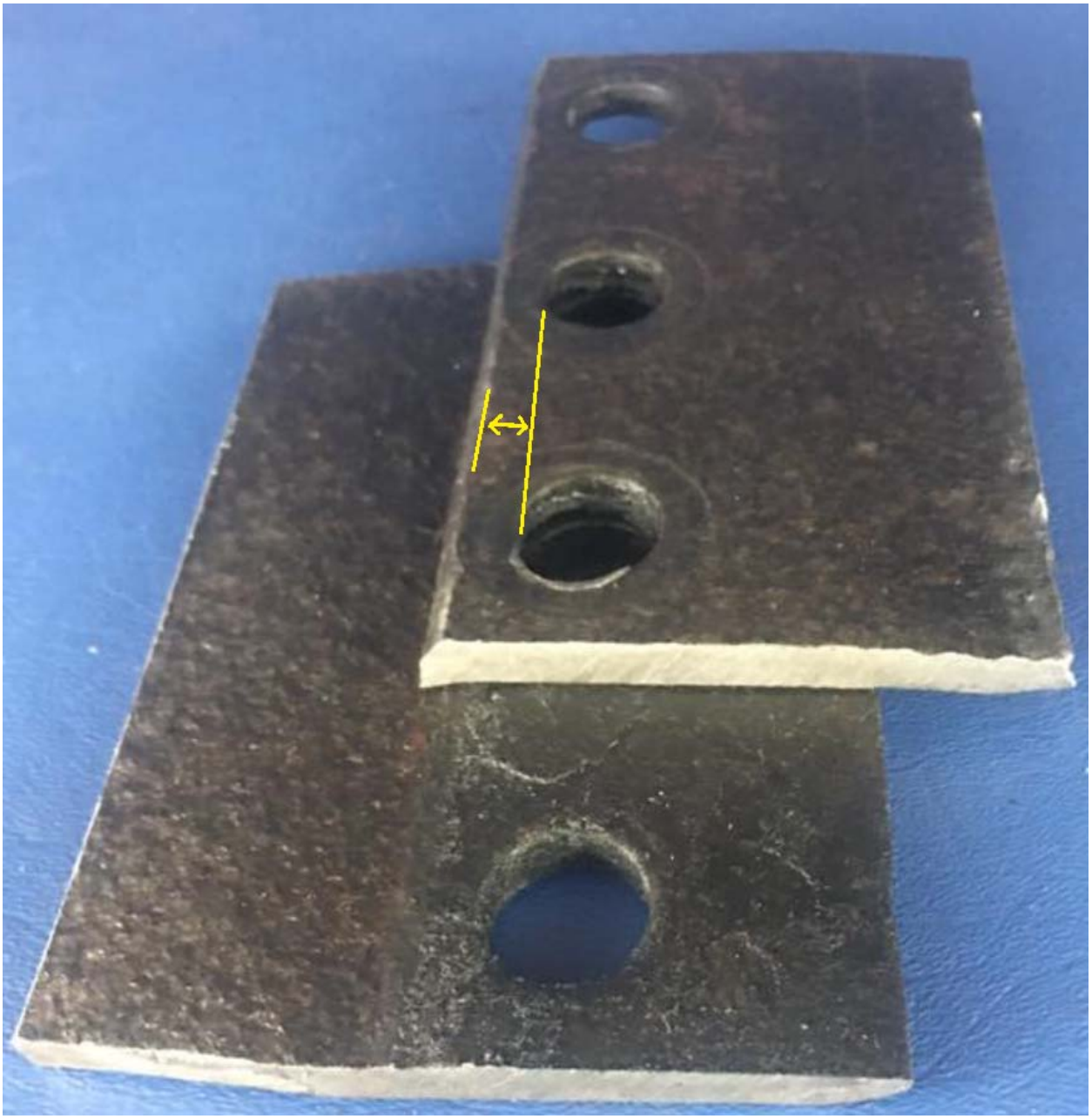
Lap Outside Rivet Holes

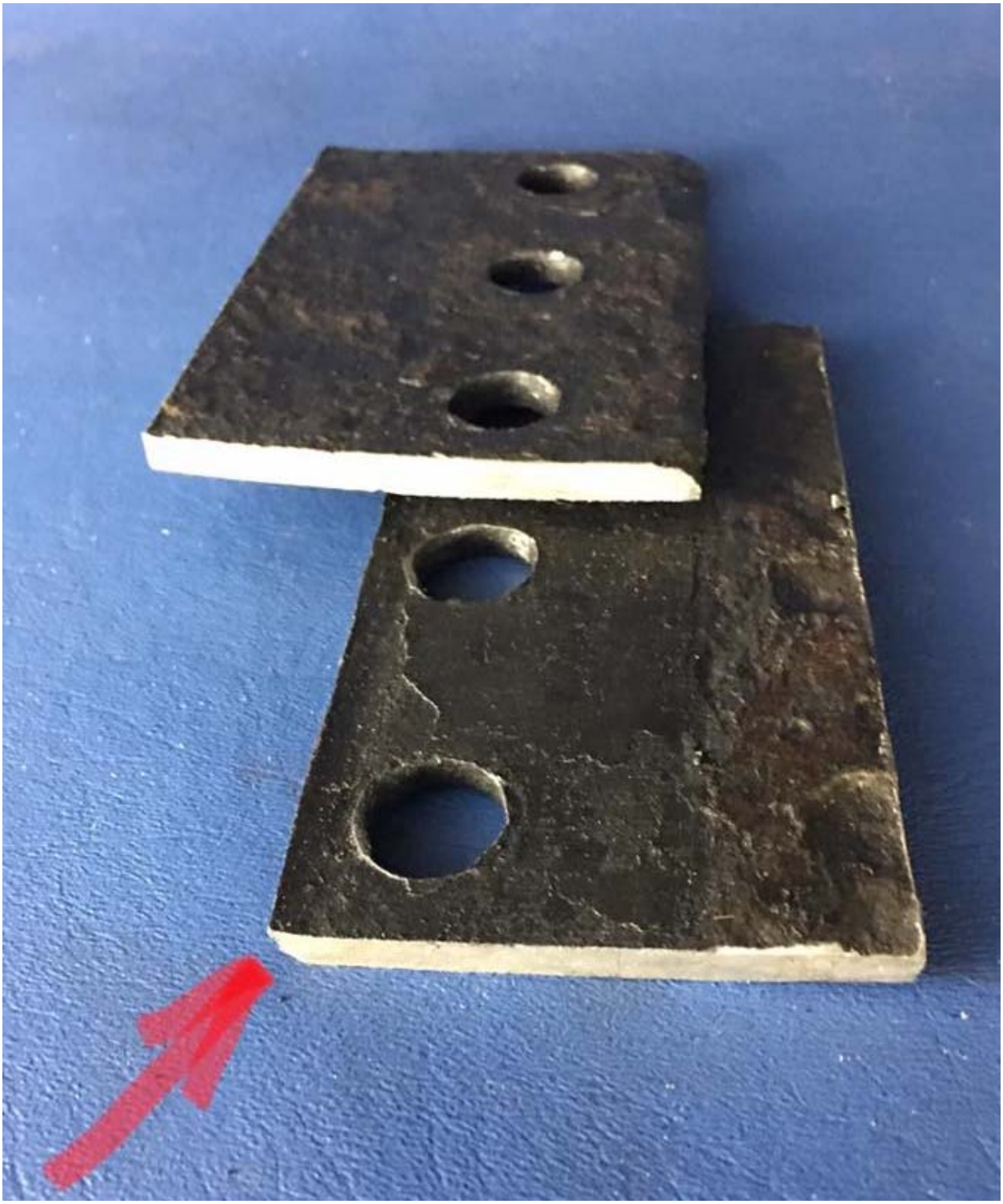
199. The lap of plate outside rivet holes measured from the outer edge of the rivet holes to edge of plate must be at least equal to diameter of rivet hole, and must not be more than 1/8 inch in excess of the diameter of the rivet hole.

Thurston, 1888:

tion. The joint is so proportioned that the fracture will occur by shearing the rivets rather than by breaking out the edge of the sheet or tearing away the lap bodily. The lap usually extends beyond the rivet-hole about 1.5 times the diameter of the rivet.

Single-row lap seam from an 1881 6hp Russell traction engine:





2.2.12.7 THERMAL FLUID HEATERS

a) Design and Operating Features

1) Many thermal fluid heaters are pressure vessels in which a synthetic or organic fluid is heated or vaporized. Some thermal fluid heaters operate at atmospheric pressure. The fluids are typically flammable, are heated above the liquid flash point, and may be heated above the liquid boiling point. The heaters are commonly direct-fired by combustion of a fuel or by electric resistance elements. Heater design may be similar to an electric resistance heated boiler, to a firetube boiler or, more commonly, to a watertube boiler. Depending on process heating requirements, the fluid may be vaporized with a natural circulation, but more often, the fluid is heated and circulated by pumping the liquid. Use of thermal fluid heating permits heating at a high temperature with a low system pressure (600°F to 700°F [316°C to 371°C] at pressures just above atmospheric). To heat water to those temperatures would require pressures of at least 1,530 psig (10.6 MPa).

2) Nearly all thermal heating fluids are flammable. Leaks within a fired heater can result in destruction of the heater. Leaks in external piping can result in fire and may result in an explosion. Water accumulation in a thermal heating system may cause upsets and possible fluid release from the system if the water contacts heated fluid (remember, flashing water expands approximately 1,600 times). It is essential for safe system operation to have installed and to maintain appropriate fluid level, temperature and flow controls for liquid systems, and level, temperature, and pressure controls for vapor systems. Expansion tanks used in thermal heater systems, including vented systems, should be designed and constructed to a recognized standard such as ASME Section VIII, Div. 1, to withstand pressure surges that may occur during process upsets. This is due to the rapid expansion of water exceeding the venting capability.

3) ~~3)~~ Because heat transfer fluids contract and become more viscous when cooled, proper controls and expansion tank venting are required to prevent low fluid level and collapse of the tank. Some commonly used fluids will solidify at temperatures as high as 54°F (12°C). Others do not become solid until -40°F (-40°C) or even lower. The fluids that become viscous will also become difficult to pump when cooled. Increased viscosity could cause low flow rates through the heater. The heater manufacturer recommendations and the fluid manufacturer's Material Safety Data Sheets (MSDS) should be reviewed for heat tracing requirements.

4) It is recommended that thermal fluid heaters have stack gas temperature indicators, alarms and safety shut down devices. Stack gas temerpatures must be monitored daily while in operation.

b) Industrial Applications

Thermal fluid heaters, often called boilers, are used in a variety of industrial applications such as solid wood products manufacturing, resins, turpentines, and various types of chemicals, drugs, plastics, corrugating plants, and wherever high temperatures are required. They are also frequently found in asphalt plants for heating of oils,

tars, asphalt pitches, and other viscous materials. Many chemical plants use this type of heater in jacketed reactors or other types of heat exchangers.

c) ~~Inspection~~

~~1) Inspection of thermal fluid heaters typically is done in either the operating mode or the shutdown mode. Internal inspections, however, are rarely possible due to the characteristics of the fluids and the need to drain and store the fluid. Reliable and safe operation of a heater requires frequent analysis of the fluid to determine that its condition is satisfactory for continued operation. If the fluid begins to break down, carbon will form and collect on heat transfer surfaces within the heater. Over- heating and pressure boundary failure may result. Review of fluid test results and control and safety device maintenance records are essential in determining satisfactory conditions for continued safe heater operation.~~

~~2)~~1) Due to the unique design and material considerations of thermal fluid heaters and vaporizers, common areas of inspection are:

a. Design — Specific requirements outlined in construction codes must be met. Some jurisdictions may require ASME Section I or Section VIII construction. Code requirements for the particular Jurisdiction should be reviewed for specific design criteria;

b. Materials — For some thermal fluids, the use of aluminum or zinc anywhere in the system is not advisable. Aluminum acts as a catalyst that will hasten decomposition of the fluid. In addition, some fluids when hot will cause aluminum to corrode rapidly or will dissolve zinc. The zinc will then form a precipitate that can cause localized corrosion or plug instrumentation, valves, or even piping in extreme cases. These fluids should not be used in systems containing aluminum or galvanized pipe. The fluid specifications will list such restrictions;

Note: Some manufacturers of these fluids recommend not using aluminum paint on valves or fittings in the heat transfer system.

c. Corrosion — When used in applications and installations recommended by fluid manufacturer, heat transfer fluids are typically noncorrosive. However, some fluids, if used at temperatures above 150°F (65°C) in systems containing aluminum or zinc, can cause rapid corrosion;

d. Leakage — Any sign of leakage could signify problems since the fluid or its vapors can be hazardous as well as flammable. Areas for potential leaks include cracks at weld attachment

points and tube thinning in areas where tubes are near soot blowers. The thermal fluid manufacturer specifications will list the potential hazards;

e. Solidification of the fluid — Determine that no conditions exist that would allow solidification of the thermal fluid. When heat tracing or insulation on piping is recommended by the heater manufacturer, the heat tracing and insulation should be checked for proper operation and installation;

f. Pressure relief devices — Pressure relief valves shall be a closed bonnet design with no manual lift lever. Pressure relief valves must be tested by a qualified repair concern every 36 months unless otherwise directed by the jurisdiction. The pressure relief discharge should be connected to a closed, vented stor- age 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

g. Inspections

In addition to the requirements set down in this part for the type of construction, inspections of thermal fluid heaters shall include verifying that fluid testing is conducted annually and that results are compared to the fluid manufacturer's standard. The inspector shall also verify the documentation of annual testing of controls and safety devices. For those types of construction where the boiler internal cannot be completed on the fluid side a borescope or other suitable device should be used to ascertain conditions to the extent possible.

S2.7.3.2 SUBSEQUENT INSPECTIONS

a) Boilers that have completed the initial inspection requirements begin the subsequent inspection intervals. The following inspection intervals should be used unless other requirements are mandated by the Jurisdiction.

1) Interval #1 — One year following initial inspection. Inservice inspection per NBIC Part 2, S2.7.1.
2) Interval #2 — Two years following initial inspection. Visual inspection per NBIC Part 2, S2.5.2.2.
3) Interval #3 — Three years following initial inspection. A pressure test per NBIC Part 2, S2.6.1.
4) ~~Interval #4 — Same as interval #1.~~
5) ~~Interval #5 — Visual inspection per NBIC Part 2, S2.5.2.2 and UT thickness testing per NBIC Part 2, S2.6.2.~~
6) ~~Interval #6 — Same as interval #3.~~

b) After interval #~~6~~ 3 is completed, the subsequent inspection cycle continues with interval #1.

c) Ultrasonic thickness testing per NBIC Part 2, S2.6.2 shall be performed twenty years from the original boiler manufacturing date and every ten years thereafter, or more frequently at the discretion of the Jurisdiction when applicable.

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;"

PROPOSED INTERPRETATION

Inquiry No.	**20-3**
Source	Nathan Carter, HSB nathan_carter@hsb.org
Subject	Inspector involvement in 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? The Body-Of-Knowledge for National Board Inspectors holding either an "IS" Commission or "R" Endorsement does not reference ASME FFS-1/API 579 Fitness-For-Service Standard or have any expectation that the Inspector be capable of determining if the correct Fitness for Service methodology was used or that the assumptions taken by the Engineer in the analysis were the most appropriate or accurate. Clarification is also requested due to the Form NB-403 signature block stating "Verified by" for the Inspector without any other disclaimers as typically found on other Forms signed by Inspectors such as ASME MDRs and NBIC Form R-1/R-2. An example is a R-Certificate holder was hired to repair a weld seam. It was discovered during a repair that multiple base metal laminations existed adjacent to the repair location. A Fitness for Services Evaluation was subsequently performed. The first question is whether or not it is the responsibility of the Repair Inspector to sign the FFSA form once everything has been properly vetted, since the defect being left in place is not necessarily within the scope of the initial repair being performed by the "R" Certificate Holder, or should this be signed off by a Commissioned Inservice Inspector, since they are examined on the rules of NBIC Part 2? Also, Form NB-403 is vague in the signature block region for the scope of what the Inspector is signed for. It could be alluded that without a statement, such as those found on the R-1 and R-2 forms, the Inspector is signing off on the appropriateness and adequacy of the Fitness-For-Service methodology performed by the Engineer.
Edition	2019; Part: Repairs and Alterations; Section: 3; Paragraph: 3.3.4.8 2019; Part: Inspection; Section: 4; Paragraph: 4.4
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?

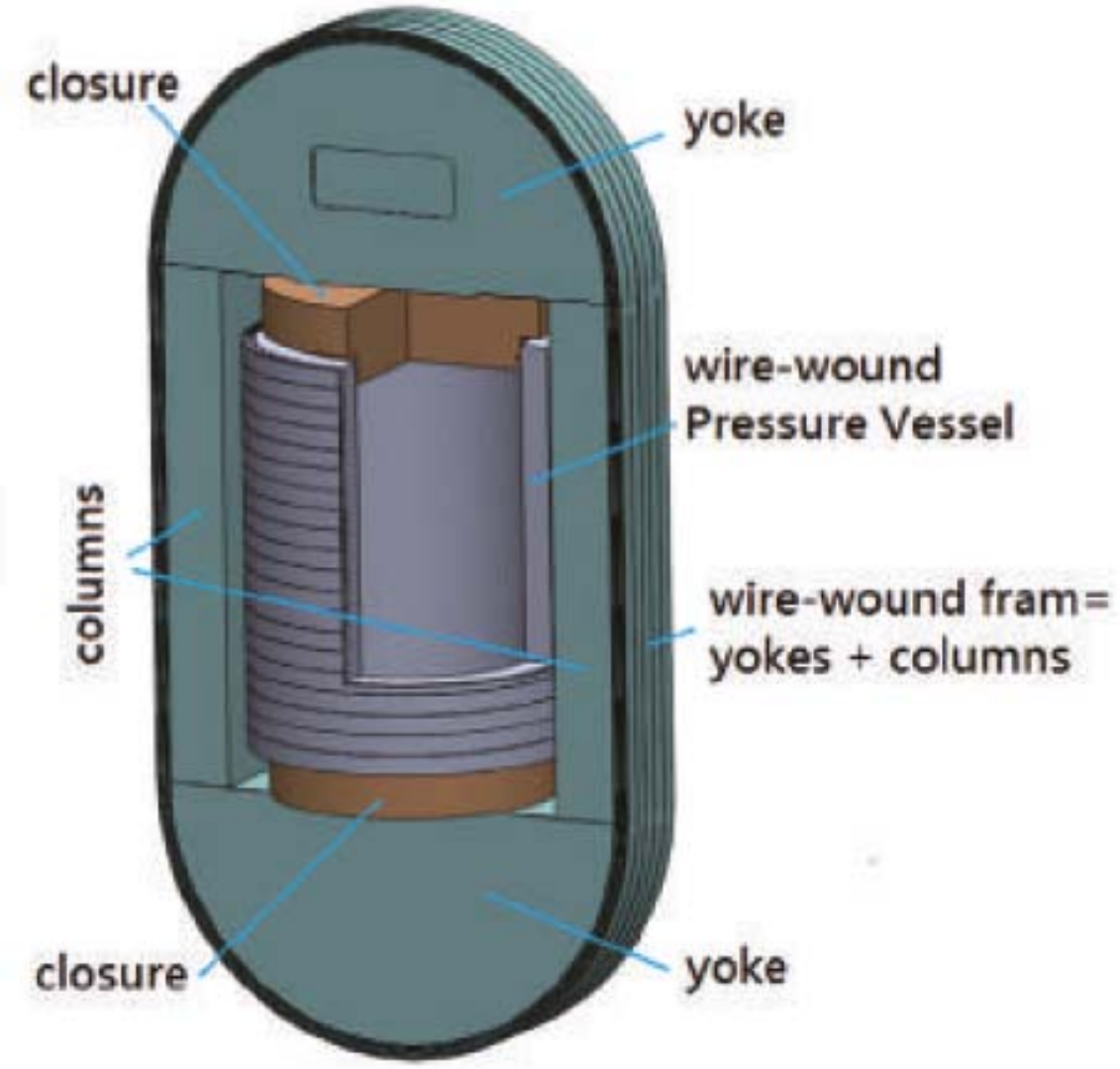
	Question 3: If the answer to Question 2 is No, is the Inspector's signature on Form NB-403 an indication of acceptance solely on the basis of review of the Form for completeness and verification that the requirements outlined in 4.4 were addressed?
Reply	Proposed Reply 1: Yes Proposed Reply 2: No Proposed Reply 3: Yes
Committee's Question	
Committee's Reply	
Rationale	

PROPOSED INTERPRETATION

Inquiry No.	**20-11**
Source	Hugh-Jean Nel, Sasol Hugh-Jean.Nel@sasol.com
Subject	Scope of Repairs **Background:** Historically NBIC has not defined limitations on the scope of repair provided the entire item is being rebuilt, see Question & Reply 2 & 3 in Interpretation 98-28. NBIC Part 3 lists several examples of repair but nowhere limits the scope or amount of these examples that can be utilized when performing repairs. This creates some uncertainty when performing some types of repairs, such as replacing the tubesheets of a fixed tubesheet type heat exchanger as listed in 3.3.3 e). According to ASME BPV Code Section VIII Division 1 Part UHX, Section 13, the length of the tubes is a design parameter and therefore replacing the tubesheet in accordance with its original design might require the replacement of the tubes as well to maintain the original design length.
Edition	2019; Part: Repairs and Alterations; Section: 3; Paragraph: 3.3.3 Examples of Repairs
Question	Question: Is it permissible for repair activities performed on pressure retaining equipment to have more than one activity listed in 3.3.3 with the scope of repair?
Reply	Proposed Reply: Yes, provided that the scope of repairs has been approved by the Inspector, and when required, by the Jurisdiction.
Committee's Question	
Committee's Reply	
Rationale	

Proposed inquiry to NBIC from Monte Bost (monte_bost@hsb.com)

Background: A Section VIII, Division 3 pressure vessel is made from machined forgings with no welding. The pressure retaining items are a cylinder, end closures and a frame that holds the end closures in place. A sketch is provided.



Inquiry

Subject: National Board Inspection Code 2019 Edition, Part 3, 3.3.3 and 5.12.4.1

Question 1: A Section VIII, Division 3 pressure vessel is made without welding from machined forgings. The pressure retaining components consist of a cylinder, end closures and a frame that holds the end closures in place. If one of the pressure retaining components is replaced with a new ASME-stamped “Part”, is this activity considered a repair?

Proposed Reply (1): Yes.

Question 2: For the repair described in Question (1) above, how shall Line 7, “REPAIR TYPE” be indicated on the Form R-1, *Report of Repair*?

Proposed Reply (2): Indicate “Type of Repair: Mechanical” in Line 10 “Remarks”.

PROPOSED INTERPRETATION

Inquiry No.	**20-17**
Source	Roy Darby, Chevron Products Company roy.darby@chevron.com
Subject	Weld build of wasted areas with different material **Background:** It is common practice to weld build the wasted area of a component with original material and then to overlap with a corrosion resistant material to prevent future wasting of the component. It would be more efficient to simply restore the wasted area with the corrosion resistant material, provided that it meets or exceeds the strength requirements of the original material. This represents cost savings for industry with no expected downside.
Edition	2019; Part: Repairs and Alterations; Section: 3; Paragraph: 3.3.3 Examples of Repairs
Question	Question: Would it be acceptable as a repair to weld build wasted areas with a material of different nominal composition and, equal to or greater in ultimate stress from that used in the original design, provided the replacement material satisfies the material and design requirements of the original code of construction under which the vessel was built? The minimum required thickness would be at least equal to the thickness stated on the original Manufacturer's Data Report. This would be an amalgamation of 3.3.3 (c),(d), and (r) into a single activity.
Reply	Proposed Reply: Yes.
Committee's Question	
Committee's Reply	
Rationale	

PROPOSED INTERPRETATION

Inquiry No.	**20-21**
Source	Eric Feeney, TEI Construction Services efeeney@teiservices.com
Subject	Nondestructive Examination **Background:** When a boiler outage is being performed, there may be 50-10,000+ welds made. We are accustomed to performing 100% volumetric examination when a hydrostatic test is not being performed. Some of our inspectors suggest that we can perform a portion of the NDE as volumetric and the remainder as VT. When I read 4.4.1 e) it seems to have validity, but I generally have understood paragraph e) to have been referring to each individual weld and not the repair as a whole. This is what I would like clarification on.
Edition	2019; Part: Repairs and Alterations; Section: 4; Paragraph: 4.4.1 e)
Question	Question: May a portion of a repair be subject to NDE other than visual, and the remainder of the repair be subject to exclusive use of VT in accordance with Part 3, 4.4.1 e)?
Reply	Proposed Reply: Yes.
Committee's Question	
Committee's Reply	
Rationale	

PROPOSED INTERPRETATION

Inquiry No.	**20-23**
Source	Paul Shanks, OneCIS Paul.shanks@onecis.com
Subject	Alteration of ASME Section VIII Div.2 vessels **Background:** Many Div.2 vessels which are in need of repair are of sufficient age whereby all of the original paperwork was paper work. Even with the best efforts such documents can become damaged or lost by the flooding event associated with the gulf coast hurricane events and or the types of refinery fires that are all too common. In a good deal of cases these vessels simply need a new B-16.5 weld neck flange or a gasket surface weld metal build up in order to allow continued leak free surface but due to some documents being unavailable the owner is left to choose between making no repair or making a repair which is not compatible with the NBIC. **Explanation of Need:** 3.3.5.2 & 3.4.5.1 both require that a repair or alteration for div.2 vessels are checked for compatibility with the original UDS which is clearly best practice for these higher stressed vessels, however a great deal of work needed on these vessels no doubt due to the higher level of engineering examination during initial fabrication is limited to fixing the problems that come form leaking gaskets i.e. corrosion on gasket faces which may require weld metal build up less than 20"2 or replacement of an ASME standard flange like for like. The professional engineer whom must review and sign for repair plans is qualified to review the service history and/or whatever original documentation is available and determine if a simple flange replacement or weld metal build up is acceptable or not.
Edition	2019 NBIC, Part 3, 3.4.5.1 b)
Question	Question: Given that Paragraph 3.4.5.1 b) allows for the User Design Specification (UDS) to be revised in the case where a proposed alteration is not compatible with the existing UDS is it unacceptable in cases where the original UDS is not available to generate a new UDS which is compatible with the design load case included with the original Manufactures Design Report?
Reply	Proposed Reply: No.
Committee's Question	
Committee's Reply	
Rationale	

PROPOSED INTERPRETATION

Inquiry No.	**20-24**
Source	Paul Shanks, OneCIS Paul.shanks@onecis.com
Subject	Certification of repair or alteration plans **Background:** 3.4.5.1 b) allows for the UDS to be revised if a proposed alteration plan is not compatible with the original. this revised UDS must be certified by an engineer as must the Alteration plan, there currently does not appear to be a separation of the two certifying activity's which is not in the spirit of Div.2 requiring different engineers for the UDS and MDR.
Edition	2019 NBIC, Part 3, 3.4.5.1 b)
Question	Question: Is it acceptable for the Repair/alteration plan to be certified by one of the same engineers that certified the UDS, Revised UDS or MDR?
Reply	Proposed Reply: No.
Committee's Question	
Committee's Reply	
Rationale	

PROPOSED INTERPRETATION

Inquiry No.	**20-29**
Source	Craig Bierl, Chubb Limited craig.bierl@chubb.com
Subject	PV Cycles of operations change as an alteration **Background:** Isostatic Presses in particular (but found in other pressure vessels also) are restricted by the data report to a finite number of cycles. Operators of these vessels routinely use curves to modify what is considered a cycle and extend the life of the vessel. These vessels represent a substantial risk of failure and this practice is very difficult for the inservice inspector to successfully track and audit to ensure the integrity of these vessels are maintained as this is a grey area in the current code as written. This is the real life scenario that has appeared on 7 of these vessels in the last 6 months (that is every one that I have been involved in evaluating for insurance coverage). 1. ASME data report says X cycles. Normally around 15-25,000. 2. Vessel is 20+ years old 3. You ask about operation and the vessel operates 330 days per year and has 5 operating cycles per day (some are 2 some are more, just throwing a number up to illustrate). So, simple math says 330x5=1650 cycles per year 25,000/1650=15.15 years of life 4. You ask for records of the operation a. You are presented with a degraded cycle curve b. "we don't operate at maximum temp (and/or) pressure" so we aren't taking a full cycle c. So now the same vessel shows that it only has 650 cycles on it or 1200 (instead of 30,000) 5. Their argument is that they are below the "design cycles", well there is no rational that the inspector can adequately track the design cycles to a degree of comfort. a. I attached one of the better design cycle tracking mechanism's I have seen, however it is still lacking Bottom line, the "operational cycle" is easily trackable. The use of curves to increase the operational cycle count beyond the ASME data report cycle maximum appears to be in conflict and lacks standardization, which makes it difficult to audit and ensure uniform measures are being taken. The cycle count appears on the data report as a criteria, if that criteria is intended to limit the operational cycle, than the use of a curve to extend that cycle should be considered an alteration and rerating of the vessel. If the cycle count on the data report is not intended to be limited by the operating cycle, then some form of standard should be created for the different types of variances that are used to extend this cycle count (by temperature, pressure, etc).
Edition	2019 NBIC, Part 3, 3.4.4 2019 NBIC, Part 2, 2.3.6.8 & 2.3.6.10
Question	Question: Should the use of a curve to extend the number of operating cycles beyond the number of cycles indicated on the ASME data report be considered an alteration/re rating of a pressure vessel (ASME Section 8 Part 3)?

Reply	Proposed Reply: Yes. The use of a curve to extend the number of operating cycles is a change in the material data on the ASME data report and is therefore an alteration of the vessel and should be considered as such through a formal re-rating process.
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.

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.

(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.

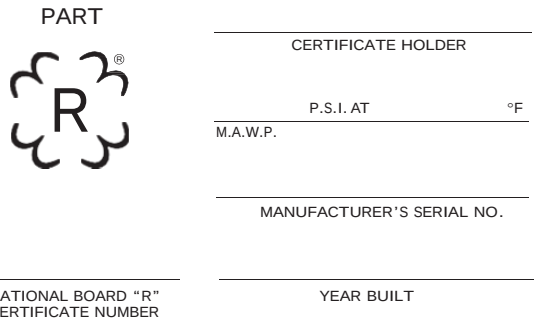
AT °F

NATIONAL BOARD "R" CERTIFICATE NUMBER

DATE ALTERED

FIGURE 5.7.5-d

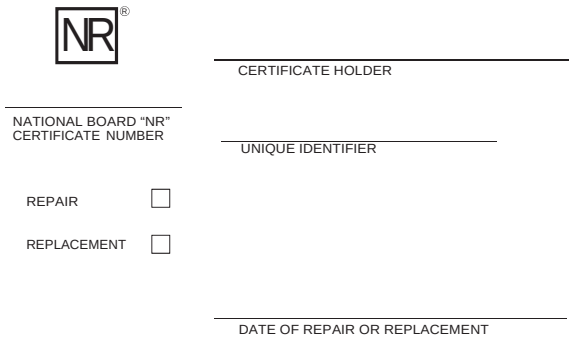
REQUIRED MARKINGS FOR PARTS FABRICATED BY WELDING, WITH USE OF NATIONAL BOARD FORM R-3



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)

This form may be obtained from The National Board of Boiler and Pressure Vessel Inspectors • 1055 Crupper Avenue, Columbus, Ohio 43229-1183 Page 1 of 2

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)

This form may be obtained from The National Board of Boiler and Pressure Vessel Inspectors • 1055 Crupper Avenue, Columbus, Ohio 43229-1183 Page 2 of 2

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

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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)

This form may be obtained from The National Board of Boiler and Pressure Vessel Inspectors • 1055 Crupper Avenue, Columbus, Ohio 43229-1183 Page 2 of 2

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.

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)

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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. — CONTINUED FROM FORM R- (6) ______

(7) ______ (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)

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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)

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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)

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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.
1.	(29)	(30)	(31)	(32)
2.				
3.				
4.				
5.				
6.				
7.				

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Page 2 of 3

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)

This form may be obtained from The National Board of Boiler and Pressure Vessel Inspectors • 1055 Crupper Avenue, Columbus, Ohio 43229-1183 Page 3 of 3

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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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 19-16: NBIC Part 3, 3.2.2 e)
Submitted by: Eben Creaser eben.creaser@gnb.ca

Explanation of Need: This wording of this clause is causing confusion. I have had multiple instances where owners have requested to purchase welded replacement parts directly and read this clause with the belief that they can purchase a replacement part for in some cases a welded pressure part for an ASME Section I boiler and safe money by having the fabricator not Hydro test as per Section I even when it was not impractical to have the testing performed.

Background Information: The second sentence of 3.2.2 seems to provide optional provisions that contradict the mandatory requirement stated in the first sentence that requires 3.2.2 c) or d) parts to be pressure tested by the original code of construction. If this is the intent of the committee then the clause should be reworded to add an "or" between the sentences. The wording could also be understood to mean that all parts addressed in 3.2.2 c) or d) have to be pressure tested. But then the second sentence alludes to an optional requirement, it's just not clear.

Proposed Text:
If the intent of this clause is to provide optional pressure test requirements for parts then;

e) Replacement parts addressed by 3.2.2 c) or d) above shall receive a pressure test as required by the original code of construction prior to installation, or, when accepted by the owner, the Inspector and, where required, the Jurisdiction, parts ~~. If replacement parts have not been pressure tested 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 in accordance with the original code of construction.

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 20-06: Update Clause 2.3 and Table 2.3

2.3 STANDARD WELDING PROCEDURE SPECIFICATIONS (SWPSs)

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

b) The AWS reaffirms, amends or revises SWPSs in accordance with ANSI procedures.

1) Reaffirmed SWPSs: When reaffirmation occurs without revision to the SWPS, the letter R is added to the SWPS designation.

2) Amended SWPSs: When an amendment occurs the suffix “AMD1” is added to the SWPS designation. Amendments are issued when essential for the prompt correction of an error that could be misleading. Amendments are incorporated into the existing text of the SWPS, which is reprinted and clearly marked as incorporating an amendment(s), and which is identified in the revised Foreword of the amended SWPS.

3) Revised SWPSs: When a revision to a published SWPS occurs, the publication date is added to the SWPS designation. The date of the superseded SWPS is also noted on the cover page. Previous versions of the superseded SWPS may be used at the option of the R Certificate holder.

c) The use of previous versions of the listed SWPSs is permitted. Previous versions include Reaffirmed, Amended, or Revised SWPSs regardless of the publication date

ITEM 20-06: Update Clause 2.3 and Table 2.3

TABLE 2.3

CARBON STEEL- (P1/M1 MATERIAL)

SMAW — Shielded Metal Arc Welding	
TITLE	**DESIGNATION: YEAR**
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel, (M-1/P-1, Group 1 or 2), 3/16 in. through 3/4 in., As- Welded Condition, With Backing, Primarily Plate and Structural Applications.	B2.1-1-001: 2018
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. through 1 ½ in. Thick, E7018, As-Welded or PWHT Condition, Primarily Plate and Structural Applications.	B2.1-1-016: 2018
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. through 1 ½ in. Thick, E6010, As-Welded or PWHT Condition, Primarily Plate and Structural Applications.	B2.1-1-017: 2018
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. through 1 ½ in. Thick, E6010 (Vertical Uphill) followed by E7018, As-Welded or PWHT Condition, Primarily Plate and Structural Applications.	B2.1-1-022: 2018
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. through 1 ½ in. Thick, E6010 (Vertical Downhill) followed by E7018, As-Welded or PWHT Condition, Primarily Plate and Structural Applications.	B2.1-1-026: 2018
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1, Group 1 or 2), 1/8 in. (3mm) through 3/4 in. (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 for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1, Group 1 or 2), 1/8 in. (3 mm) through 3/4 in. (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 for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1, Group 1 or 2), 1/8 in. (3 mm) through 3/4 in. (19 mm) Thick, E6010 (Vertical Uphill), In the As-Welded Condition, Primarily Pipe Applications.	B2.1-1-203: 2019
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1, Group 1 or 2), 1/8 in. (3 mm) through 3/4 in. (19 mm)Thick, E6010 (Vertical Downhill Root with balance Vertical Uphill), in the As-Welded Condition, Primarily Pipe Applications.	B2.1-1-204: 2019
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1, Group 1 or 2), 1/8 in. (3 mm) through 1 ½ in. (38 mm) Thick, E6010 (Vertical Uphill) followed by E7018 (Vertical Uphill), in the As-Welded or PWHT Condition, Primarily Pipe Applications.	B2.1-1-205:2019
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1, Group 1 or 2), 1/8 in. (3 mm) through 1-1/2 in. (38 mm) Thick, E6010 Vertical Downhill) followed by E7018 (Vertical Uphill), in the As-Welded or PWHT Condition, Primarily Pipe Applications.	B2.1-1-206:2019
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1, Group 1 or 2), 1/8 in. (3 mm) through 1 ½ in. (38 mm) Thick, E7018, in the As-Welded or PWHT Condition, Primarily Pipe Applications.	B2.1-1-208: 2019

ITEM 20-06: Update Clause 2.3 and Table 2.3

GTAW — Gas Tungsten Arc Welding	
TITLE	**DESIGNATION: YEAR**
Standard Welding Procedure Specification for Gas Tungsten Arc Welding of Carbon Steel, (M-1/P-1, Group 1 or 2), 3/16 in. through 7/8 in. Thick, in the As-Welded Condition, With or Without Backing, Primarily Plate and Structural Applications.	B2.1-1-002: 2006
Standard Welding Procedure Specification for Gas Tungsten Arc Welding of Carbon Steel (M-1/P-1, Group 1 or 2), 1/8 in. (3 mm) through 1 ⅛in. (38 mm) Thick, ER70S-2, As-Welded or PWHT Condition, Primarily Pipe Application.	B2.1-1-207: 2019
Standard Welding Procedure Specification for Gas Tungsten Arc Welding with Consumable Insert Root of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. through 1-1/2 in. Thick, INMs-1, ER70S-2, As-Welded or PWHT Condition, Primarily Pipe Applications.	B2.1-1-210: 2012

FCAW — Flux Core Arc Welding	
TITLE	**DESIGNATION: YEAR**
Standard Welding Procedure Specification for Self-Shielded Flux Cored Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. through 1 ½ in. Thick, E71T-8, As-Welded Condition, Primarily Plate and Structural Applications.	B2.1-1-018: 2005
Standard Welding Procedure Specification for CO2 Shielded Flux Cored Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. through 1 ½ in. Thick, E70T-1 and E71T-1, As-Welded Condition, Primarily Plate and Structural Applications.	B2.1-1-019: 2018
Standard Welding Procedure Specification for 75% Ar/25% CO2 Shielded Flux Cored Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. through 1-1/2 in. Thick, E70T-1M and E71T-1M, As-Welded or PWHT Condition, Primarily Plate and Structural Applications.	B2.1-1-020: 2018
Standard Welding Procedure for Self-Shielded Flux Cored Arc Welding of Carbon Steel (M-1/P-1 Group 1 or 2), 1/8 in. (3 mm) through 1/2 in. (13 mm) Thick, E71T-11, As-Welded Condition, Primarily Plate and Structural Applications.	B2.1-1-027: 2018
Standard Welding Procedure Specification (SWPS) for Argon Plus 25% Carbon Dioxide Shielded Flux Cored Arc Welding of Carbon Steel (M-1/P-1/S-1, Groups 1 and 2), 1/8 in. through 1 ½ in. Thick, E7XT-XM, As-Welded or PWHT Condition, Primarily Pipe Applications.	B2.1-1-234: 2006

GMAW – Gas Metal Arc Welding	
TITLE	**DESIGNATION: YEAR**
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. through 1 ½ in. Thick, ER70S-3, 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. through 1 ½ in. Thick, ER70S-3, Flat Position Only, As-Welded or PWHT Condition, Primarily Pipe Applications.	B2.1-1-235: 2006

ITEM 20-06: Update Clause 2.3 and Table 2.3

GTAW/SMAW Combination of Welding Processes	
TITLE	**DESIGNATION: YEAR**
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. through 1 ½ in. Thick, ER70S-2 and E7018, As-Welded or PWHT Condition, Primarily Plate and Structural Applications.	B2.1-1-021: 2018
Standard Welding Procedure Specification for Gas Tungsten Arc Welding followed by Shielded Metal Arc Welding of Carbon Steel (M-1/P-1, Groups 1 or 2), 1/8 in. (3 mm) through 1 ½ in. (38 mm) Thick, ER70S-2 and E7018, As-Welded or PWHT Condition, Primarily Pipe Applications.	B2.1-1-209: 2019
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. through 1 ½ in. Thick, INMs-1, ER70S-2, and E7018 As-Welded or PWHT Condition, Primarily Pipe Applications.	B2.1-1-211: 2012

GMAW/FCAW – Combination of Welding Processes	
TITLE	**DESIGNATION: YEAR**
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. through 1 ½ in. Thick, ER70S-3 and EXT-X, As-Welded or PWHT Condition, Primarily Pipe Applications.	B2.1-1-232: 2006

Austenitic Stainless Steel — (M8/P8 Materials)

SMAW — Shielded Metal Arc Welding	
TITLE	**DESIGNATION: YEAR**
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 in. through 1½ in. Thick, As-Welded Condition, Primarily Plate and Structural Applications.	B2.1-8-023: 2018
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 in through 1½ in. Thick, E3XX-XX, As-Welded Condition, Primarily Pipe Application.	B2.1-8-213: 2012

GTAW — Gas Tungsten Arc Welding	
TITLE	**DESIGNATION: YEAR**
Standard Welding Procedure Specification for Gas Tungsten Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/16 in. through 1 ½ in. Thick, ER3XX, As-Welded Condition, Primarily Plate and Structural Applications.	B2.1-8-024: 2012
Standard Welding Procedure Specification for Gas Tungsten Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/16 in. through 1 ½ in. thick, ER3XX, As-Welded Condition, Primarily Pipe Applications.	B2.1-8-212: 2012

ITEM 20-06: Update Clause 2.3 and Table 2.3

Standard Welding Procedure Specification for Gas Tungsten Arc Welding With Consumable Insert Root of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 in. through 1 ½ in. Thick, IN3XX and ER3XX As-Welded Condition, Primarily Pipe Applications.	B2.1-8-215: 2012

Combination Processes GTAW/SMAW	
TITLE	**DESIGNATION: YEAR**
Standard Welding Procedure Specification for Gas Tungsten Arc Welding followed by Shielded Metal Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 in. through 1 ½ in. Thick, ER3XX and E3XX-XX, As-Welded Condition, Primarily Plate and Structural Applications.	B2.1-8-025: 2012
Standard Welding Procedure Specification for Gas Tungsten Arc Welding Followed by Shielded Metal Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 in. through 1 ½ in. Thick, ER3XX and E3XX-XX, As-Welded Condition, Primarily Pipe Applications.	B2.1-8-214: 2012
Standard Welding Procedure Specification for Gas Tungsten Arc Welding with Consumable Insert Root followed by Shielded Metal Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 in. through 1 ½ in. Thick, IN3XX, ER3XX, and E3XX-XX As-Welded Condition, Primarily Pipe Applications.	B2.1-8-216: 2012

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

SMAW — Shielded Metal Arc Welding	
TITLE	**DESIGNATION: YEAR**
Standard Welding Procedure Specifications for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Groups 1 or 2) to Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 in. through 1 ½ in. Thick, E309 (L)-15, -16, or -17, As-Welded Condition, Primarily Pipe Applications.	B2.1-1/8-228: 2013

GTAW — Gas Tungsten Arc Welding	
TITLE	**DESIGNATION: YEAR**
Standard Welding Procedure Specification for Gas Tungsten Arc Welding of Carbon Steel (M-1/P-1/S-1, Groups 1 or 2) to Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/16 in. (1.6 mm) through 1 ½ in. Thick, ER309(L), As-Welded Condition, Primarily Pipe Applications.	B2.1-1/8-227: 2013
Standard Welding Procedure Specifications for Gas Tungsten Arc Welding with Consumable Insert Root of Carbon Steel (M-1/P-1/S-1, Groups 1 or 2) to Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/16 in. (1.6 mm) through 1½ in. Thick, IN309 and ER309(L), As-Welded Condition, Primarily Pipe Applications.	B2.1-1/8-230: 2013

ITEM 20-06: Update Clause 2.3 and Table 2.3

GTAW/SMAW Combination of Welding Processes	
TITLE	**DESIGNATION: YEAR**
Standard Welding Procedure Specifications for Gas Tungsten Arc Welding followed by Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1,Groups 1 or 2) to Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 in through 1½ in. Thick, ER309 (L) and E309 (L)-15, -16, or -17, As-Welded Condition, Primarily Pipe Applications.	B2.1-1/8-229: 2013
Standard Welding Procedure Specifications for Gas Tungsten Arc Welding with Consumable Insert Root followed by Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Groups 1 or 2) to Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 In. through 1½ in. Thick, IN3009, ER309, and E309-15, -16, or -17 or IN309, ER309 (L) and ER309 (L)-15, -16, or -17, As-Welded Condition, Primarily Pipe Applications.	B2.1-1/8-231: 2015

Chromium Molybdenum Steel (M4/P4 and M5A/P5A Materials)

SMAW — Shielded Metal Arc Welding	
TITLE	**DESIGNATION: YEAR**
Standard Welding Procedure Specifications for Shielded Metal Arc Welding of Chromium-Molybdenum Steel (M-4/P-4, Group 1 or 2), E8018-B2, 1/8 in. through 1 ½ in. Thick, As-Welded Condition, 1/8 in. through 1½ in. Thick, PWHT Condition, Primarily Pipe Applications.	B2.1-4-218: 2009
Standard Welding Procedure Specifications for Shielded Metal Arc Welding of Chromium-Molybdenum Steel (M-5A/P-5A), E9018-B3, 1/8 in. through 1 ½ in. Thick, As-Welded Condition, 1/8 in. through 1½ in. Thick, PWHT Condition, Primarily Pipe Applications.	B2.1-5A-223: 2009

GTAW — Gas Tungsten Arc Welding	
TITLE	**DESIGNATION: YEAR**
Standard Welding Procedure Specifications for Gas Tungsten Arc Welding of Chromium-Molybdenum Steel (M-4/P-4, Group 1 or 2), ER80S-B2, 1/8 in. through 1 ½ in. Thick, As-Welded Condition, 1/8 in. through ¾ in. Thick, PWHT Condition, Primarily Pipe Applications.	B2.1-4-217: 2009
Standard Welding Procedure Specifications for Gas Tungsten Arc Welding (Consumable Insert Root) of Chromium-Molybdenum Steel (M-4/P-4, Group 1 or 2), E8018-B2, 1/8 in. through 1 ½ in. Thick, As-Welded Condition, 1/8 in. through ¾ in. Thick, PWHT Condition, IN515 and ER80S-B2, Primarily Pipe Applications.	B2.1-4-220: 2009
Standard Welding Procedure Specifications for Gas Tungsten Arc Welding of Chromium-Molybdenum Steel (M-5A/P-5A), ER90S-B3, 1/8 in. through 1½ in. Thick, As-Welded Condition, 1/8 in. through 3/4 in. (19 mm) Thick, PWHT Condition, Primarily Pipe Applications.	B2.1-5A-222: 2009

ITEM 20-06: Update Clause 2.3 and Table 2.3

Standard Welding Procedure Specifications for Gas Tungsten Arc Welding (Consumable Insert Root) of Chromium-Molybdenum Steel (M-5A/P-5A), 1/8 in. through 1-1/2 in. Thick, As-Welded Condition, 1/8 in. through 3/4 in. Thick, PWHT Condition, IN521 and ER90S-B3, Primarily Pipe Applications.	B2.1-5A-225: 2009

GTAW/SMAW Combination of Welding Processes	
TITLE	**DESIGNATION: YEAR**
Standard Welding Procedure Specifications for Gas Tungsten Arc Welding (Consumable Insert Root) followed by Shielded Metal Arc Welding of Chromium- Molybdenum Steel (M-4/P-4, Group 1 or 2), 1/8 in. through 1-1/2 in. Thick, As-Welded Condition, 1/8 in. through 1 ½ in. Thick, PWHT Condition, IN515, ER80S-B2, and E8018-B2, Primarily Pipe Applications.	B2.1-4-221: 2009
Standard Welding Procedure Specifications (SWPS) for Gas Tungsten Arc Welded followed by Shielded Metal Arc Welding of Chromium-Molybdenum Steel (M-4A/P-4, Group 1 or 2), 1/8 in. through 1/2 in. Thick, As-Welded Condition, 1/8 in. through 1 ½ in. Thick, PWHT Condition, ER80S-B2 and E8018-B2, Primarily Pipe Applications.	B2.1-4-219: 2009
Standard Welding Procedure Specifications for Gas Tungsten Arc Welded followed by Shielded Metal Arc Welding of Chromium-Molybdenum Steel (M-5A/P-5A), 1/8 in. through 1 ½ in. Thick, As-Welded Condition, 1/8 in. through 1 ½ in. Thick, PWHT Condition, ER90S-B3 and E9018-B3, Primarily Pipe Applications	B2.1-5A-224: 2009
Standard Welding Procedure Specifications for Gas Tungsten Arc Welding (Consumable Insert Root) followed by Shielded Metal Arc Welding of Chromium-Molybdenum Steel (M-5A/P-5A), 1/8 in. through 1 ½ in. Thick, As- Welded Condition, 1/8 in. through 1 ½ in. Thick, PWHT Condition, IN521, ER90S-B3, and E9018-B3, Primarily Pipe Applications.	B2.1-5A-226: 2009

Item 20-7

Routine repairs of Div.2 & or Div.3 vessels

Part 3, 3.3.2 a)

Submitted by: Paul Shanks

Explanation of Need: An interpretation is scheduled to be issued under item number 19-26 asserting that Routine repairs are not to be used on Div.2 or Div.3 vessels. Rather than require review of an interpretation which may expire in two years the body of the code should make it clear that Routine repairs are not compatible with div.2 or div.3 vessels.

Background Information: 3.3.5.2 b) makes clear that an Inspector will make the acceptance inspection and sign the R1, the provision in 3.3.2 to waive the AI involvement or routine repairs is simply not applicable.

Proposed Change:

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. As such routine repairs are not acceptable for ASME Section VIII Div.2 or Div. 3 vessels. 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;

Item 20-9

Define "Verify" in the NBIC Glossary

Part 3, 9.1

Submitted by: Terry Hellman

Explanation of Need: Defining "Verify" in the NBIC Part 1, 2, 3, and 4 to align with the definition in NB-263, RCI-1, Rules for Commissioned Inspectors.

Background Information: The need for the definition of "verify" was initiated from Interpretation Item 18-03, which addresses 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.

Proposed Change:

9.1 DEFINTIONS

Verify – To determine that a particular action has been performed in accordance with the requirements either by witnessing the action or reviewing records.

Item 20-15

Stamping requirements for routine repairs

Part 3, 3.3.2 & 5.7.2 b)

Submitted by: Kathy Moore

Explanation of Need: This would offer traceability to the R-Stamp holder responsible for the work.

Background Information: Requested by the Chief of Texas.

Proposed Change:

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;

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~~b) 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.

Item 20-16
Part 3, 3.4.4
Submitted by: Paul Shanks

Explanation of Need: ASME Section VIII Div.1 Mandatory Appendix 44 paragraph 44-6.2(g) clearly sets out that a vessel built to those rules needs to be re-stretched, having had repair welding. It is not clear if ASME is referring to in process (at the original manufactures location) repairs or post construction repairs. However, the NBIC is currently silent on this and this potential issue should be addressed.

Background Information: ASME Section VIII Div.1 Mandatory Appendix 44 establishes rules that allow a vessel to be designed and built for use at low temperatures using allowable stresses which are higher than would normally be allowed at 'room temperature'. The condition for doing so is that said vessels are subject to a pre-stressing operation that actually stretches the base material. The use of these higher stresses is contingent on certain design and manufacturing criteria.

Proposed Change:
3.4.4 EXAMPLES OF ALTERATIONS

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

b) A decrease in the minimum temperature;

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

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

e) In a boiler, Heat Recovery Steam Generator (HRSG), or Pressure Retaining Item (PRI), an increase in the steaming capacity by means of increasing heating surface, total heat input, firing rate, adjustment, or other modification to the primary or auxiliary heat source, resulting in the steaming capacity exceeding the original Manufacturer's Minimum Required Relieving Capacity (MRRC) as described on the nameplate and or Manufacturer's Data Report (MDR);

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

g) Except as permitted in NBIC Part 3, 3.3.3 s); replacement of a pressure retaining part in a pressure retaining item with a material of different allowable stress or nominal composition from that used in the original design;

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

i) The replacement of a pressure relieving device (PRD) as a result of work completed on a pressure-retaining item (PRI) that changes the resultant capacity to exceed the minimum required relieving capacity (MRRC) required by the original code of construction as described on the original Manufacturer's Data Report;

j) For plate heat exchangers, in addition to the applicable examples of alterations above, the following changes from what is listed on the MDR or described on the Original Equipment Manufacturer's (OEM)-drawing:

1) For heat transfer plates:
   a. A change in material grade or nominal thickness;
   b. A reduction in number beyond any minimum, or when no minimum is specified;
   c. An increase in number beyond any maximum, or when no maximum is specified;
   d. A change in model type;

2) Any change in material whether described at 3.3.3 s) or as described at 3.4.4 g):
   a. A change in connection bolt or frame compression bolt diameter or material grade;

k) Performing postweld heat treatment where none was originally performed on the pressure retaining item; ~~and~~

l) The installation of a welded leak box~~.~~; and

m) Welding on a vessel marked with the cold stretching 'CS' mark without subsequent renewed cold stretching operating witness by the Inspector.

Item 20-20

Revision to Part 3, 3.2.2 e)

Part 3, 3.2.2 e)

Submitted by: Eric Feeney – efeeney@teiservices.com

Explanation of Need: The certificate holder should not have to explain or justify why a part was not pressure tested in the manufacturing stage. PG-106.8 of Section I allows the part to be fabricated and shipped as such therefore no explanation should be required.

Background Information: The certificate holder is rarely the supplier of the replacement parts. Parts are typically supplied by the owner or OEM. The current wording places the onus on the certificate holder to explain why the parts were not tested in accordance with the original code of construction. (Section I for the inquirer) The reason is most likely a cost savings to the supplier and even if it was, the certificate holder has no authority to rectify this. My company, for one, takes ownership of the parts at the time of receipt inspection at the site of installation.

Proposed Change:

3.2.2 REPLACEMENT PARTS

e) Replacement parts addressed by 3.2.2 c) or d) above shall receive a pressure test as required by the original code of construction. If replacement parts have not been pressure tested 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 in accordance with the original code of construction.~~.

Subject: NBIC Part 3, Qualification of Weld Procedures by Multiple Organizations

Proposal: To add words to 2.2.1 permitting simultaneous qualification of weld procedures by more than one organization.

Explanation: Cost of qualification of weld procedures can represent a considerable cost for a manufacturer for labor, materials, testing etc. Further, when new materials are being introduced to the industry, availability can be extremely limited. Section IX will introduce new rules (already board approved) under item 18-555 (provided in the background information), which provides the framework to allow multiple organizations to supervise the welding of a single test coupon. The rules only permit this when it is expressly permitted by the referencing code. This proposal intends to add words to 2.2.1 of Part 3 to allow Manufacturers to take advantage of the new rules coming to Section IX.

Such testing sessions have already taken place, organized by EPRI, for qualification of repair procedures for Welding Method 6 and Supplement 8.

Current Wording	Proposed Wording
2.2.1 PROCEDURE SPECIFICATIONS A procedure specification is a written document providing direction to the person applying the material joining process. Welding, brazing and fusing shall be performed in accordance with procedure specifications for welding (WPS), brazing (BPS), and fusing (FPS) qualified in accordance with the original code of construction or the construction standard or code selected. When this is not possible or practicable, the procedure specification may be qualified in accordance with ASME Section IX.	**2.2.1 PROCEDURE SPECIFICATIONS** A procedure specification is a written document providing direction to the person applying the material joining process. Welding, brazing and fusing shall be performed in accordance with procedure specifications for welding (WPS), brazing (BPS), and fusing (FPS) qualified in accordance with the original code of construction or the construction standard or code selected. When this is not possible or practicable, the procedure specification may be qualified in accordance with ASME Section IX. Welding procedures may be simultaneously qualified by more than one organization under the rules of ASME Section IX QG-106.4, provided that each organization accepts full responsibility for any such qualifications and complies with the other requirements of Section IX for documentation of welding records. The manufacturer's or assembler's written quality control program shall include requirements for addressing the rules of Section IX QG-106.4.