



THE NATIONAL BOARD  
OF BOILER AND PRESSURE VESSEL INSPECTORS

# NATIONAL BOARD INSPECTION CODE SUBGROUP INSTALLATION

## MINUTES

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Meeting of January 10, 2023  
Charleston, SC

*These minutes are subject to approval and are for committee use only. They are not to be duplicated or quoted for other than committee use.*

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

## 1. Call to Order

Mr. Brockman called the meeting to order at 8:03 a.m. Eastern Standard Time (EST).

## 2. Introduction of Members and Visitors

Mr. Brockman held roll call with the members and visitors. Each member and visitor (in person and remote) introduced themselves with their name and company/interest category. Mr. Kim Black (with ABMA) sat as an alternate for Mr. Gene Tompkins. All attendees are listed on **Attachment 1**.

## 3. Check for a Quorum

With 16 out of 17 members present/represented (in person and remote), a quorum was reached.

## 4. Awards/Special Recognition

There were no awards or special recognitions for this meeting.

## 5. Announcements

- Ms. Vance gave the announcements. See **Attachment 2**.

## 6. Adoption of the Agenda

Mr. Brockman added Interpretation Item 23-03. A motion to adopt the agenda as revised was made, seconded, and unanimously approved.

## 7. Approval of the Minutes of July 12, 2022, Meeting

A motion to approve the minutes from the July 12, 2022, meeting was made, seconded, and unanimously accepted.

## 8. Review of Rosters

### a. Membership Nominations

There were no membership nominations for this meeting.

### b. Membership Reappointments

The following subgroup memberships are set to expire prior to the July 2023 NBIC meeting:

- Mr. Todd Creacy
- Mr. Matt Downs
- Mr. Patrick Jennings
- Mr. Stanley Konopacki
- Mr. Rex Smith

Mr. Smith stated that he is planning to retire in the next year or so, so he does not wish to renew his membership.

The rest of the above members stated their interest in renewing their membership.

### c. Officer Appointments

There were no officer appointments for this meeting.

## 9. Presentations

We viewed two presentations being given in Part 3's subgroup meeting: Teresa Melfi of *Lincoln Electric* gave a presentation on Weld Metal Additive Manufacturing (**Attachment 3**). You can view her additional materials on the cloud in the Subgroup Repairs and Alterations folder. Olley Scholer of *HJ3 Composite Technologies* gave a presentation on Vessel Repairs with Carbon Fiber (**Attachment 4**). The floor was opened to questions and discussion after each presentation.

## 10. Open PRD Items Related to Installation

Mr. Brockman stated that he will follow up with PRD for updates on the below items.

- NB15-0305 – Create Guidelines for Installation of Overpressure Protection by System Design – D. Marek (PM).
- NB15-0315 – Review isolation valve requirements in Part 1, 4.5.6 and 5.3.6 – D. DeMichael (PM)
- 19-83 – Address Alternate Pressure Relief Valve Mounting Permitted by ASME CC2887-1 – D. Marek (PM)
- 22-08 – Review and improve guidance for T&P valve installation relating to probe.
- 22-15 – What is the meaning of "service limitations" as used in Part 4, 2.4.5?
  - Mr. Clark updated the group on the history of this item. There used to be definitions listed right after the references, but they have since moved to the Glossary. The task group is working on wording to correct the references.
- 22-16 – Allow the use of pressure relief valves on potable water heaters.
  - Mr. Clark brought up PRD's proposal. There was a lot of discussion that followed. The task group is finalizing the wording.

## 11. Interpretations

<b>Item Number:</b> 23-03	<b>NBIC Location:</b> Part 1, 1.6.3	<b>Attachment</b> 5
<b>General Description:</b> Boiler Room Exit		
<b>Subgroup:</b> SG Installation		
<b>Task Group:</b> None assigned.		
<b>Explanation of Need:</b> Some Inspectors' interpretations are restricting exits to ground-level egress only.		
<b>January 2023 Meeting Action:</b> Proposal		
Mr. Brockman discussed the background of this item. A task group was assigned. After a breakout session, Mr. Jennings shared the proposed committee response. A motion to recommend the committee response as written was made, seconded, and unanimously approved.		
<b>Task Group:</b> P. Jennings (PM), T. Clark, and J. Kleiss		

## 12. Action Items

<b>Item Number: 20-27</b>	<b>NBIC Location: Part 1, 1.6.9 &amp; S6.3</b>	<b>No Attachment</b>
<b>General Description:</b> Carbon Monoxide Detector/Alarm NBIC 2019		
<b>Subgroup:</b> SG Installation		
<b>Task Group:</b> E. Wiggins (PM), G. Tompkins, R. Spiker, R. Smith, S. Konopacki, R. Austin, T. Creacy, and J. Kleiss		
<b>Explanation of Need:</b> 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?		
<b>January 2023 Meeting Action: Close with no Action</b>		
Ms. Wadkinson reported on the Executive Committee's discussion on this. They went through the history of this item, previous ballot comments, various concerns that have been brought forth, and the way some jurisdictions are handling this. The Executive Committee thought it best to leave this topic up to individual jurisdictions to handle and to close this item with no action. A motion to recommend closing this item with no action was made, seconded, and unanimously approved.		

<b>Item Number: 20-33</b>	<b>NBIC Location: Part 1</b>	<b>No Attachment</b>
<b>General Description:</b> Flow or Temp Sensing Devices forced Circulation Boilers		
<b>Subgroup:</b> SG Installation		
<b>Task Group:</b> M. Downs (PM), D. Patten, and M. Wadkinson		
<b>Explanation of Need:</b> Incorporation of applicable CSD-1 requirements.		
<b>January 2023 Meeting Action: Close with no Action</b>		
After a breakout session, Mr. Downs shared that the NBIC already contains temperature sensing requirements that match those of CSD-1. A motion to recommend closing this item with no action was made, seconded, and unanimously approved.		

<b>Item Number: 20-44</b>	<b>NBIC Location: Part 1</b>	<b>No Attachment</b>
<b>General Description:</b> CW Vacuum Boilers		
<b>Subgroup:</b> SG Installation		
<b>Task Group:</b> R. Spiker (PM), M. Washington, and J. Byrum		
<b>Explanation of Need:</b> Incorporation of applicable CSD-1 requirements.		
<b>January 2023 Meeting Action: Close with no Action</b>		
Mr. Scribner gave some background information on this item. The manufacturer is not offering any information. A motion to recommend closing this item with no action was made, seconded, and unanimously approved.		

<b>Item Number: 20-62</b>	<b>NBIC Location: Part 1, 1.4.5.1</b>	<b>No Attachment</b>
<p><b>General Description:</b> Update the National Board Boiler Installation Report</p> <p><b>Subgroup:</b> SG Installation</p> <p><b>Task Group:</b> T. Clark (PM), E. Wiggins, R. Spiker, T. Creacy, P. Jennings, G. Tompkins, and D. Patten</p> <p><b>Explanation of Need:</b> The form has not been updated in years. The form will be part of the National Board's Jurisdictional Reporting System (JRS) which is currently under development.</p>		
<p><b>January 2023 Meeting Action: Progress Report</b></p> <p>Mr. Clark stated that more work needs to be done to combine Mr. Spiker's version of the report with his version of the report. He will have that finished for Wednesday's subcommittee meeting.</p>		

<b>Item Number: 20-86</b>	<b>NBIC Location: Part 1, 2.10.1 a)</b>	<b>No Attachment</b>
<p><b>General Description:</b> Testing and Acceptance: Boil-out Procedure</p> <p><b>Subgroup:</b> SG Installation</p> <p><b>Task Group:</b> E. Wiggins (PM), D. Patten, M. Washington, and S. Konopacki</p> <p><b>Explanation of Need:</b> This was brought to my (Mr. Eddie Wiggins) attention by Ernest Brantley. Mr. Brantley indicated during an acceptance inspection, he found boiler with excessive oil on the tubes and tube sheet after boiler was delivered and installed. He could not find any reference to boil-out to remove this extraneous material.</p>		
<p><b>January 2023 Meeting Action: Progress Report</b></p> <p>Mr. Wiggins discussed his changes to the proposal. The following part of the proposal (shown in italics) was sent to Part 3 as an inquiry:</p> <p><i>Existing boilers having tube replacement, re-rolling, or other extensive repairs to pressure parts should be boiled out prior to operation. The lubricant used for rolling tubes and/or the protective coating on the new tubes must also be removed as they could lower the heat transfer rate and/or cause localized overheating.</i></p> <p>There was further discussion on a location for the rest of the proposal.</p>		

<b>Item Number: 22-13</b>	<b>NBIC Location: Part 1, 3.8.2.2</b>	<b>Attachment 6</b>
<b>General Description:</b> Align hot-water boiler thermometer requirements with ASME Section IV		
<b>Subgroup:</b> SG Installation		
<b>Task Group:</b> T. Clark (PM), P. Jennings, G. Tompkins, R. Adams, and D. Zalusky		
<b>Explanation of Need:</b> NBIC Part 1 does not expressly permit the use of temperature sensors or digital displays as thermometers for hot water heating or supply boilers, even though they are permitted under ASME Section IV, HG-612. NBIC Part 1 also does not address the required temperature range of thermometers, inconsistent with ASME Section IV.		
<b>January 2023 Meeting Action: Proposal</b>		
Mr. Clark went through his proposal. A motion to recommend the proposal as presented was made, seconded, and unanimously approved.		

### 13. New Items:

<b>Item Number: 22-28</b>	<b>NBIC Location: Part 1, 9.1</b>	<b>No Attachment</b>
<b>General Description:</b> Pool Heater definition		
<b>Subgroup:</b> SG Installation		
<b>Task Group:</b> None assigned.		
<b>Explanation of Need:</b> The NBIC Installation and Inspection Codes do not have a definition for pool heaters. There is potential for confusion regarding which NBIC requirements, if any, should apply to pool heaters.		
<b>January 2023 Meeting Action: Progress Report</b>		
A task group was assigned. They will work on adding pool heater requirements and then will follow up with definitions for the Glossary.		
<b>Task Group: J. Kleiss (PM), R. Spiker, T. Creacy, and M. Byrum</b>		

<b>Item Number: 22-30</b>	<b>NBIC Location: Part 1, 3.6.3</b>	<b>No Attachment</b>
<b>General Description:</b> Drains in equipment rooms with heating boilers containing glycol		
<b>Subgroup:</b> SG Installation		
<b>Task Group:</b> None assigned.		
<b>Explanation of Need:</b> Glycol should be disposed of in accordance with regulations. The intent of this addition to the text is to identify that drains may not be the proper way to dispose of glycol.		
<b>January 2023 Meeting Action: Progress Report</b>		
Mr. Jennings explained the background on this item. A task group was assigned.		
<b>Task Group: P. Jennings (PM), R. Adams, D. Zalusky, D. Patten, and R. Smith</b>		

<b>Item Number: 22-31</b>	<b>NBIC Location: Part 1, 3.8.2.3</b>	<b>Attachment 7</b>
<b>General Description:</b> Location of temperature controls		
<b>Subgroup:</b> SG Installation		
<b>Task Group:</b> None assigned.		
<b>Explanation of Need:</b> There is currently no requirement that the temperature controls measure the boiler temperature at or near the boiler outlet.		
<b>January 2023 Meeting Action: Proposal</b>		
Mr. Jennings presented his proposal. He matched the language from Part 1, 3.8.2.2, but used the words “temperature sensing elements” instead of “thermometer.” After some discussion, the group revised the proposal. A motion to recommend the revised proposal was made, seconded, and unanimously approved.		
<b>Task Group: P. Jennings (PM)</b>		

<b>Item Number: 22-32</b>	<b>NBIC Location: Part 1, 3.8.1.4 b)</b>	<b>No Attachment</b>
<b>General Description:</b> High pressure limit control requirements for fired jacketed steam kettles		
<b>Subgroup:</b> SG Installation		
<b>Task Group:</b> None assigned.		
<b>Explanation of Need:</b> As a safeguard to over pressurizing the fired jacketed steam kettle, the pressure range of the actuated high pressure limit control should not exceed the MAWP of the vessel.		
<b>January 2023 Meeting Action: Progress Report</b>		
Mr. Adams talked about the needs of this item. Some discussion followed. A task group was assigned. They will work to find a new location for this item as it’s not relevant to 3.8.1.4 b).		
<b>Task Group: R. Adams (PM), D. Patten, T. Clark, and T. Creacy</b>		

#### 14. Future Meetings

Mr. Brockman announced the future NBIC meeting dates and locations.

- July 10 – 13, 2023 – St. Louis, MO
- January 8 – 11, 2024 – Charlotte, NC

#### 15. Adjournment

Mr. Brockman motioned to adjourn the meeting at 1:42 p.m. (EST). The motion was seconded and unanimously approved.

Respectfully submitted,



Michelle Vance  
Subgroup Installation Secretary

# Subgroup Installation Attendance: January 10, 2023

Attachment 1

<b>MEMBERS:</b>	<b>Interest Category</b>	<b>In Person</b>	<b>Remote</b>	<b>Not In Attendance</b>
Joe Brockman	Authorized Inspection Agencies	x		
Edward Wiggins	Jurisdictional Authorities		x	
Rodger Adams	Authorized Inspection Agencies	x		
Jim Byrum	Authorized Inspection Agencies	x		
Tom Clark	Jurisdictional Authorities	x		
Todd Creacy	Authorized Inspection Agencies	x		
J. Matt Downs	Manufacturers	x		
Patrick Jennings	Authorized Inspection Agencies	x		
Jeff Kleiss	Manufacturers	x		
Stanley Konopacki	Users		x	
Don Patten	Manufacturers	x		
H. Michael Richards	General Interest			x
Rex Smith	Authorized Inspection Agencies		x	
Ron Spiker	Jurisdictional Authorities	x		
Kim Black (Alternate for Gene Tompkins)	Manufacturers	x		
Melissa Wadkinson	Manufacturers	x		
Milton Washington	Jurisdictional Authorities		x	
Michelle Vance	Secretary	x		

<b>VISITORS:</b>	<b>Company / Interest</b>	<b>In Person</b>	<b>Remote</b>
Bryan Ahee	Bradford White Corporation	x	
David Zalusky	CNA Insurance	x	
Jessica Robertson	Chemours		x
Robert Smith	Naval Facilities Engineering Systems Command	x	
Gary Scribner	NBBI Staff	x	
Greg Goossens	NBBI Staff	x	
Luis Ponce	NBBI Staff	x	



# Announcements

- Zoom Notes:
  - Make sure your actual name is on your Zoom account.
  - Please add an “M” for Member, “V” for Visitor, or “S” for Staff at the end of your name (e.g., Michelle Vance – S).
    - Click “Participants”, click “more” next to your name, click “rename,” and add the applicable letter.
  - Please stay muted during the meeting. If you would like to speak, please use the “raise hand” feature, and then you can unmute as you are called on.
- Starting with the July meeting, we will use MS Teams instead of Zoom for these meetings.
- The National Board will be hosting a reception on Wednesday evening from **5:30pm to 7:30pm** in the Colonial Ballroom at the hotel. We will also host a breakfast and lunch on Thursday. Breakfast will be served from 7:00am to 8:00am, and lunch will be served from 11:30am to 12:30pm. Both meals will be served in the Colonial Ballroom at the hotel. Members, visitors, and guests are all welcome.  
**Please register if you have not already done so.**
- We will be adding two presentations to our agenda today that will be given through the SG R&A meeting: one is on **Weld Metal Additive Manufacturing** (9:00am); the other one is on **Vessel Repairs with Carbon Fiber**. We will join them through their Zoom link. If you are joining us remotely and would like to be listening in on these presentations, you will need the Zoom links for the SG R&A meeting. In order to gain access to the links you will need to make sure you are registered through the website. Once registered you will have access to the website with the Zoom links to all meetings.
- Meeting schedules, meeting room layouts, and other helpful information can be found on the National Board website under the **Inspection Code** tab → NBIC Meeting Information.
- We now have a review and comment Letter Ballot type. When we send out a LB for review and comment, the layout of the ballot will look different, as it will not have any voting options.
- Remember to add any attachments that you’d like to show during the meeting (proposals, reference documents, PowerPoint, etc.) to the cloud *prior to the meeting*.
  - If needed, we can go over how to do this.
  - *All* PowerPoint attachments need to be sent to Jonathan for approval prior to the meeting.
- Always submit attachments in Word format showing “strike through/underline” (track changes)
  - Please contact me if you need any help with this.
- Naming format reminder:
  - *Item number - person who made the revision - date update* [YYMMDD]  
(e.g., Item 22-28 - Vance- 221209)
- If you’d like to open a new Interpretation or Action item, this should be done on the National Board Business Center.
  - Anyone, member or not, can open a new item
- As a reminder, anyone who would like to become a member of a group or committee:
  - Should attend at least two meetings prior to being put on the agenda for membership consideration. The nominee will be on the agenda for voting during their third meeting.
  - The nominee must submit the formal request along with their resume to Jonathan *prior to the meeting*. **Email Jonathan at [nbicsecretary@nbbi.org](mailto:nbicsecretary@nbbi.org).**

# Announcements

- If needed, we can also create a ballot for voting on a new member between meetings. To do this, you will need to contact Jonathan.
  
- Thank you to everyone who registered online for these meetings. The online registration is very helpful for planning our reception, meals, the room set up, etc. It also helps to ensure we have the most up-to-date contact information on file. Please continue to use the online registration for each meeting. If you are here in person and did not register, please do so now. To register, go to <https://www.nationalboard.org>, then under the Inspection Code tab, click “NBIC Meeting Information,” then click “In-Person Registration.”

# Weld Metal Additive Manufacturing

**Using weld metal as a replacement material**

Teresa Melfi  
NBIC Meeting  
January 2023

# Outline

- Chevron Case Study: weld metal as material for replacement parts
- Current projects and trends in weld metal manufacture
- How codes treat weld metal as a replacement material
- NBIC approach
  - Interpretation
  - Code change
  - Wait for ASME rules



# ICAM2022

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## API and ASME Qualification of a Printed Pressure Component

Robert Rettew, Chevron  
Teresa Melfi, Lincoln Electric  
Matt Sanders, Stress Engineering

[www.amcoe.org](http://www.amcoe.org)

**Selected slides are shown in this presentation.  
The entire Chevron ICAM presentation will be  
attached to the meeting minutes.**

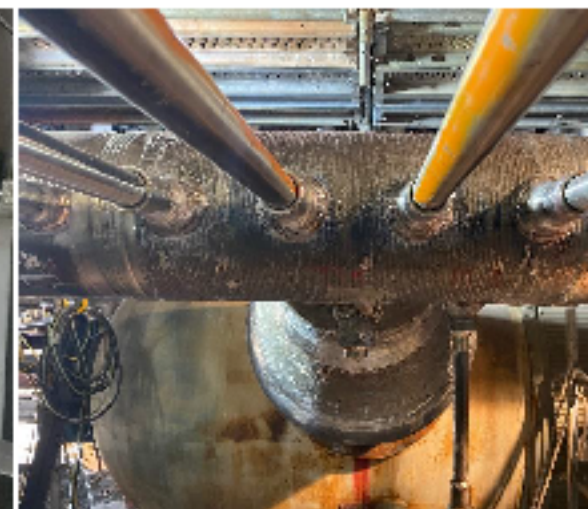


# A Refinery 3D Printing Success Story

- In early 2022, a facility turnaround needed replacements for several components in hydrogen furnace service. These components were critical path to restart the facility.
- Service requirements were 1500F and 300psi, with a design lifetime of 20 years.
- Application was for a furnace header. Previous installation was Alloy 800H with Alloy 617 weldments.
- Existing components were damaged and unusable. Replacement using traditional methods estimated ~3 months.
- 3D printing was used to deliver replacements in just under 4 weeks, avoiding a significant shutdown.



Piping components being printed at Lincoln Electric Additive Services



(left) Digital part verification, (right) Final Installation

# Inspection & Testing Summary

- Testing Conducted on Each Piece
  - Dimensional Checks
  - 100% Dye Penetrant surface inspection
  - Phased Array UT of Critical Locations
- Testing Conducted on Witness Coupons
  - Hardness Survey
  - Metallographical Assessment
  - Tensile Testing in multiple orientations
  - Chemistry
- Additional Testing Conducted on First Article
  - Pressure Testing at 6,000psi
  - Tensile Tests at elevated temperature, from wall thickness at various critical locations
  - Local RT Inspection
  - Creep testing using samples from sacrificial part



# Production Images





# Printed Components Testing

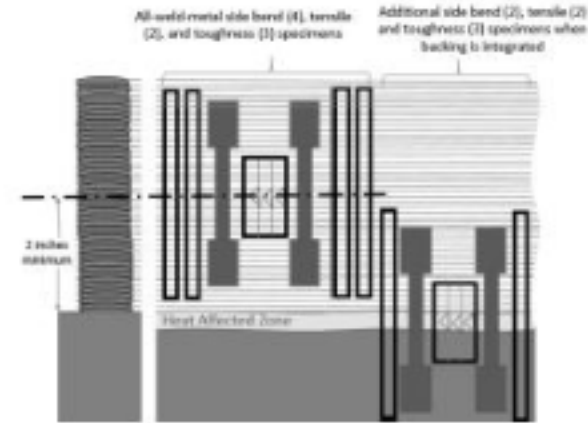
- Hydrotest (photo on right)
- Acoustic Emissions
- Phased Array Ultrasonics in critical areas, require special qualification
- Radiographic Inspection of 100% Volumetric
- Dye Penetrant 100% surface



# ASME 3020 Qualification

Cooling Rate	Wall Thickness	Yield Strength	Ultimate Strength
<i>(type)</i>	<i>(type)</i>	<i>(ksi)</i>	<i>(ksi)</i>
<b>Slow</b> <i>High Heat Input &amp; High Interpass</i>	Thin	49.9	99.0
		51.0	100.0
	Thick	59.0	103.0
		60.5	102.0
		58.0	103.0
		58.0	102.0
		61.5	104.0
		58.0	103.0
<b>Fast</b> <i>Low Heat Input &amp; Low Interpass</i>	Thin	57.0	96.5
		56.0	96.5
	Thick	63.5	107.0
		63.5	98.0

Figure 1  
Specimen Locations for Layer Widths Less Than or Equal to  $\frac{1}{2}$  in. (12 mm)

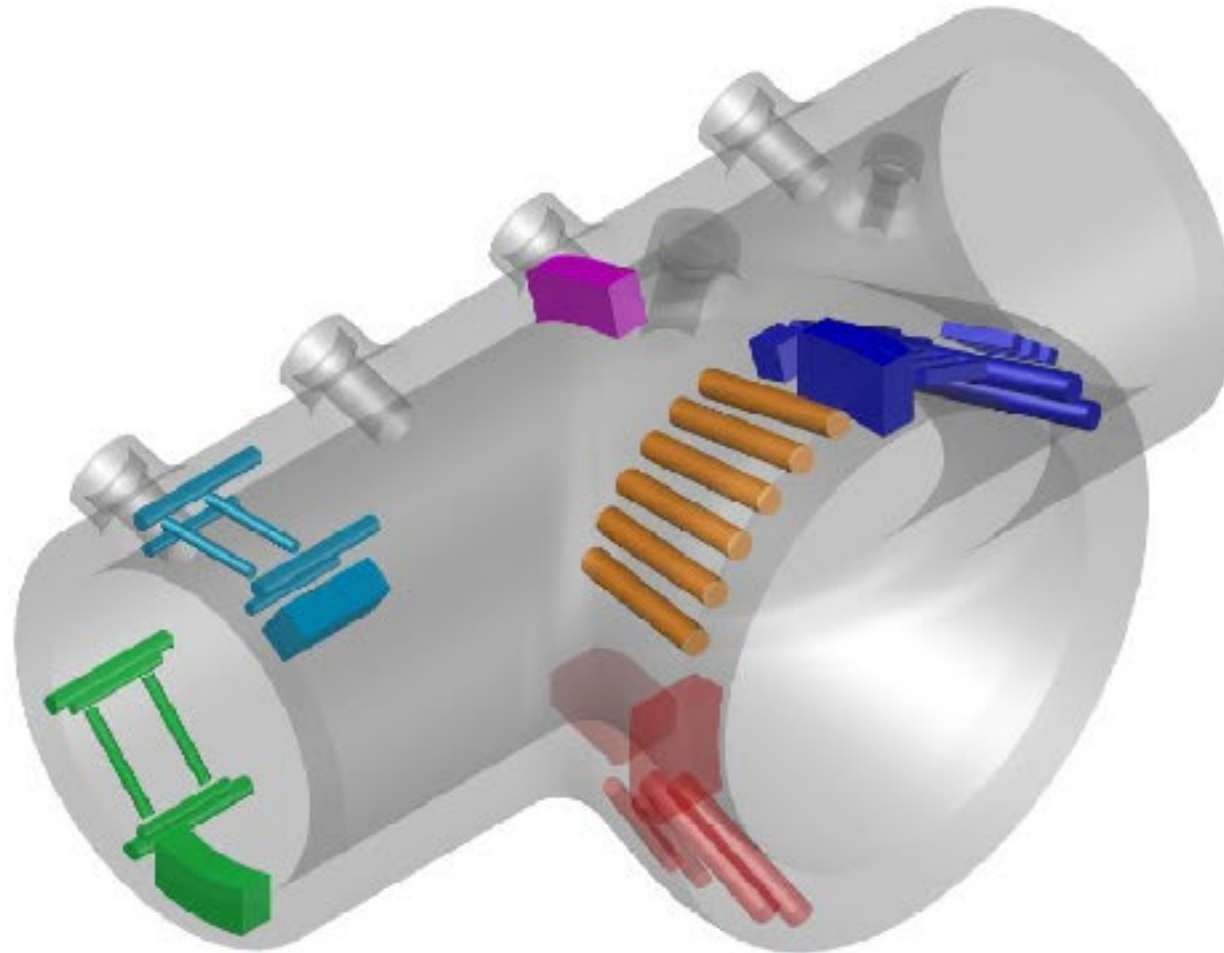


GENERAL NOTES:

- Weld specimen is shown with one bead per layer. Multiple weld beads per layer are permitted with the layer width and number of weld beads per layer qualified in accordance with Table 2.
- Three Charpy V-notch toughness specimens shall be located with the notch at approximately  $\frac{1}{16}$  in. (2 mm) from the edge of the weld beads.
- With integrated backing, an additional three Charpy V-notch toughness specimens shall be located with the notch within the heat-affected zone.
- Full-width bead and tensile specimens shall be tested and examined.
- The order of specimen removal is not mandatory.

# Specimen Locations from Sacrificial Article

Attachment 3



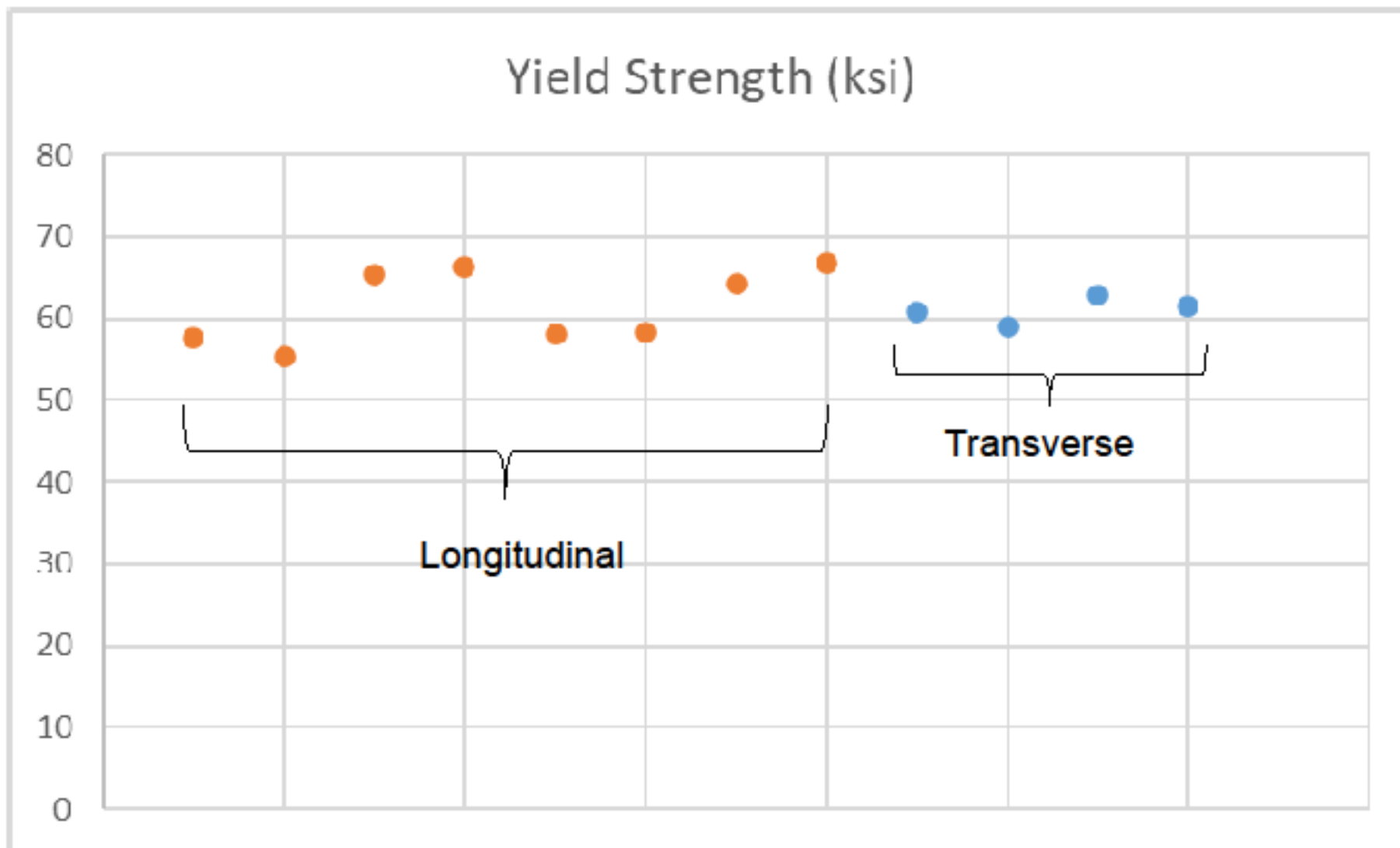




# Tensile Testing from Sacrificial Part

Section	Orientation	Location	Yield Strength (ksi)	Tensile Strength (ksi)	Elongation (%)	Reduction of Area (%)
Light Blue	Longitudinal	ID	57.6	107.5	44.8	53.7
			55.4	99.9	40.1	52.6
	Longitudinal	OD	65.5	108.7	40.4	55.0
			66.4	108.7	40.5	51.0
	Transverse	Mid wall	60.9	106.1	45.5	42.5
			59.0	102.7	34.9	31.1
Transverse	Mid-wall	63.0	107.0	39.9	51.4	
		61.6	107.9	37.4	44.0	
Green	Longitudinal	ID	58.0	101.8	43.1	49.4
			58.3	102.2	44.9	57.2
	Longitudinal	OD	64.3	109.4	42.1	44.7
			66.7	108.6	42.5	45.8
Red	Longitudinal	Mid-wall	60.9	101.8	47.0	55.2
			60.4	102.4	48.6	55.7
	Transverse		61.0	104.2	44.4	58.7
			61.5	104.7	43.7	51.0
Dark Blue	Longitudinal	Mid wall	60.6	101.1	46.5	59.2
			60.5	101.1	46.8	59.2
	Transverse		61.4	103.5	40.3	48.7
			62.5	105.4	40.5	54.0

# Tensile Testing



# Timeframe Recap

- **Week One**
  - First Inquiry
  - Meetings & Printability Assessment with Lincoln Electric
  - Determined code case and API guidance
- **Week Two**
  - Risk Assessment, supported by review of Lincoln and Industry Data
  - Visit to Lincoln, review QA/QC and manufacturing
  - Initial Mechanical Results, Surface Roughness, and FEA model
- **Week Three**
  - Hydrotest, PAUT, and RT on test piece
  - Grinding & photography of surface indications
- **Week Four**
  - Delivery of subsequent parts for final machining, inspection, & installation







# ICAM 2022

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## Questions & Discussion

[www.amcoe.org](http://www.amcoe.org)





# Weld Metal Manufacture Today ... and trends

- Huge use in repair – due to supply chain constraints on large forgings, castings and specialty metals
- Still used in prototyping and in tooling (no code rules)
- Significant work on multi-metal and functionally gradient parts – pups for dissimilar metal joining, moving field welds outside of critical zones, corrosion and heat resistance, etc.
- Significant work on redesigns to remove excess thickness required for metal flow (castings, forgings)

# Weld Metal AM Code Rules

- Code case 3020 is incorporated into 2023 Section IX as QW-600 series – bracketed qualifications required
- Scattered specific BPV code cases allow use of additive materials
- Broad code case has been balloted by ASME BPV AM group.
  - Will go on to VIII and III quickly. Possibly to B31, B16, I – as they choose.
  - Limited materials including mild, low alloy, stainless and nickel-alloy steels.
  - Limited to time-independent use.
- AM has been applied in BPV using weld metal buildup rules
- API 20S, AWS D20, DNV and others have use rules in place

# NBIC Possible Approaches

- Don't add or subtract any rules
  - Let repairs and alterations language cover this, along with jurisdictions/AIs
  - Wait for rules to be adopted into BPV codes (2025-2027 for III and VIII)
- Add specific rules for repair or alteration using weld metal
- Issue interpretation(s) to address how this is covered
  - See B31.3 interpretation on the next slide

Dr. Amir Farzadfar  
Emerson Process Management  
301 S. 1st Avenue  
Marshalltown, IA 50158  
Email: [amir.farzadfar@emerson.com](mailto:amir.farzadfar@emerson.com)

Subject: B31.3-2014, Interpretation of Paras. 302.3.2(f), 304.7.2, 323.1.2 Additive Manufacturing Materials

Reference: Your September 9, 2015 Request for Interpretation; ASME C&S File #15-2052

Dear Dr. Farzadfar:

Your request for interpretation has been reviewed by the B31.3 Process Piping Committee. Following is the Committee's understanding of your question and official response:

Question: Does ASME B31.3 permit the use of an unlisted piping component manufactured using the additive manufacturing process?

Reply: Yes, provided it meets all of the requirements of the Code including material being qualified in accordance with the requirements of para. 323.1.2, and the component meeting the requirements of paras. 326.1.2 and 326.2.2.

Sincerely,



Riad Mohamed  
Secretary, B31.3 Process Piping Committee  
212-591-8528  
[mohamedr@asme.org](mailto:mohamedr@asme.org)



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**For pressure vessel repair  
per ASME PCC-2 Article 401  
January 2023**

Presented By: Olley Scholer  
VP Technical Development



**Building  
Stronger  
Bonds™**



# Agenda

Attachment 4

**01 – What is Carbon Fiber?**

**02 – ASME PCC-2 Compliance**

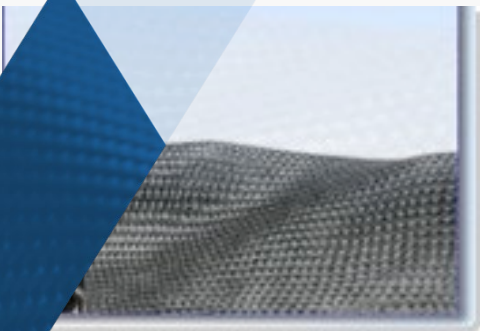
**04 - Type of Repair**

**05 - Value Engineering**

**06 – Case History**

**07 – Q & A**

# \* What is Carbon Fiber?



Input Thread



Fabric Weaving



Fabric Rolls



Thermoset Resin



Saturated Reinforcing Fabric



Apply Saturated Carbon Fabric

# \* ASME PCC-2 Article 401

## Repair of Pressure Vessels with Carbon Fiber

### 401-1.2 Applicability

- Repair of vessels originally designed in accordance with a variety of construction standards, including ASME BPVC, BS EN 13121-2, and PD 5500
- Article 401 provides guidance for material qualification testing, repair designs, installation, and quality control and assurance for carbon fiber repair of vessels



# \* Types of Repair

## Shell Repair



## Nozzle Repair



## Head Repair



# \* Value Engineering

## Engineering Process

Engineering  
Assessment  
Form

HJ3 Provides  
Design  
Calculations

Quote is  
provided to  
Certified  
Installer



# \* Case History

## Secondary Heat Exchanger

- Corrosion under insulation corrosion led to a pinhole leak in the shell
- State inspection recommended shutdown
- Vessel was a critical asset used in plant operations in an intrinsically safe area



# \* Case History

## Secondary Heat Exchanger

- A 16-hour emergency shutdown was scheduled to execute the repair
- The Shell was prepared to SSPC SP-11 “Power Tool Clean to Near-White Metal”
- The engineered repair was PE stamped and submitted to the state inspector
- Four layers of carbon fiber was applied, cured, inspected, and returned to service





# \* Case History

## Ion Exchanger

- The vessel head was corroded from HCL acid stored in a tank above the vessel
- Plant operations required a repair to the exchanger during the semi-annual outage
- Welding could not be performed without damaging the internal rubber liner

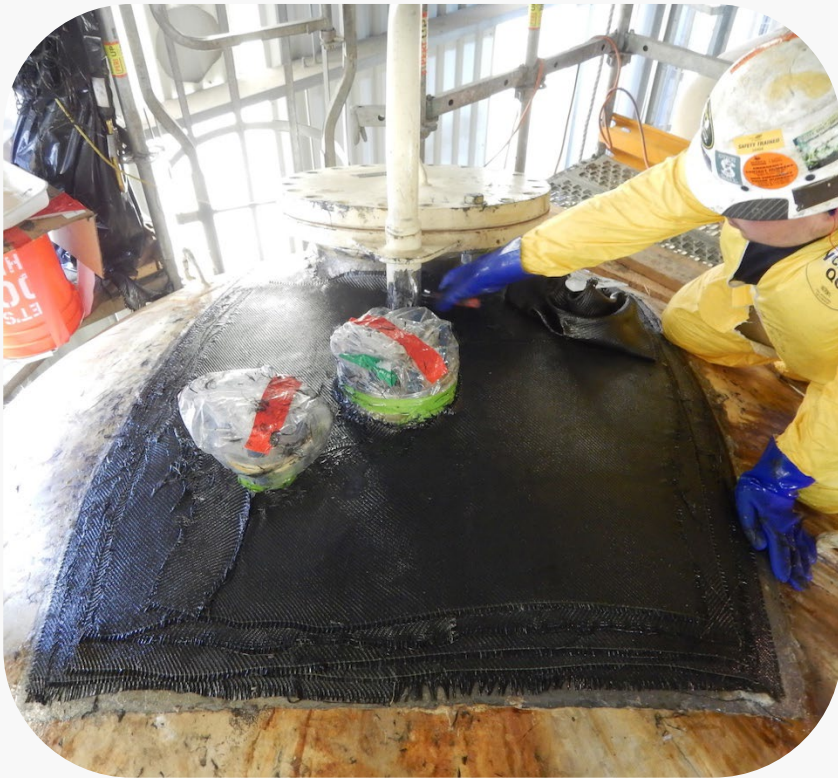




# \* Case History

## Ion Exchanger

- The head was prepared to SSPC SP-11 “Power Tool Clean to Near-White Metal”
- The engineered repair was PE stamped and submitted to the inspector
- Six layers of carbon fiber was applied, cured, and inspected
- The vessel was returned to service and has been operational since 2017



# \* Post-Installation Inspection

Inspection Method	What to Look For
Ultrasonic Thickness (UT)	Steel thickness can be read on original steel through pre-fabricated cut-outs in the CFRP
Acoustic Tap Test	voids and air encapsulation between concrete and layers of primer, resin or adhesive, and within the FRP system itself;
Acoustic Tap Test	de-laminations between layers of FRP system;
Visual	broken or damaged edges of the FRP system;
Acoustic Tap Test & Visual	wrinkling and buckling of fiber and fiber tows;
Visual	discontinuities due to fracture of fibers, breakage in the fabric, or cracks in pre-cured shells;
Visual	cracks, blisters and peeling of the protective coating;
Visual	resin-starved areas or areas with non-uniform impregnation or wet-out
Shore D Hardness	under-cured or incompletely cured resin



# **CARBON SEAL**<sup>TM</sup>

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**For Pressure Vessel  
Repair**



**Building  
Stronger  
Bonds<sup>TM</sup>**





### PROPOSED INTERPRETATION

<b>Item No.</b> 23-03
<b>Subject/Title</b> Boiler Room Exit
<b>Project Manager and Task Group</b>
<b>Source (Name/Email)</b> Dwayne Dierksen / dwayne.dierksen@chubb.com
<b>Statement of Need</b> Some inspectors interpretations are restricting exits to ground level egress only.
<b>Background Information</b> A boiler room on a roof elevation with exit onto that roof elevation would only be allowed if a fire escape or an additional roof egress back into another part of the building was incorporated to reach the ground level.
<b>Proposed Question</b> Are there any restrictions where the boiler room exits to? Such as roofs, a secured (fenced area), other rooms, etc?
<b>Proposed Reply</b> No.
<b>Committee's Question 1</b> Does NBIC Part 1 specify where the boiler room exits should lead?
<b>Committee's Reply 1</b> No
<b>Rationale</b> NBIC Part 1 – Neither 1.6.3 nor the glossary of terms definition for “Exit” state where exits lead.
<b>Committee's Question 2</b>
<b>Committee's Reply 2</b>
<b>Rationale</b>

## CODE INTERPRETATIONS

Requests for code Interpretations shall provide the following:

**a) Inquiry**

Provide a condensed and precise question, omitting superfluous background information and, when possible, composed in such a way that a "yes" or a "no" reply, with brief provisos if needed, is acceptable. The question should be technically and editorially correct.

**b) Reply**

Provide a proposed reply that clearly and concisely answer the inquiry question. Preferably the reply should be "yes" or "no" with brief provisos, if needed.

**c) Background Information**

Provide any background information that will assist the committee in understanding the proposed Inquiry and Reply Requests for Code Interpretations must be limited to an interpretation of the particular requirement in the code. The Committee cannot consider consulting type requests such as:

A review of calculations, design drawings, welding qualifications, or descriptions of equipment or Parts to determine compliance with code requirements;

A request for assistance in performing any code-prescribed functions relating to, but not limited to, material selection, designs, calculations, fabrication, inspection, pressure testing, or installation; or

A request seeking the rationale for code requirements.

**Item 22-13**

Submitted by: Tom Clark

Page 1 of 1

**Part 1****3.8.2.2 THERMOMETERS**

Each hot-water heating or hot-water supply boiler shall have a thermometer so located and connected that it shall be easily readable. The thermometer shall be so located that it shall at all times indicate the temperature of the water in the boiler at or near the outlet. The thermometer shall have a minimum indication of 70°F (20°C) or less, and a maximum indication at least equal to 320°F (160°C) but not more than 400°F (205°C).

An electronic temperature sensor and display may be used in lieu of a thermometer, provided that the display is always on and complies with the requirements above.

**HG-612 Thermometers/Temperature Sensors**

Each hot water heating or hot water supply boiler shall have a thermometer or temperature sensor with display so located and connected that it shall be easily readable. The thermometer or sensor shall be so located that it shall at all times indicate the temperature of the water in the boiler at or near the outlet.

- (a) Thermometer shall have a minimum reading of 70°F (20°C) or less.
- (b) Thermometer shall have a maximum reading at least equal to 320°F (160°C) but not more than 400°F (205°C).
- (c) Electronic temperature sensor used in lieu of a thermometer shall meet the following requirements:
  - (1) The sensor shall be powered from the boiler power supply, and it shall have a display that remains on at all times. The sensor shall have a backup power supply.
  - (2) The full scale of the sensor and display must be a minimum of 70°F (20°C) to 320°F (160°C). It shall be accurate to within ±1 deg.
  - (3) The sensor shall have a minimum operating temperature range of 32°F to 300°F (0°C to 150°C).
  - (4) The display shall have an ambient operating temperature range of 32°F to 120°F (0°C to 50°C) unless otherwise required by the application.

**Item 22-31**

Submitted by: Patrick Jennings

Page 1 of 1

**Part 1, 3.8.2.3****3.8.2.2 THERMOMETERS**

Each hot-water heating or hot-water supply boiler shall have a thermometer so located and connected that it shall be easily readable. The thermometer shall be so located that it shall at all times indicate the temperature of the water in the boiler at or near the outlet.

**3.8.2.3 TEMPERATURE CONTROL**

Each automatically fired hot-water heating or hot-water supply boiler shall be protected from over-temperature by at least two temperature-operated controls.

- a) Each individual hot-water heating or hot-water supply boiler or each system of commonly connected boilers shall have at least one control that will cut off the fuel supply when the water temperature reaches an operating limit, which shall be less than the maximum allowable temperature.
- b) In addition to a) above, each individual automatically fired hot-water heating or hot-water supply boiler shall have at least one safety limit control with manual reset that will cut off the fuel supply at or below the maximum allowable temperature at the boiler outlet.
- c) Each operating and safety limit control shall have its own sensing element and operating switch. The temperature sensing elements shall be so located that they shall at all times sense the temperature of the water in the boiler at or near the outlet.
- d) Alternatively, integrated controls with multiple sensors may be used to meet the requirements of 3.8.2.3 a) and b).