



*THE NATIONAL BOARD
OF BOILER AND PRESSURE VESSEL INSPECTORS*

NATIONAL BOARD INSPECTION CODE SUBGROUP REPAIRS & ALTERATIONS

MINUTES

**Meeting of January 10, 2023
Charleston, SC**

These minutes are subject to approval and are for the 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
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1. Call to Order

Chair Boseo called the meeting to order at 8:00 a.m. EST in the Gold Ballroom on the 2nd Floor of the hotel.

2. Roll call of Members and Introduction of Visitors

Secretary Hellman called roll of the Members and held introductions of visitors ([Attachment 1](#))

3. Check for a Quorum

Secretary Hellman verified a quorum was reached.

4. Announcements

- The National Board will be hosting a reception on Wednesday evening from 6:30 p.m. to 8:30 p.m. in the Colonial Ballroom at the hotel.
- The National Board will be hosting breakfast and lunch on Thursday. Breakfast will be served from 7:00 a.m. to 8:00 a.m. in the Colonial Ballroom, and lunch will be served from 11:30 a.m. to 12:30 p.m. in the Colonial Ballroom.

5. Adoption of the Agenda

a. The following revisions were made to the Agenda:

- Editorial: Removal of “Attachment” numbers
- Added J. Ferreira as PM for Item A22-27
- Added A. Khssassi for SG R&A membership consideration
- Added L. Dura for SG R&A membership consideration
- Removed M. Schaser for SG R&A membership consideration due to interest category concerns
- Removed J. Ferreira from SG R&A membership consideration due to interest category concerns
- Added:
 - I22-24
 - I22-33
 - A23-05 (Underwood)
 - A23-XX (Boseo)
- Added Presentations:
 - Teresa Melfi, Lincoln Electric – **Weld Metal Additive Manufacturing**
 - Olley Scholer, HJ3 Composite Technologies – **Vessel Repairs with Carbon Fiber**

b. The agenda was unanimously approved (UA), as revised.

6. Approval of the Minutes of the July 12, 2022 Meeting

The minutes are available for review on the National Board website, www.nationalboard.org. The Minutes were motioned, seconded, and unanimously approved.

7. Review of Rosters

a. Membership Nominations

- i. L. Dutra, and Aziz Khssassi were considered for SG R&A membership.
 - L. Dutra accepted UA
 - A. Khssassi accepted UA

b. Membership Reappointments

- i. The following Subgroup R&A memberships are set to expire prior to the July 2023 NBIC meetings: Mr. Craig Hopkins, Mr. Walt Sperko, and Mr. Marty Toth.
 - All membership reappointments were UA.

c. Officer Nominations

None

8. Presentations:

- a. Teresa Melfi, Lincoln Electric – **Weld Metal Additive Manufacturing (Attachment 2)**
- b. Olley Scholer, HJ3 Composite Technologies – **Vessel Repairs with Carbon Fiber (Attachment 3)**

9. Interpretation Items

Item Number: I22-24	NBIC Location: Part 3, 3.3.4.8	Attachment 4
General Description: Repair of pressure retaining items without complete removal of defect		
Subgroup: Repairs and Alterations		
Task Group: M. Quisenberry (PM), L. Dutra		
Explanation of Need: 3.3.4.8 does imply that the defect should be known in regards to characteristics such as orientation, nature, depth, configuration but does not fully state this.		
INTEPR TG January 2023 Meeting Action: M. Quisenberry presented. The Committee Q & A were revised. The proposal was UA as revised .		
SG R&A January 2023 Meeting Action: M. Quisenberry presented. The Committee Q & A were revised. The proposal was UA as revised .		

Item Number: I22-33	NBIC Location: Part 3, 3.4.3	Attachment 5
<p>General Description: Encapsulation of Shells and Heads</p> <p>Subgroup: Repairs and Alterations</p> <p>Task Group: M. Quisenberry (PM), R. Derby, ADDED: L. Dutra</p> <p>Explanation of Need: To clarify that encapsulation cannot be used to maintain the pressure retaining capability of shells and heads of pressure retaining items.</p> <p>INTERP TG January 2023 Meeting Action: M. Quisenberry presented. Added L. Dutra to TG. Proposal was UA as revised.</p> <p>SG R&A January 2023 Meeting Action: T. Sieme presented. The proposal was UA. Discussion took place regarding relaxing some of these restrictions if these activities were moved to a Supplement.</p>		

10. Action Items

Item Number: A20-67	NBIC Location: Part 3, S6	Attachment 6
<p>General Description: Revisions to Part 3, Supplement 6</p> <p>Subgroup: Repairs and Alterations</p> <p>Task Group: R. Underwood (PM), T. McBee, G. Galanes</p> <p>Explanation of Need: Supplement 6 was implemented into the 2007 Edition of the NBIC Part 3 to provide requirements and guidelines for repairs, alterations and modifications to DOT Transport Tanks using the National Board's "TR" Program (which was never implemented). S6 has been revised over the years to remove reference to the "TR" Program, but still contains many requirements that are not correct. This purpose of this proposal is to review the entire Supplement and make appropriate revisions that comply with NBIC Part 3 and DOT requirements.</p> <p>July SG R&A 2022 Meeting Action: B. Underwood presented. The proposal was UA with an email sent to the R&A SC to review before tomorrow's SC Meeting.</p> <p>Jan. SG R&A 2023 Meeting Action: B. Underwood presented this item passed SG LB 1/9/2023 with one disapproval that has been addressed. The revised proposal UA</p>		

Item Number: A21-02	NBIC Location: Part 3, 1.6	Attachment 7
<p>General Description: Define "Fuel Loading" as it pertains to NR activities</p> <p>Subgroup: NR TG</p> <p>Task Group: P. Edwards (PM), R. Spuhl appointed as PM in Dec. 2021.</p> <p>Explanation of Need: The NR TG would like to clarify "Fuel Loading" as used to determine Category 1, 2 or 3 NR activities.</p> <p>July SG R&A 2022 Meeting Action: R. Spuhl presented. The proposal was UA</p> <p>NOTE: At the July 2022 NBIC meeting, Main Committee requested that this item go back to the NR TG for further work.</p> <p>Jan. SG R&A 2023 Meeting Action: R. Spuhl presented. The proposal (as revised at the NR TG) was UA.</p>		

Item Number: A21-12	NBIC Location: Part 3, 3.3.3, 3.4.4, Section 9	No Attachment
<p>General Description: Clarify the definitions and examples of "Repair" and "Alteration"</p> <p>Subgroup: Repairs and Alterations</p> <p>Task Group: K. Moore, R. Underwood, M. Chestnut, T. Seime</p> <p>Explanation of Need: Clarify the definitions of "Repair" and "Alteration" in the Glossary and revise the list of examples of each to better define the allowable scope of activities.</p> <p>July SG R&A 2022 Meeting Action: P. Becker presented a revised proposal. A Rvw & Comment LB will go to SG R&A.</p> <p>Jan. SG R&A 2023 Meeting Action: P. Becker presented a PR</p>		

Item Number: A21-31	NBIC Location: NBIC Glossary	No Attachment
<p>General Description: Revise definition of "Field"</p> <p>Subgroup: Repairs and Alterations</p> <p>Task Group: R. Miletti (PM), P. Gilston, M. Toth, J. Walker</p> <p>Explanation of Need: A "Field" site under the current definition could be multiple rented or leased spaces used for repairs/alterations, where there is no single or specific customer or job, but rather the locations(s) are used for conducting repair/alteration activities by personnel employed by the Certificate Holder on a continual basis.</p> <p>July SG R&A 2022 Meeting Action: P. Gilston presented a PR</p> <p>Jan. SG R&A 2023 Meeting Action:R. Miletti presented a PR. Revisions to NB-415 required first.</p>		

Item Number: A21-37	NBIC Location: Part 3, 1.6	Attachment 8
<p>General Description: Parts used in NR Activities</p> <p>Subgroup: NR TG</p> <p>Task Group: R. Spuhl (PM)</p> <p>Explanation of Need: Clarification that parts used in NR activities are fabricated by NR Certificate Holders and inspected by appropriately endorsed National Board commissioned Inspectors.</p> <p>July SG R&A 2022 Meeting Action: R. Spuhl presented a PR</p> <p>Jan. SG R&A 2023 Meeting Action: R. Spuhl presented. The proposal was Revised and UA.</p>		

Item Number: A21-43	NBIC Location: Part 3, Glossary	No Attachment
<p>General Description: Defining and revising "Practicable" and "Practical" within the NBIC</p> <p>Subgroup: Repairs and Alterations</p> <p>Task Group: M. Toth (PM), B. Underwood</p> <p>Explanation of Need: Defining and revising Practicable and Practical within the NBIC and revising where applicable</p> <p>July SG R&A 2022 Meeting Action: M. Toth presented that a new item may need to be opened to find these words in the other Parts of the NBIC to verify consistency. This proposal will be sent to a LB to all SG (Parts 1, 2, 3, and 4) for a vote.</p> <p>Jan. SG R&A 2023 Meeting Action: M. Toth presented a PR</p>		

Item Number: A21-44	NBIC Location: Part 3, Glossary	No Attachment
General Description: Defining "De-Rating" within Part 3		
Subgroup: Repairs and Alterations		
Task Group: M. Toth (PM), B. Underwood, B. Wielgoszinski		
Explanation of Need: Defining de-rating within Part 3		
July SG R&A 2022 Meeting Action: M. Toth presented. A Rvw & Comment LB will go to all SG (Parts 1, 2, 3, and 4).		
Jan. SG R&A 2023 Meeting Action: M. Toth presented a PR		

Item Number: A21-45	NBIC Location: Part 3, Supplements	No Attachment
General Description: Add a supplement to address oil, gas and chemical repair & alteration scope		
Subgroup: Repairs and Alterations		
Task Group: R. Underwood (PM)		
Explanation of Need: There has been interest from companies operating with the Oil, Gas and Chemical industries to address certain types of repairs that may exist in ASME PCC-2 or API. NBIC does not have many of these repair methods within the book.		
July SG R&A 2022 Meeting Action: B. Underwood presented. Discussion held regarding lap patches being considered as "repairs" instead of "alterations". Per Gary Scribner, BOT may change NB-415 or may create a new document that would give direction as to where this proposal will go (i.e. new type of "R" Stamp, new 'Division' created within the "R" Cert. program, etc.) This was a PR.		
Jan. SG R&A 2023 Meeting Action: B. Underwood presented a PR		

Item Number: A21-53	NBIC Location: Part 3, S8.5 a)	No Attachment
<p>General Description: Post Repair Inspection of weld repairs to CSEF steels</p> <p>Subgroup: Repairs and Alterations</p> <p>Task Group: P. Gilston (PM), E. Cutlip</p> <p>Explanation of Need: The requirement for Inspector involvement in post-repair inspections to CSEF weld repairs is to ensure future safe operation of the boiler. This is a function of the inservice Authorized Inspection Agency, not the Repair Inspector, whose duties end with completion of repair documentation.</p> <p>July SG R&A 2022 Meeting Action: P. Gilston presented a PR.</p> <p>Jan. SG R&A 2023 Meeting Action: P. Gilston presented a PR.</p>		

Item Number: A21-67	NBIC Location: Part 3, 3.4.9	No Attachment
<p>General Description: Add welding requirements to plugging firetubes</p> <p>Subgroup: Repairs and Alterations</p> <p>Task Group: P. Gilston (PM), K. Moore, M. Quisenberry, T. Sieme</p> <p>Explanation of Need: The current NBIC does not have enough direction or requirements for welding tube plugs in firetubes.</p> <p>July SG R&A 2022 Meeting Action: P. Gilston presented a PR.</p> <p>Jan. SG R&A 2023 Meeting Action: P. Gilston presented a PR.</p>		

Item Number: A21-82	NBIC Location: Part 3, 3.3.3(s)	No Attachment
<p>General Description: Examples of Repairs</p> <p>Subgroup: Repairs and Alterations</p> <p>Task Group: P. Davis (PM), R. Underwood, P. Gilston, , J. Ferreira, J. Walker, E. Cutlip, . P. Miller, L. Dutra</p> <p>Explanation of Need: Adding "repair" to 3.3.3(s) would then address use of different weld material. Currently 3.3.3(s) only addresses replacement of the part, not repair (Repair is addressed in 3.3.3(r)).</p> <p>July SG R&A 2022 Meeting Action: B. Underwood presented a PR. The PM was changed to P. Davis. P. Miller and L. Dutra were added to the taskgroup.</p> <p>Jan. SG R&A 2023 Meeting Action: P. Davis presented a PR.</p>		

Item Number: A22-02	NBIC Location: Part 3, 3.3.2 e) 1)	No Attachment
General Description: Part 4 Item A21-83 may impact part 3, 3.3.2 e) 1)		
Subgroup: Repairs and Alterations		
Task Group: M. Toth (PM), B. Derby, L. Dutra, M. Carlson		
Explanation of Need: Part 4 Item A21-83 was reviewed as it may impact part 3, 3.3.2 e) 1) examples of Routine Repairs. An Item for Part 3 will be opened to address “valve” repairs as they relate to SRVs.		
July 2022 Meeting Action: M. Toth presented. The group verified 3.3.2 e) 1) verbiage. M. Toth to work with Part 4 to verify no impact to Part 3. This was a PR.		
Jan. SG R&A 2023 Meeting Action: M. Toth presented a PR		

Item Number: A22-12	NBIC Location: Part 3, 3.3.5.2 & 3.4.5.1	Attachment 9
General Description: Lost or Destroyed UDS		
Subgroup: Repairs and Alterations		
Task Group: T. Seime (PM)		
Explanation of Need: To provide the ability to repair/alter these vessels with a reconstructed UDS.		
July 2022 Meeting Action: T. Sieme presented. This passed SC LB and will be on MC Agenda.		
NOTE: This item was balloted to SG R&A and SC R&A after the July 2022 meeting. Both groups approved the proposal unanimously.		
Jan. SG R&A 2023 Meeting Action: T. Sieme presented this has passed LB and is ready for MC.		

Item Number: A22-18	NBIC Location: Part 3, Glossary	No Attachment
<p>General Description: Definition of blowdown and blowoff</p> <p>Subgroup: Repairs and Alterations</p> <p>Task Group: K. Moore (PM). M. Quisenberry</p> <p>Explanation of Need: These terms are not consistently used throughout the industry. This is to provide guidance to use the correct term when addressing the equipment or the action.</p> <p>July 2022 Meeting Action: K. Moore presented. The proposal was compared to ASME Sect. I and B31.1 definitions for consistency. G. Scribner commented on the history of these terms and their use in the industry and Codes and the need for these definitions. M. Quisenberry volunteered for the taskgroup. Rvw & Comment LB to all SG (Part 1, 2, 3, and 4)</p> <p>Jan. SG R&A 2023 Meeting Action: K. Moore presented a PR</p>		

Item Number: A22-19	NBIC Location: Part 3, 5.2.2	No Attachment
<p>General Description: R Certificate Holders with Design Only Scope</p> <p>Subgroup: Repairs and Alterations</p> <p>Task Group: J. Ferreira (PM), R. Valdez, G. Scribner, B. Schaefer</p> <p>Explanation of Need: To add new paragraphs 5.2.2 d) and 5.2.2 e) which will provide guidance for R Certificate Holders with "Design Only" on which activities they are permitted to perform and how they and the Inspectors shall complete the R-2 Form.</p> <p>July 2022 Meeting Action: J. Ferreira presented. After discussion, it was pulled back for more work. Several members added to taskgroup. This was a PR.</p> <p>Jan. SG R&A 2023 Meeting Action: J. Ferreira presented a PR</p>		

New Action Items:

Item Number: A22-27	NBIC Location: Part 3	No Attachment
General Description: Post Repair Activity - Boil Out		
Subgroup: Repairs and Alterations		
Task Group: J. Ferreira (PM), L. Dutra, M. Quisenberry, M. Toth		
Explanation of Need: When major repairs are made and the boiler is not properly cleaned of oils, it will cause water level instability and carryover.		
Jan. SG R&A 2023 Meeting Action: J. Ferreira presented a PR. L. Dutra, M. Toth and M. Quisenberry added to TG.		

Item Number: A22-29	NBIC Location: Part 3	Attachment 10
General Description: Removal of the requirement of AIA audits from the NR program		
Subgroup: Repairs and Alterations		
Task Group: R. Spuhl (PM)		
Explanation of Need: This requirement cannot be enforced and is not defined by the NR Certificate Holder and therefore must be removed.		
Jan. SG R&A 2023 Meeting Action: R. Spuhl presented. The proposal was UA.		

Item Number: A22-41	NBIC Location: Part 3, 1.5	No Attachment
General Description: Reference NB-415 in Quality System		
Subgroup: Repairs and Alterations		
Task Group: P. Davis selected as PM. Added M. Carlson and J. Walker , L. Ponce		
Explanation of Need: Requirements in the NB-415 should be included in the R Cert. Holder's QC Manual. Examples : a) Notifying the National Board when an organization changes scope, ownership, name, location, address, or Inspection Agreement and b) Return of the stamp.		
Jan. SG R&A 2023 Meeting Action: P. Davis selected as PM. Added M. Carlson, L. Ponce and J. Walker to TG – This was a PR		

Item Number: A23-05	NBIC Location: Part 3,	Attachment 11
General Description: Signing of R Forms		
Subgroup: Repairs and Alterations		
Task Group: R. Underwood (PM)		
Explanation of Need:		
Jan. SG R&A 2023 Meeting Action: B. Underwood presented. New Action was opened (A23-05) to go with this Interp. This proposal was UA.		

Item Number: A23-06	NBIC Location: Part 3, 3.3.4.8	Attachment 12
General Description: Signing of R Forms		
Subgroup: Repairs and Alterations		
Task Group: B. Boseo (PM)		
Explanation of Need: The specified period of time the defect can remain in service after weld repair shall be based on no <i>measurable</i> defect growth during subsequent inspections, or a period of time as specified by the Jurisdiction, if applicable.		
Jan. SG R&A 2023 Meeting Action: B. Boseo presented a revision (editorial) and was UA		

Item Number: A23-04	NBIC Location: Part 3, 3.3.4.6	No Attachment
General Description: Addressing Flush Patch Plate Weld NDT		
Subgroup: Repairs and Alterations		
Task Group: K. Moore (PM), J. Ferreira, Added M. Schaser		
Explanation of Need: NBIC Item to Address Flush Patch Plate Weld NDT.		
Jan. SG R&A 2023 Meeting Action: K. Moore presented. Added M. Schaser to TG. This was a PR		

11. Future Meetings

- July 2023 – St. Louis, MO
- January 2024 – Charlotte, NC

12. Adjournment

Chair Boseo adjourned the meeting at 4:27 PM.

Respectfully submitted,

Terrence Hellman

Terrence Hellman

SG R&A Secretary

Full Name	Email Address	Company Name	Title	Registration Type	ATTENDANCE	
Beauregard, Joseph	joeducati@hotmail.com	Los Alamos National Laboratory	Pressure Safety Manager	In-person		In-Person Members: 19
Becker, Pat	pbecker3135@gmail.com	EPRI	Sr. Technical Leader	In-person	1	In-Person Visitors: 21
Black, Kim	rkjblack@aol.com	American Boiler Manufacturers Association	Technology Consultant	In-person		Remote Members: 4
Boseo, Brian	bmboseo@burnsmcd.com	Burns & McDonnell	Department Manager	In-person	1	Remote Visitors: 14
Carlson, Mike	camx235@lni.wa.gov	State of Washington	Chief Boiler/Pressure Vessel Inspector	In-person	2	58
Collins, Riley	rileycollins@eastman.com	Eastman Chemical Company		In-person		24 Members = 13 Quorum
Davis, Paul	paul.davis22@woodplc.com	Wood Group USA, Inc.	Director QA/QC	In-person	1	
Derby, Robert	rderby@uanet.org	United Association ITF	Administrator of Welder Certification Program	In-person	1	
Dinic, Caslav	cdinic@tssa.org	Technical Standards and Safety Authority - Ontario	Supervisor Technical Services	In-person	1	
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Ferreira, Jon	jonathan_ferreira@hsb.com	The Hartford Steam Boiler Inspection and Insurance Company	Technical Service Manager	In-person	1	
Galanes, George	ggalanes@diamondtechnicalservices.com	DTS, Inc.	Consulting Engineer	In-person	1	
Gilston, Philip	philip_gilston@hsb.com	The Hartford Steam Boiler and Inspection Co.	Principal Engineer	In-person	1	
Goossens, Greg	ggoossens@nationalboard.org	NBBI	Director of Jurisdictional Affairs	In-person		
Hellman, Terry	thellman@nationalboard.org	National Board	Senior Staff Engineer	In-person	1	
Hopkins, Craig	CHOPKINS@SEATTLEBOILER.COM	Seattle Boiler Works, Inc.	President	In-person	1	
Johnson, Frank	fjkeck22@aol.com	Johnson Welding		In-person	1	
Kinney, Don	don.kinney@labor.nc.gov	North Carolina Boiler Safety Bureau	Bureau Chief	In-person		
Melfi, Teresa	teresa_melfi@lincolnelectric.com	Lincoln Electric	Technical Fellow	In-person	1	
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Moore, Kathy	kathymoore@joemoorecompany.com	Joe Moore & Company		In-person	1	
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Schaser, Matt	mschaser@e2g.com	The Equity Engineering Group, Inc.	Senior Engineer	In-person	1	
Scholer, Olley	oscholer@hj3.com	HJ3 Composite Technologies	VP Technical Development	In-person	1	
Scribner, Gary	gscribner@nationalboard.org	National Board	Assistant Executive Director, Technical	In-person	1	
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Siefert, John	jsiefert@epri.com	EPRI	Program Manager	In-person	1	
Sowinski, James	jsowinski@e2g.com	The Equity Engineering Group, Inc.	Principal Engineer	In-person		
Sperko, Walter	sperkow@bellsouth.net	Sperko Engineering Services, Inc	President	In-person	1	
Spuhl, Raymond	RAYMOND_SPUHL@HSB.COM	The Hartford Steam Boiler Inspection and Insurance Company	Manager Code Services	In-person	1	
Toth, Marty	mtoth@boiscotraininggroup.com	ECS Consulting, LLC	Principal	In-person	1	
Underwood, Bob	robert_underwood@hsb.com	Hartford Steam Boiler	Quality Engineer	In-person	1	
Valdez, Rick	rvaldez@prim.com	Rick Valdez	Quality Director	In-person	1	
Vogt, Mark	mark.vogt@vistracorp.com	Luminant	Principal Engineer - Boiler SME	In-person	1	
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Walker, Jamie	jwalker@hayesmechanical.com	Hayes Services	Quality Control Consultant	In-person	1	
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AHMED, S M FAYSAL	smfaysal.ahmed@rsc-bd.org	RMG SUSTAINABILITY COUNCIL	BOILER SAFETY ENGINEER	Remote		
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Quisenberry, Michael	michael@spartan-mech.com	Spartan Boiler & Mechanical	President	Remote	1	
Sekeley, Jim	jsekeley@comcast.net	Welding Services, Inc.	President	Remote	1	
SHAH, M. A.	abmindustrialervices@gmail.com	ABM Industrial Services Inc.	Technical Manager	Remote		
Shanks, paul	paul.shanks@onecis.com	BVI&I	Inspection Coordinator	Remote		
Shear, Emily	Emily@stateboilerinspectors.com	Arizona Boiler Inspectors	GM	Remote		
Simmons, Douglas	Heatsolutionsllc@aol.com	1st Heating Solutions llc	ceo	Remote		
Triplett, Andrew	triplett@ornl.gov	UT-Battelle, LLC	Boiler and Pressure Vessel Program Lead	Remote	1	
Todd Colvin				Remote	1	
Bob McGuire				Remote	1	
Charles McDaris				Remote	1	

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



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API and ASME Qualification of a Printed Pressure Component

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

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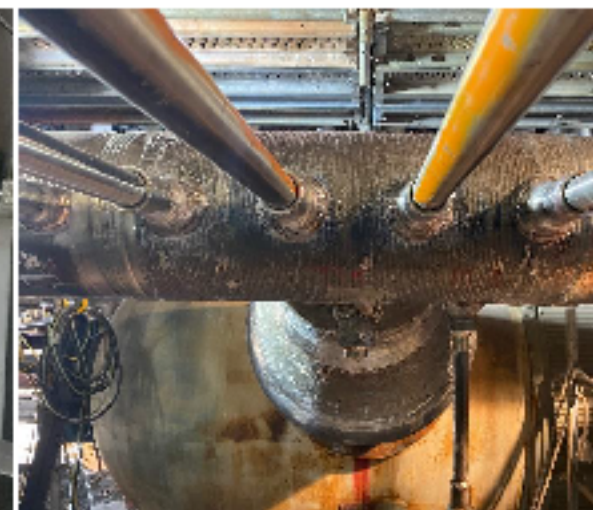
**Selected slides are shown in this presentation.
The entire Chevron ICAM presentation will be
attached to the meeting minutes.**

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



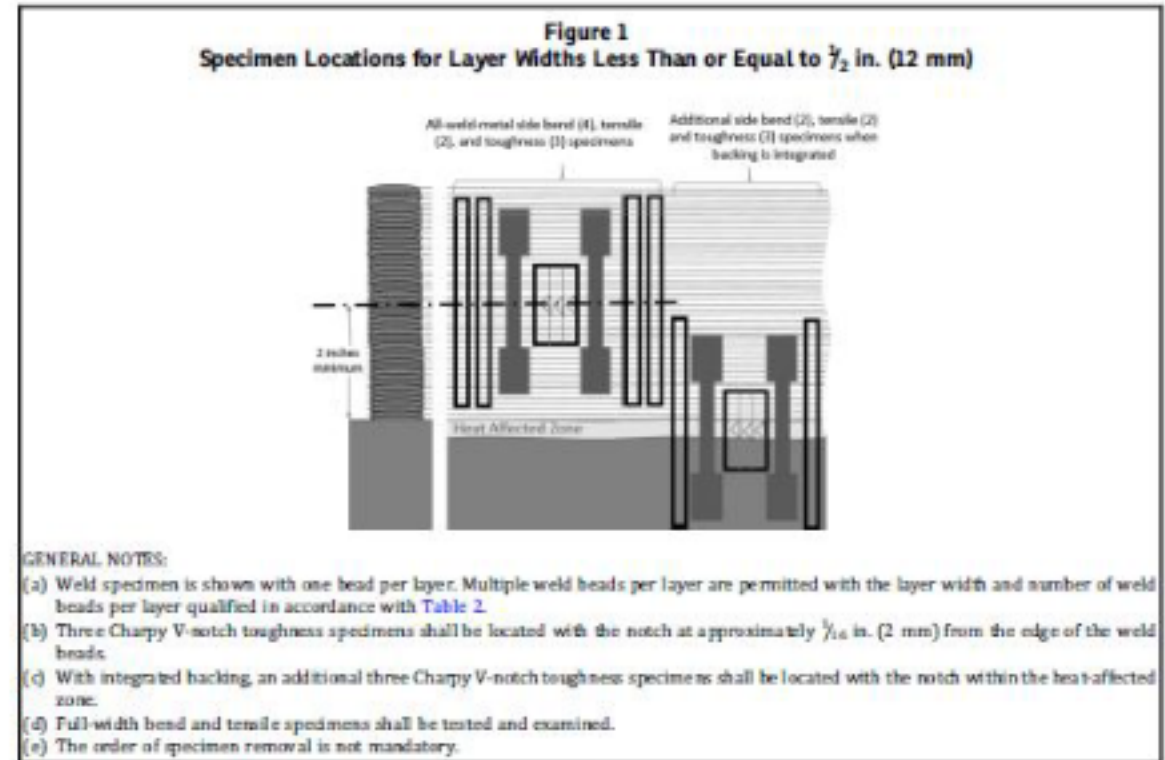
Printed Components Testing

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

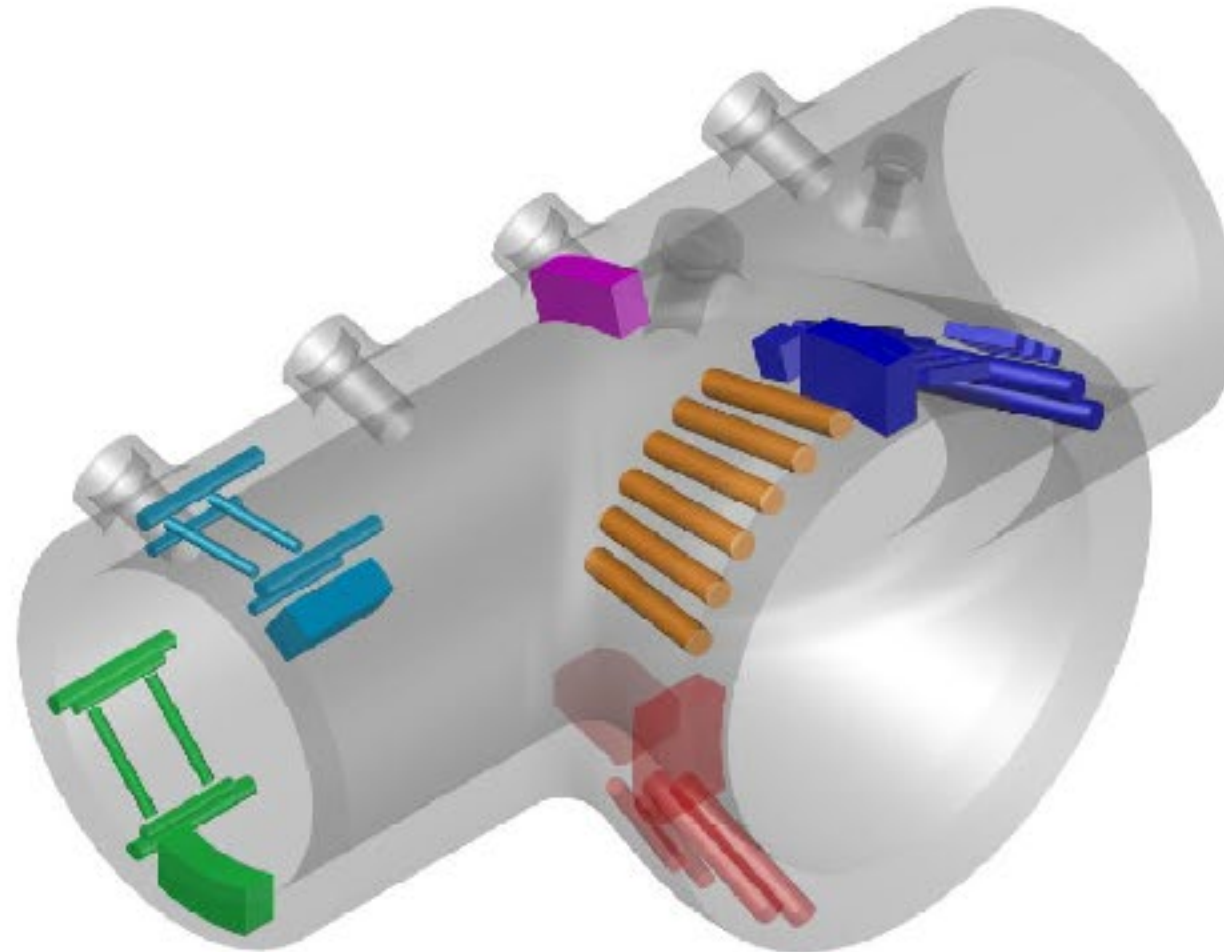


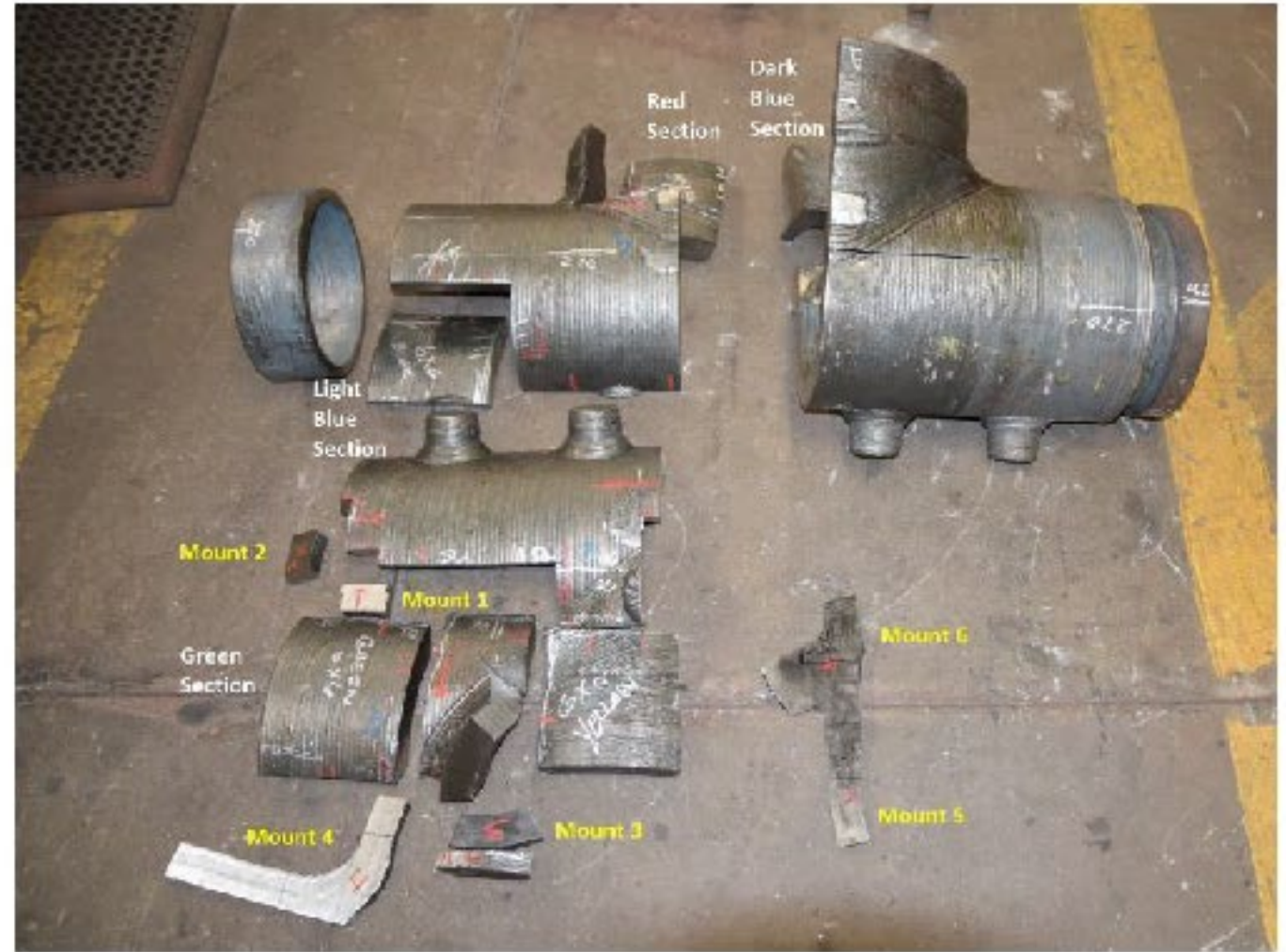
ASME 3020 Qualification

Cooling Rate	Wall Thickness	Yield Strength	Ultimate Strength
<i>(type)</i>	<i>(type)</i>	<i>(ksi)</i>	<i>(ksi)</i>
Slow <i>High Heat Input & 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
Fast <i>Low Heat Input & Low Interpass</i>	Thin	57.0	96.5
		56.0	96.5
	Thick	63.5	107.0
		63.5	98.0



Specimen Locations from Sacrificial Article

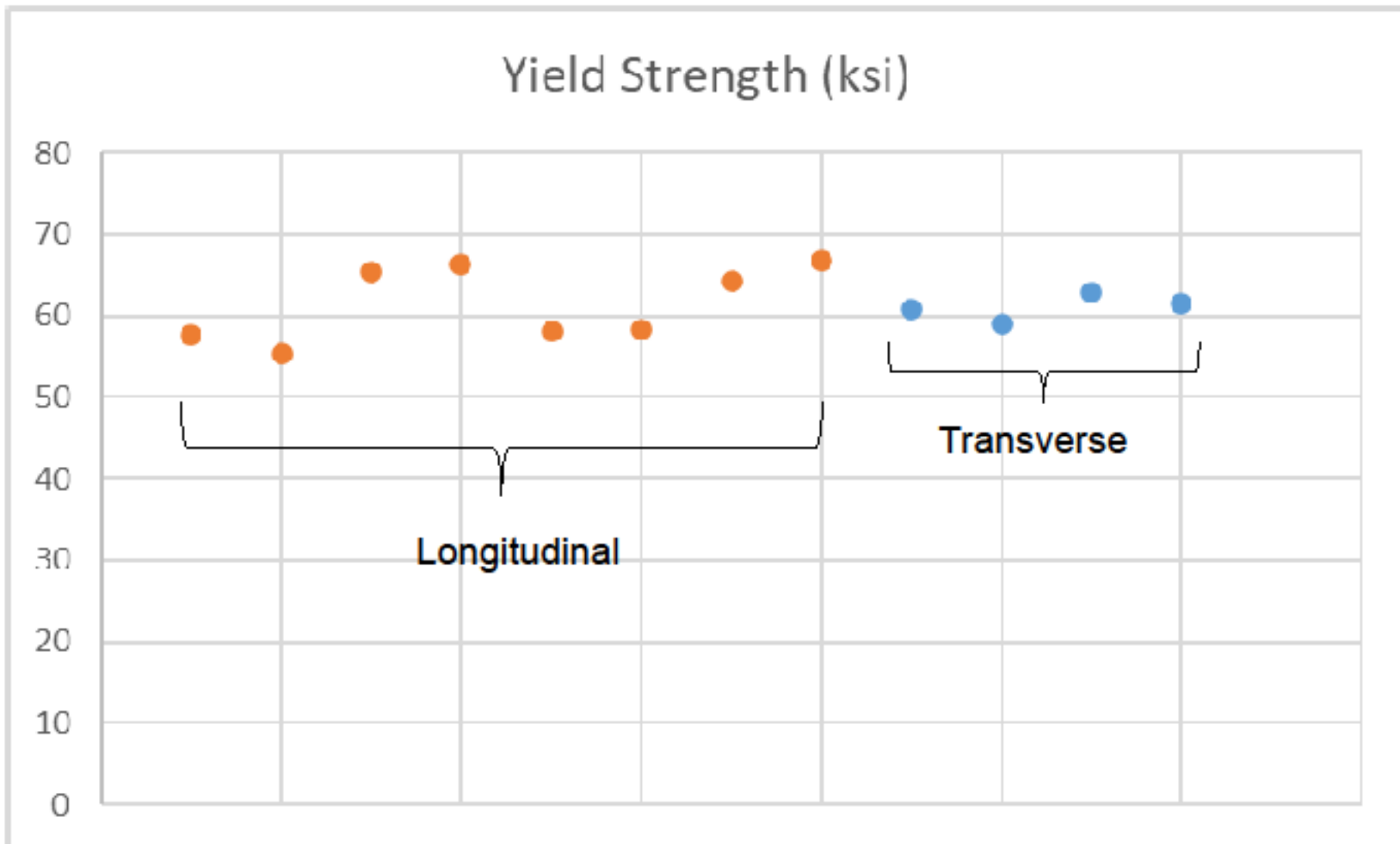




Tensile Testing from Sacrificial Part

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



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Questions & Discussion

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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

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



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API and ASME Qualification of a Printed Pressure Component

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

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Agenda

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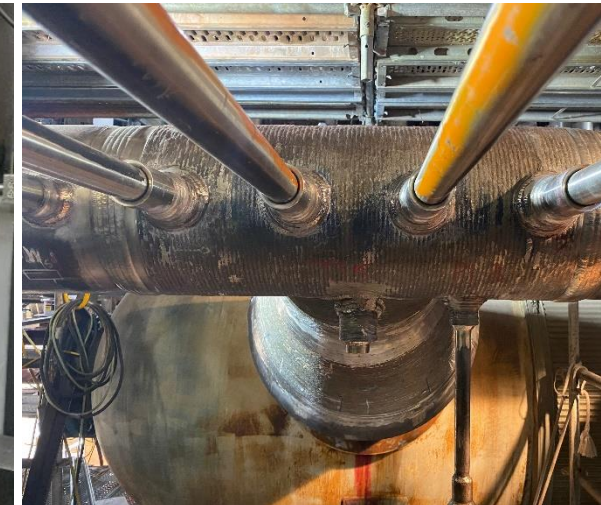
- Introduction and Background
- Design, Codes, and Standards
- Qualification & Data Presentation
- Discussion & Conclusions

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

Three Value Drivers for the Energy Sector

1. Revolutionize Spare Parts – Existing Designs
 - On-demand spare part supply prevents shutdowns
 - ‘Digital Warehouse’: Reduce overhead cost associated with spare parts inventory
2. Improve Existing Designs
 - Weight reduction
 - Performance improvement
3. New Materials
 - Improved Material Properties
 - Functional Gradient Materials

Background & Prior Experience

ICAM2022

- Chevron has been working on additive manufacturing since 2017, with a first internal guideline in 2019 and participation in 2021's API 20S publication.
- Prior to the pressure containing WAAM application discussed today, Chevron has conducted 4+ pilot applications in non-pressure-containing service in a variety of services.

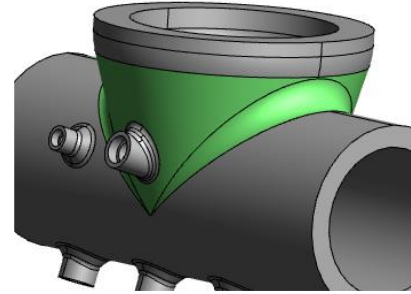


Workflow of an Urgent WAAM Job



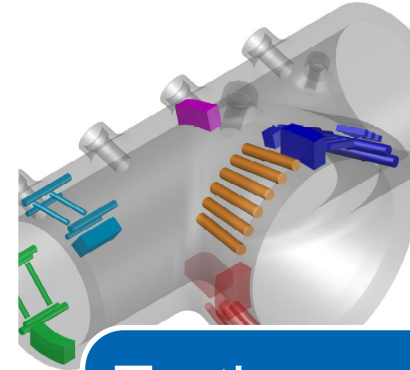
ID the Need

- Four tees required, Alloy 800H @ 1100lb weight each.
- 4 week delivery timeframe to avoid extending the



Design & Engineering Review

- Review of existing data showed Alloy 617 weldments were suitable.
- Optimized design to



Testing

- ASME 3020 Qualification using test walls
- API 20S using sacrificial part
- Additional testing including creep,



Final Inspection & Installation

- API 20S volumetric NDT: RT and PAUT
- Machining of weld bevels



Design, Codes, and Standards

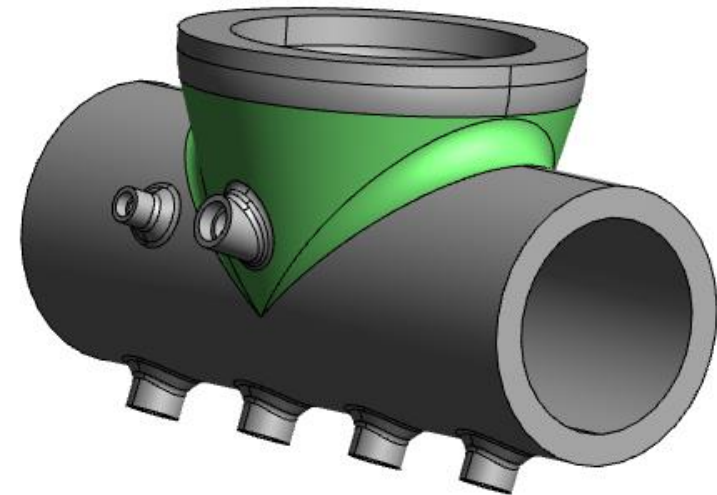


Printed Components Design

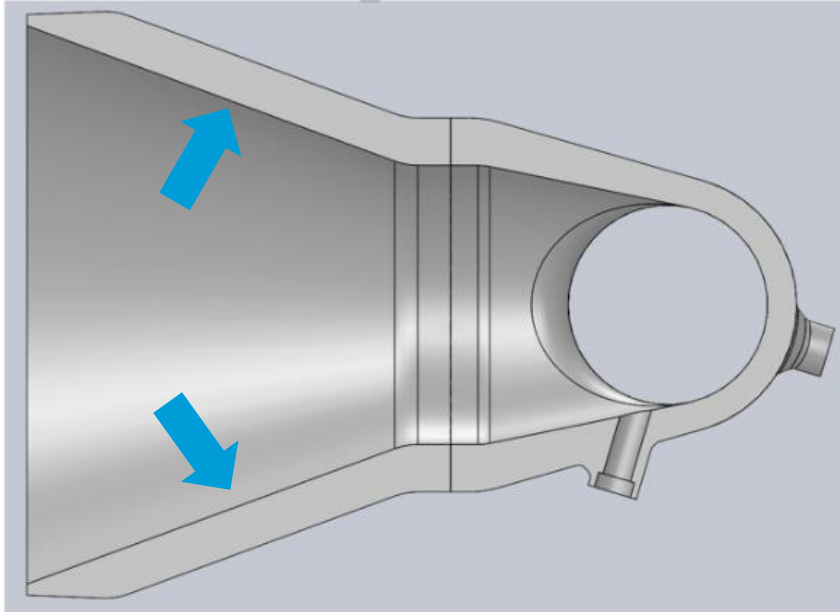
- Printing of a replacement part is permissible per expert review of API 530 (construction design document), combined with API 20S (3D printing standard) and ASME 3020 (code case permitting additive manufacturing).
- Design has been based on a 3D model of the original part.
- Alloy 617 is used for the new part. Compared to the old part (Alloy 800H), this has a higher allowable design value and increased strength/life at elevated temperature.
- The design is supported by a successful FEA model at design conditions (>1500F, 300psi).

Factors of Conservatism:

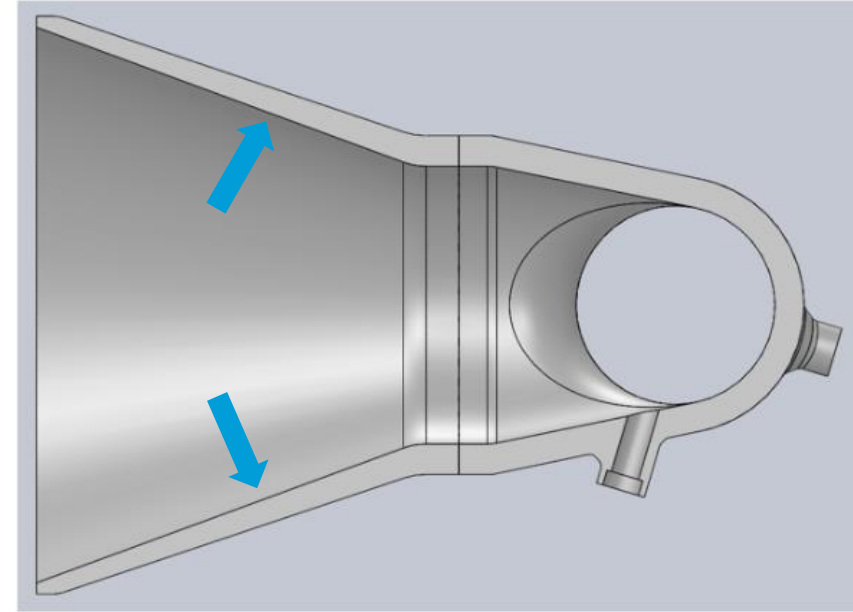
- 617 is already field proven – it is the weld consumable used in F-8620
- New design does not take credit for additional strength of 617.
- New design is derated by a conservative joint factor.



Success Side Story: Nimble Redesign & Production



Original Part (left) weighed ~1200lb. We did not have enough weld wire to build this!



New design (right) weighs ~840lb. This was crucial to success.

Digital redesign of the part was conducted on a Thursday night by FEA and design engineers. We communicated the new design to the supplier on Friday morning and printing started the same day. The part was on a truck by the following Tuesday.

Relevant Documents

API 530 Calculation of Heater-tube Thickness in Petroleum Refineries

Covers calculation methods for heater tube thickness

- Formulae are based on mostly based ASME B31.3, Section VIII Division 1 and 2 with appendices covering high temperature data for suitable materials.
- Cast components (like the old tee) and components made from additive manufacturing (like the new tee) are neither addressed nor prohibited in this standard.

API 20S Additively Manufactured Metallic Components for Use in the Petroleum and Natural Gas Industries

- Provides guidance that includes tensile testing, micrographic examination, and quality control.



Relevant Documents (2)

ASME PTB 13-2021 Criteria for Pressure Retaining Metallic Components Using Additive Manufacturing

- Guidance on design, quality control, and NDE of AM components.
- Intended to be used in conjunction with a governing design code.
- Recommends the use of ASME Section VIII Division 2 Part 5 for design AM components.

ASME Code Case 3020

- Provides guidance on qualifying the Gas Metal Arc Additive Manufacturing (GMAAM) Process as a qualified weld procedure per ASME Section IX.

ASTM B564 Standard Specification for Nickel Alloy Forgings

- Specification for forgings, but for this job we referenced the tensile and mechanical requirements only.



Qualification & Data

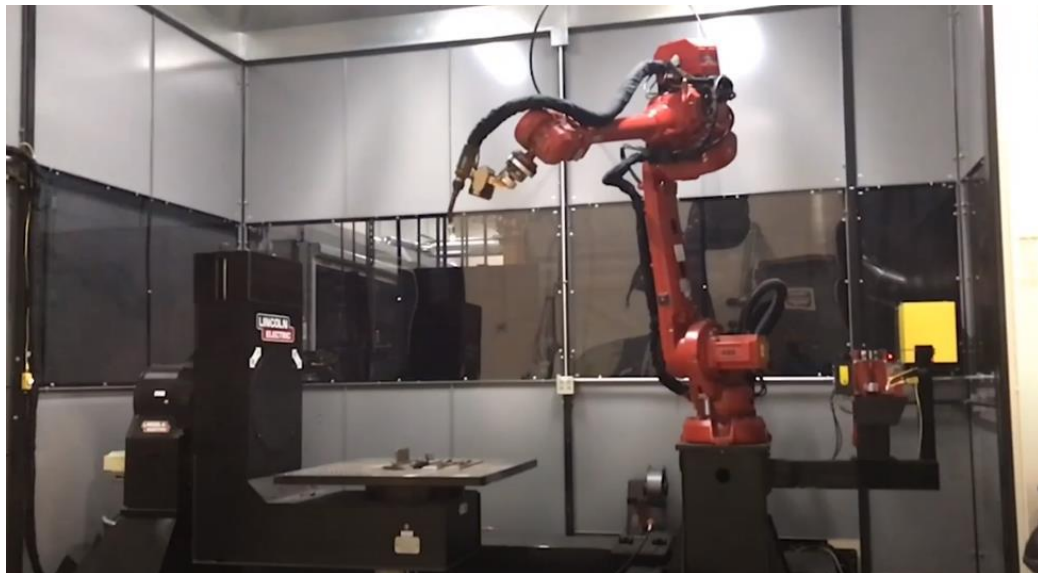


Inspection & Testing Summary

- 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

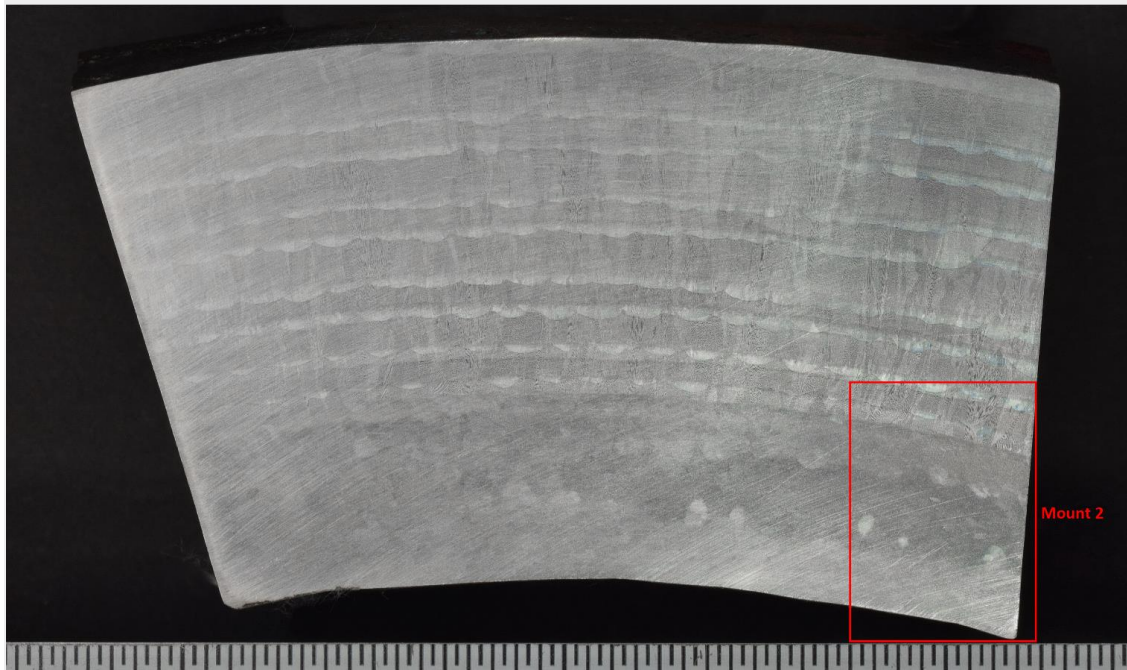


Printed Components Testing

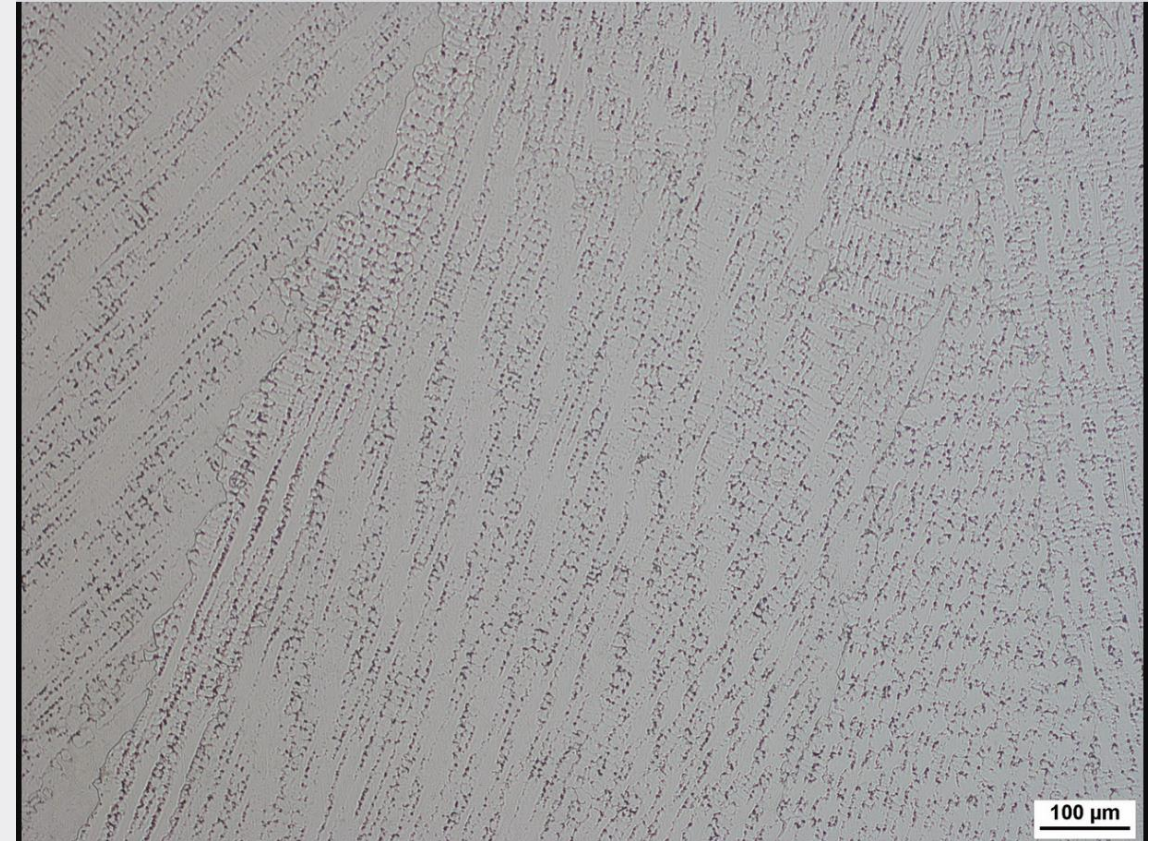
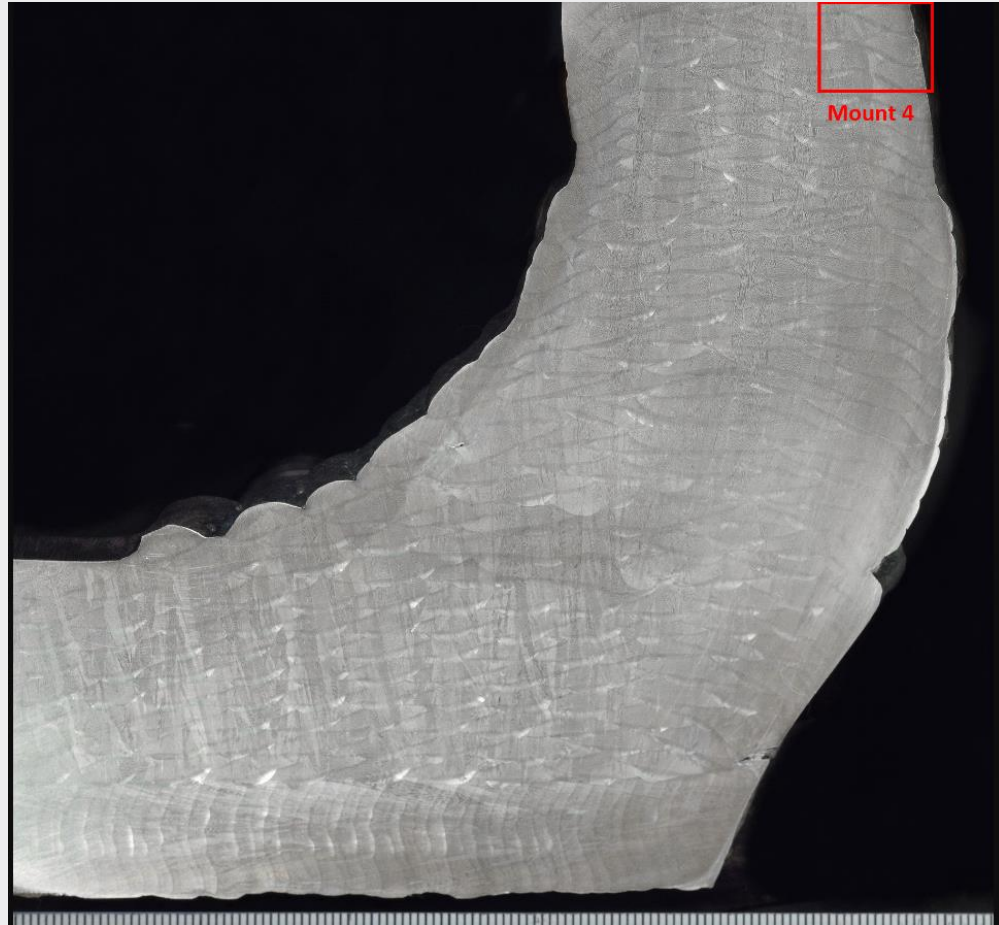
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- Radiographic Inspection of 100% Volumetric
- Dye Penetrant 100% surface



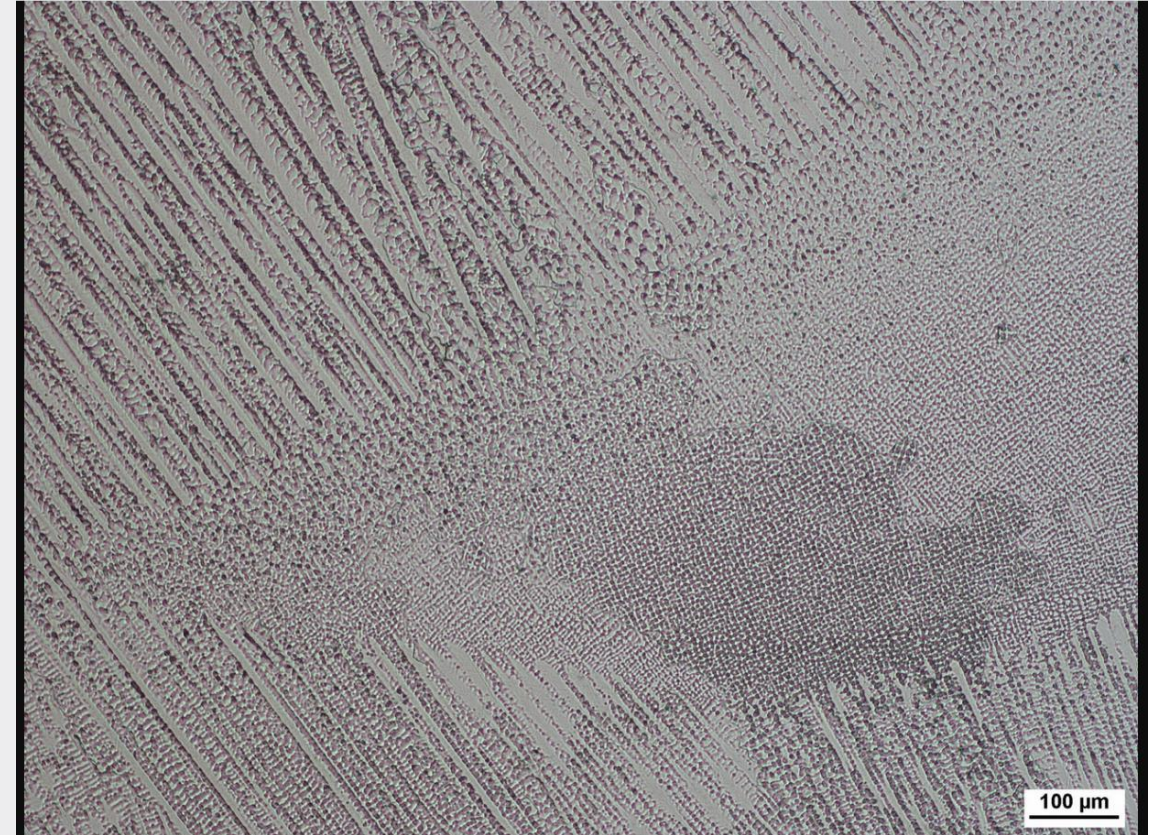
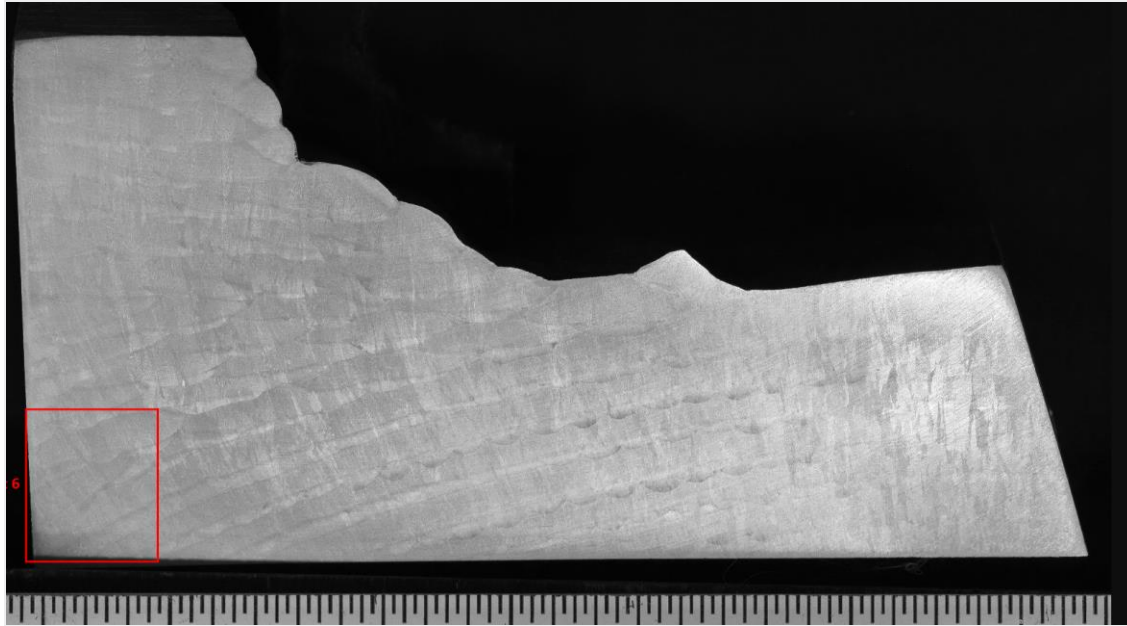
Micrographs



Micrographs (2)

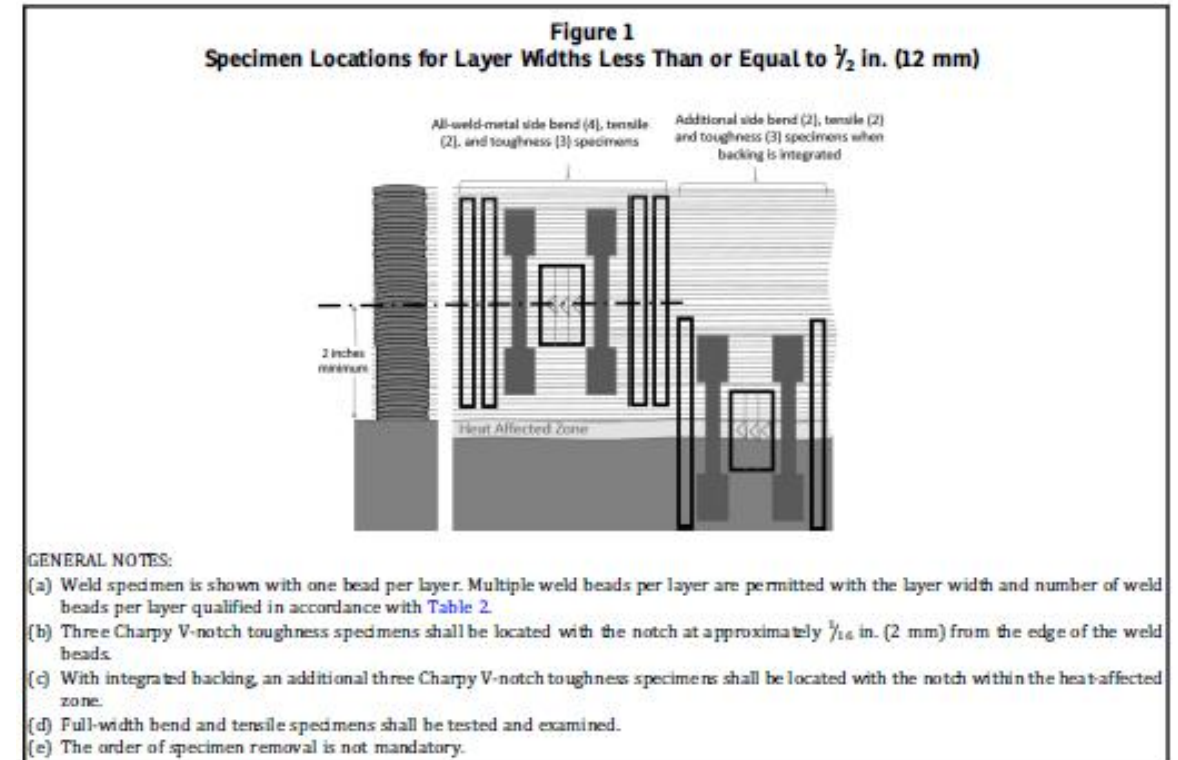


Micrographs (3)

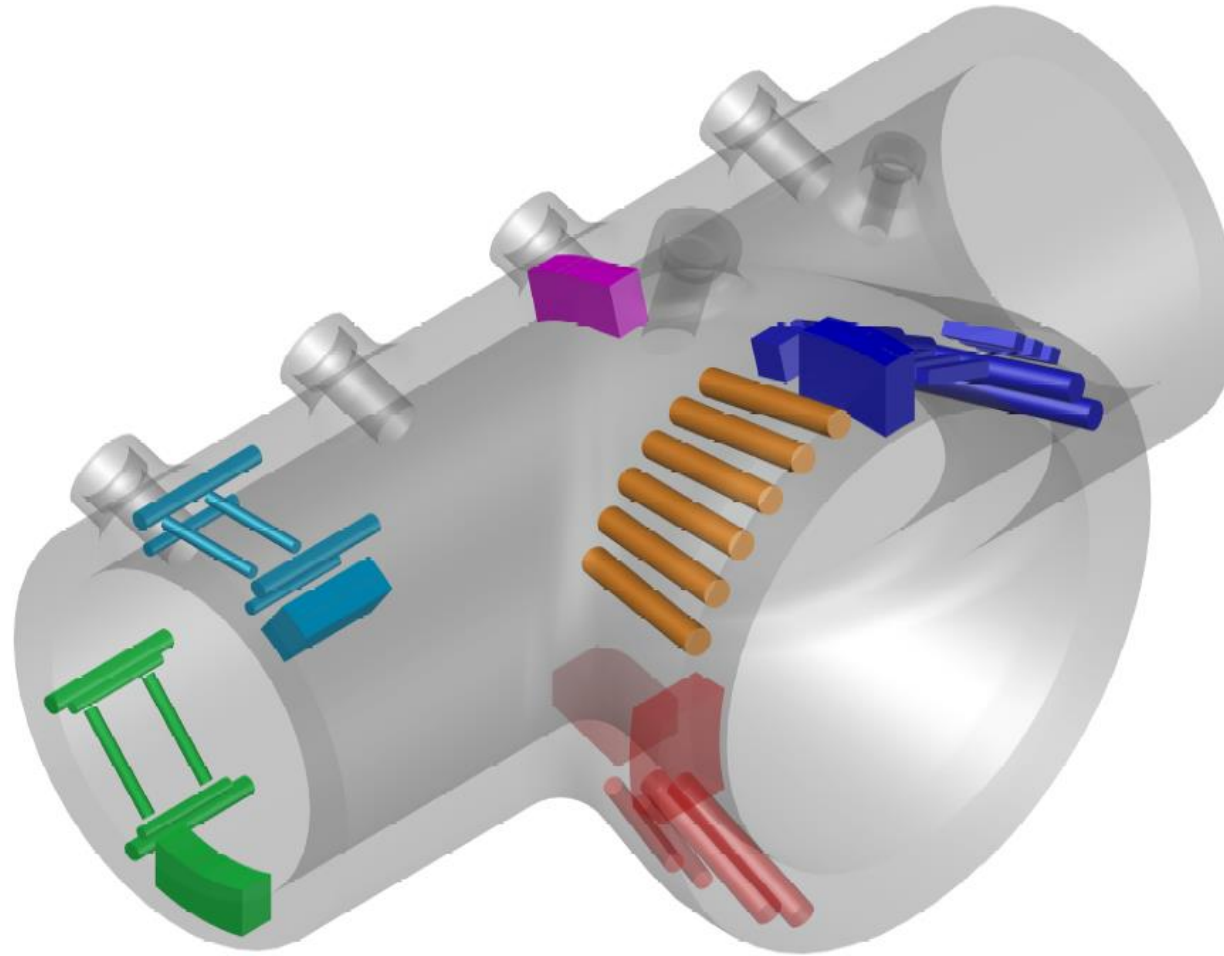


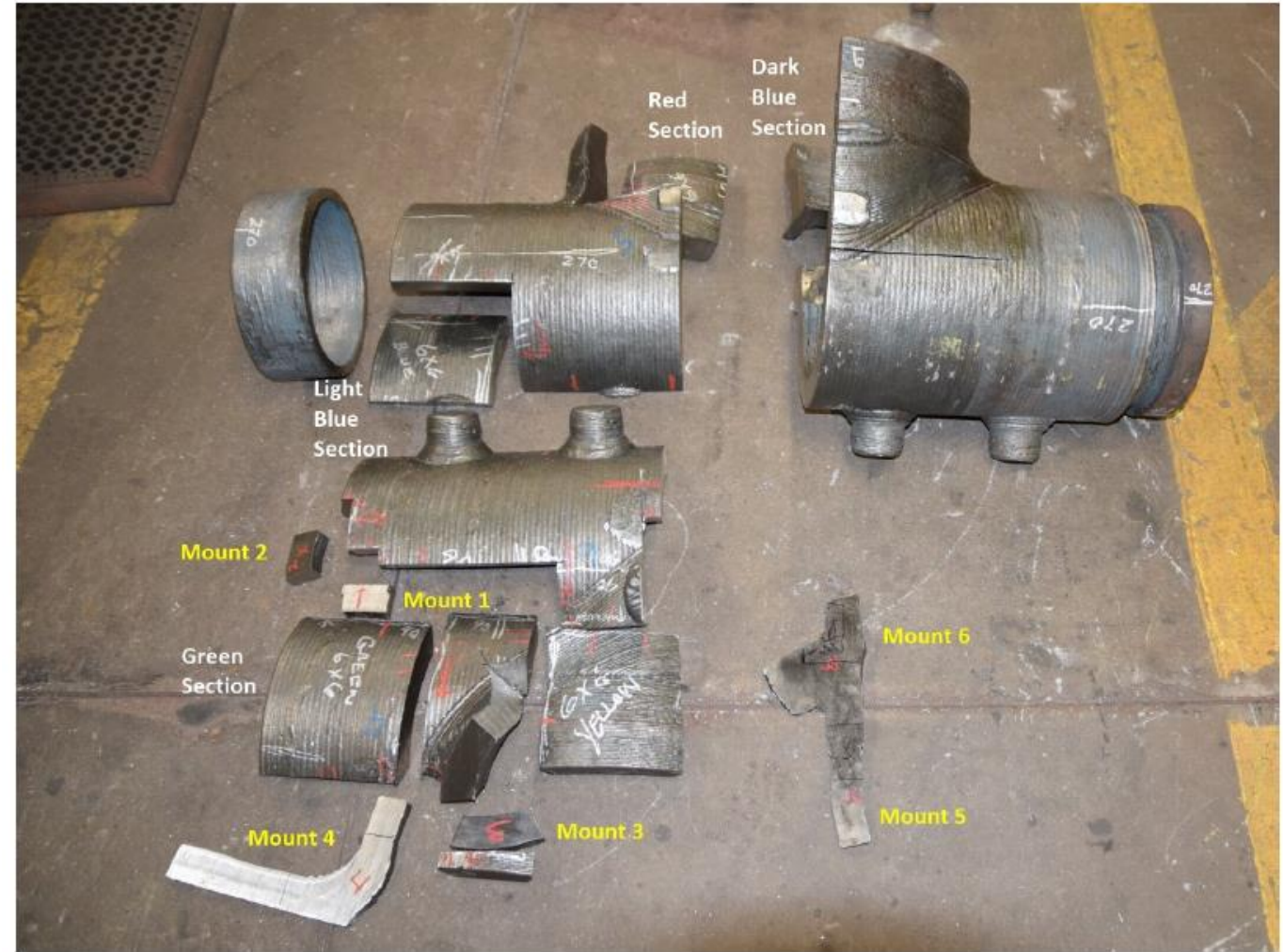
ASME 3020 Qualification

Cooling Rate	Wall Thickness	Yield Strength	Ultimate Strength
<i>(type)</i>	<i>(type)</i>	<i>(ksi)</i>	<i>(ksi)</i>
Slow <i>High Heat Input & 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
Fast <i>Low Heat Input & Low Interpass</i>	Thin	57.0	96.5
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	Thick	63.5	107.0
		63.5	98.0



Specimen Locations from Sacrificial Article

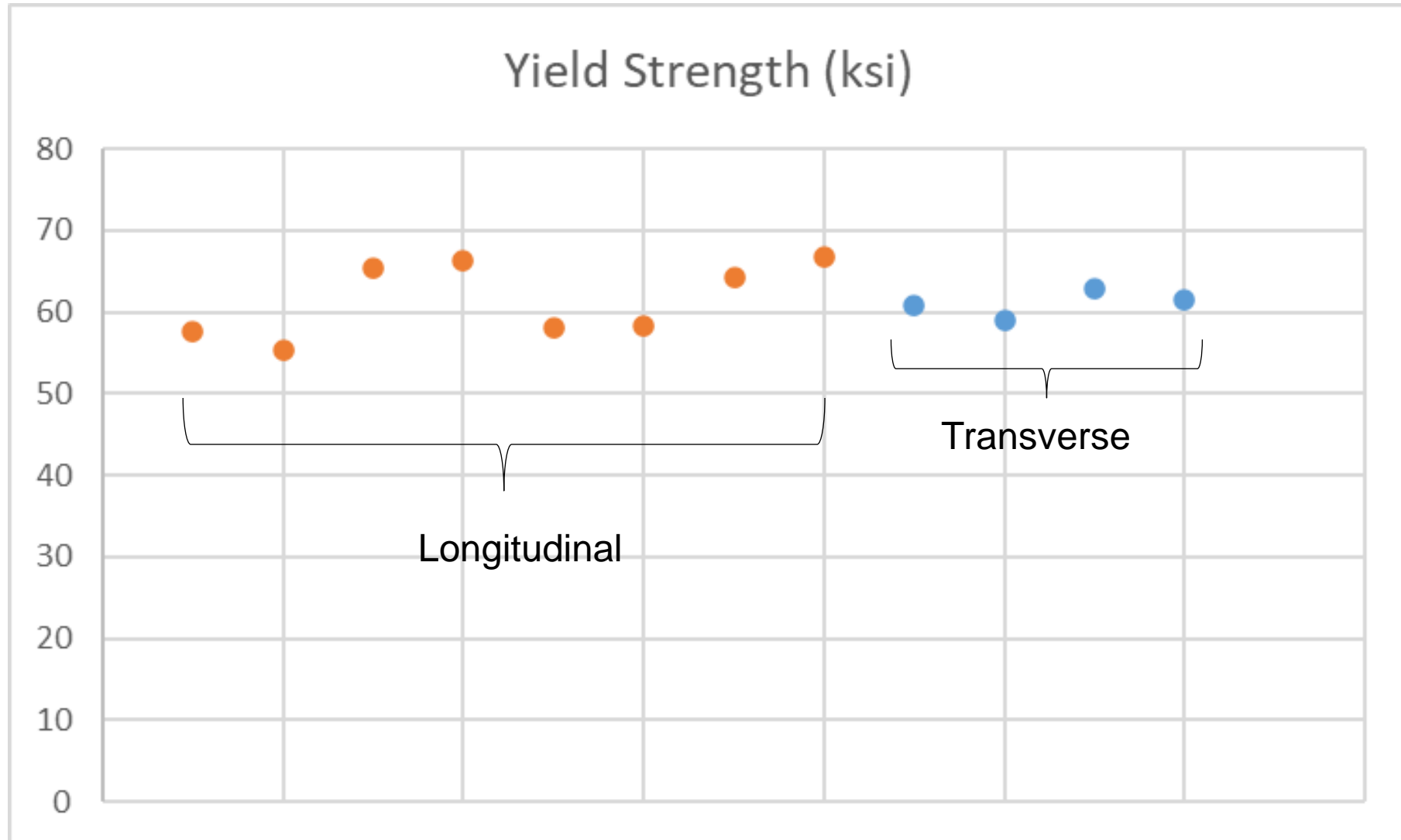




Tensile Testing from Sacrificial Part

Section	Orientation	Location	Yield Strength (ksi)	Tensile Strength (ksi)	Elongation (%)	Reduction of Area (%)
Light Blue	Longitudinal	ID	57.6	102.5	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
Green	Transverse	Mid-wall	63.0	107.0	39.9	51.4
			61.6	107.9	37.4	44.0
	Longitudinal	ID	58.0	101.8	43.1	49.4
			58.3	102.2	44.9	57.2
		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



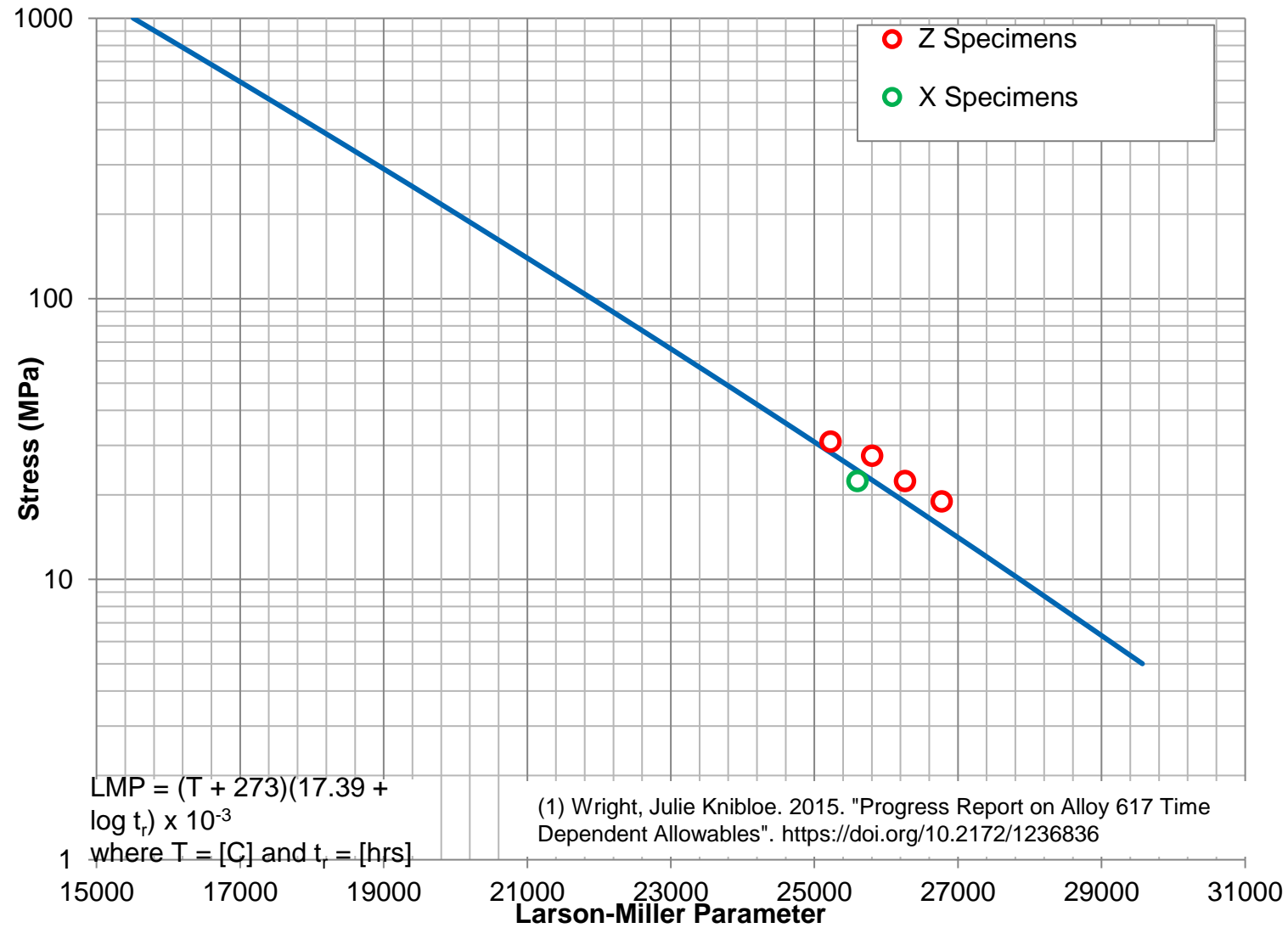
Additional Analysis

Element	Tee	ASME SFA-5.14 ERNiCrCoMo-1
Chromium	21.7	20.0 - 24.0
Cobalt	12.0	10.0 - 15.0
Molybdenum	8.68	8.0 - 10.0
Aluminum	1.25	0.8 - 1.5
Carbon	0.05	0.05 - 0.15
Manganese	0.35	1.0 max
Iron	0.48	3.0 max
Phosphorus	0.009	0.03 max
Sulfur	0.002	0.015 max
Silicon	0.07	1.0 max
Copper	0.01	0.50 max
Titanium	0.34	0.60 max
Nickel	Remainder	Remainder

Section	Orientation	Absorbed Energy (ft.lb)	Percent Shear (%)
Dark Blue	Longitudinal	110	100
		101	100
		101	100
	Transverse	79	100
		91	100
		107	100

CVN @ 0C

Creep 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



Conclusions

- We have shown successful delivery of large scale WAAM pressure components on a 4 week timeframe.
- We have successfully completed API 20S AMSL 3 qualification of the delivered parts, along with ASME 3020 code case qualification.
- Inspection techniques such as UT and RT will require modification and qualification if used on as-printed WAAM surfaces.
- In this case we did not require fully machined surfaces, but for future applications this could pose a bottleneck to the rapid delivery of AM parts.



Questions & Discussion





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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

01 – What is Carbon Fiber?

02 – ASME PCC-2 Compliance

04 - Type of Repair

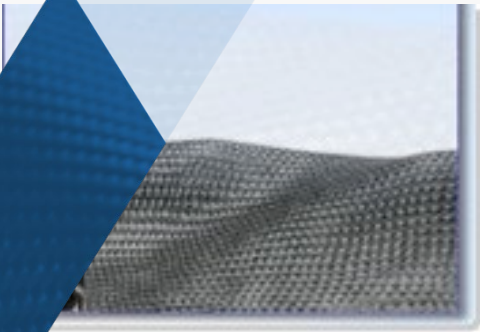
05 - Value Engineering

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

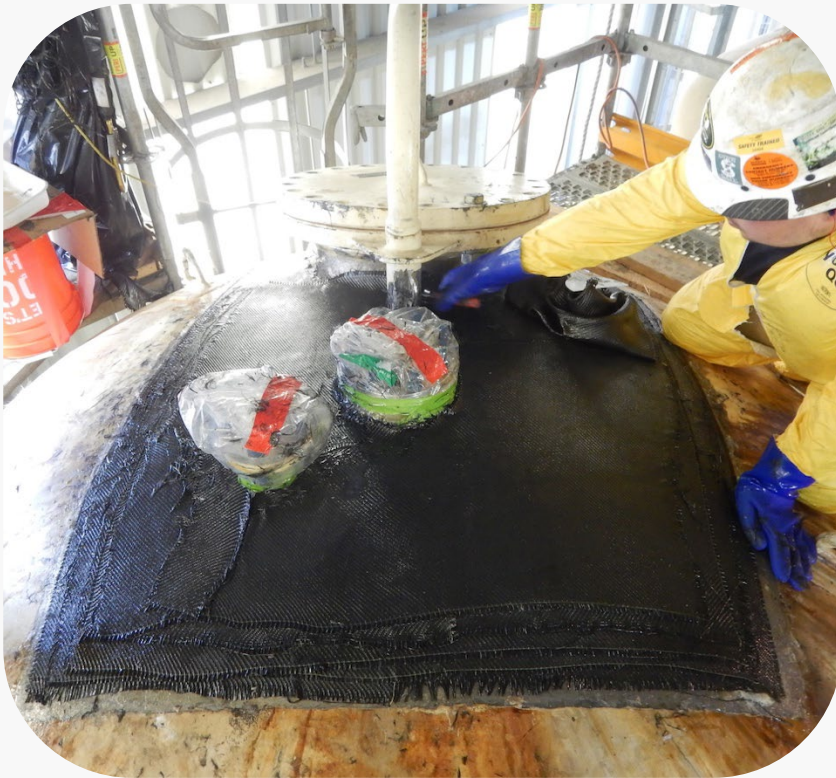
- The vessel head was corroded from HCL acid stored in a tank above the vessel
- Plant operations required a repair to the exchanger during the semi-annual outage
- Welding could not be performed without damaging the internal rubber liner



* 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 SEALTM

**For Pressure Vessel
Repair**



**Building
Stronger
BondsTM**



PROPOSED INTERPRETATION

Item No. 22-24
Subject/Title Repair of pressure ret'ing items without complete removal of defect
Project Manager and Task Group M. Quisenberry (PM), L. Dutra
Source (Name/Email) Fazlollah (Fred) Afshar / fredafshar@bandmriskadvice.com
Statement of Need 3.3.4.8 does imply that the defect should be known in regards to characteristics such as orientation, nature, depth, configuration but does not fully state this.
Background Information On a 1 1/2" thick 304 H reactor operating normally in vacuum and around 1200 degrees F, cracking is found on the lower head to shell joint. Grinding to 1 1/4" thick has eliminated more than 60% of the cracks but still in areas not accessible, the cracks do exist. Detection requires special phased array sensor that is being built but not yet available. Client is citing NB 3.3.4.8 for the cracks left in place and planning to return to operation. Question is submitted to seek the Committee's view.
Proposed Question Q: If the size, orientation and/ or the contour of the defect may not be fully established, would the provisions of 3.3.4.8 be applicable? 3.3.4.8 Repair of pressure retaining items without complete removal of defects does not address the situation where the defect (i.e. cracks) characteristics are not fully established due to geometrical configuration of internals or other physical obstacles not allowing use of available NDE techniques to fully study the size, orientation and configuration of cracks.
Proposed Reply No. The defect shall be characterized in full per the requirements of NBIC 3.3.4.8 Part A
Committee's Question 1 If the characteristics of the defect cannot be fully established, would the provisions of 3.3.4.8 be applicable?
Committee's Reply 1 No.
Rationale
Committee's Question 2
Committee's Reply 2
Rationale



PROPOSED INTERPRETATION

Item No. 22-33
Subject/Title Encapsulation of Shells and Heads
Project Manager and Task Group
Source (Name/Email) Robert Underwood / robert_underwood@hsb.com
Statement of Need To clarify that encapsulation cannot be used to maintain the pressure retaining capability of shells and heads of pressure retaining items.
Background Information A pressure vessel owner believes PCC-2 allows encapsulation of components other than what's listed in 3.4.3 of Part 3 (such as heads) and therefore it should be acceptable per the NBIC. Paragraph 3.4.3 clearly indicates that the encapsulation method only applies to pipe, nozzles, fittings, and valves. This proposal would reinforce existing wording in Part 3.
Proposed Question Does the NBIC Part 3, paragraph 3.4.3, allow for the encapsulation of components other than pipe, nozzles, fittings, and valves?
Proposed Reply No.
Committee's Question 1 Does the NBIC Part 3, paragraph 3.4.3, allow for the encapsulation of components other than pipe, nozzles, fittings, and valves?
Committee's Reply 1 No.
Rationale
Committee's Question 2
Committee's Reply 2
Rationale

SUPPLEMENT 6**REPAIR, ALTERATION, AND MODIFICATION OF DOT TRANSPORT (TRANSPORT (CARGO))
TANKS****S6.1 SCOPE**

This supplement provides requirements and guidelines for repairs, alterations, or modifications to DOT Transport Tanks Transport Tanks used for the transportation of dangerous goods via highway, rail, air, or water.

S6.2 DEFINITIONS

The definitions specified in NBIC Part 3, Section 9, *Glossary*, shall be used in conjunction with those specified in NBIC Part 2, S6.17. Where conflicts between definitions exist, those identified in NBIC Part 2, S6.17 shall take precedence.

S6.3 CONSTRUCTION STANDARDS

When the standard governing the original construction is the ASME Code or other regulations of the Competent Authority, repairs, alterations, or modifications shall conform, insofar as possible, to the edition of the construction standard or specification most applicable to the work. Where this is not possible or practical practicable, it is permissible to use other codes, standards or specifications, including the ASME Code provided the "R" Certificate Holder has the concurrence of the Inspector and, if required, the Competent Authority.

S6.4 ACCREDITATION AND REGISTRATION

Organizations performing repairs, alterations, or modifications shall be accredited in accordance with the National Board "R" Accreditation Program. In addition repair organizations performing repairs, alterations, or modifications to transport transport tanks shall be registered with DOT as required by 49 CFR Part 180.

S6.5 AUTHORIZATION

The Inspector's authorization to perform a repair, alteration, or modification shall be obtained prior to initiation of the work to be performed on a transporttransport tank. Additional requirements are specified in NBIC Part 3, 1.3.1 and 1.3.2.

S6.6 INSPECTION

Inspection and certification shall be made by an Inspector holding an appropriate National Board Commission as required by NBIC Part 3, 1.3.

S6.7 MODIFICATIONS

All modifications, as defined in NBIC Part 2, Supplement 6, to the pressure-retaining item shall meet the requirements of NBIC Part 3 for alterations.

S6.8 DRAWINGS AND CALCULATIONS

a) Design requirements for repairs, alterations and modifications shall comply with the requirements of NBIC Part 3, 3.2.4.

- b) As appropriate, drawings or instructions shall be prepared to describe the repair, alteration, or modification. Drawings shall include sufficient information to satisfactorily perform the activity.
- c) The design of alterations and modifications shall be completed by an organization experienced in the design portion of the standard used for the construction of the item and certified by a Design Certifying Engineer as defined in NBIC Part 2, S6.17. Design documents shall be completed prior to the start of any physical work and be available for review by the Inspector accepting the design.

S6.95 MATERIALS

The materials used in making repairs, alterations, or modifications shall conform to the original code of construction including the material specification requirements. Carbon or alloy steel having a carbon ~~con-~~content of more than 0.35% (0.30% for ton tanks) shall not be welded unless permitted by the original code of construction. The "R" Certificate Holder is responsible for verifying the identification of existing materials from original data, drawings, or unit records and identification of the material to be installed. Materials that have previously been in service, as described in Part 3, 3.2.1 c), are not permitted for alterations or modifications of DOT ~~Transport~~Transport Tanks per 49 CFR Part 180. Additional material requirements are provided in NBIC Part 3, Section 3.

S6.6-10 REPLACEMENT PARTS

Replacement parts to be used in repairs, alterations, and modifications of DOT ~~Transport~~Transport Tanks shall comply with the requirements provided in NBIC Part 3, 3.2.2.

- a) ~~Replacement parts that will be subject to internal or external pressure that consist of new material which may be formed to the required shape by spinning, forging, die forming, and on which no fabrication welding is performed shall be supplied as material. Such parts shall be marked with the material and part identification and the name or trademark of the parts manufacturer. In lieu of full identification marking on the material or part, the part manufacturer may use a coded marking system traceable to the original marking. Such markings shall be considered as the part manufacturer's certification that the part complies with the original code of construction. Examples include seamless or welded tube or pipe, forged nozzles, heads or subassemblies attached mechanically.~~
- b) ~~Replacement parts that will be subject to internal or external pressure, that are preassembled by attachment welds, shall have the welding performed in accordance with the original code of construction. This certificate shall be supplied in the form of a bill of material or drawings with statement of certification.~~
- c) ~~Replacement parts subject to internal or external pressure fabricated by welding that require shop inspection by an Authorized Inspector shall be fabricated by an organization having an appropriate ASME *Certificate of Authorization*. The item shall be inspected and stamped as required by the applicable section of the ASME Code and DOT specification requirements. A completed ASME *Manufacturer's Partial Data Report* shall be supplied by the manufacturer.~~
- d) ~~When the original code of construction is other than ASME, replacement parts subject to internal or external pressure fabricated by welding shall be manufactured by an organization certified as required by the original code of construction. The item shall be inspected and stamped as required by the original code of construction. Certification as required by the original code of construction shall be supplied with the item. When this is not possible or practicable the organization fabricating the part may have a National Board *Certificate of Authorization*. Replacement parts fabricated by an "R" stamp holder shall be documented on Form R-3 and the "R" Stamp applied as described in NBIC Part 3, S6.15.~~

S6.7 AUTHORIZATION

The Inspector's written authorization to perform a repair, alteration, or modification shall be obtained prior to initiation of the work to be performed on a transport tank. Additional requirements are specified in NBIC Part 3, 1.3.1 and 1.3.2.

S6.8 INSPECTION

Inspection and certification shall be made by an Inspector holding an appropriate National Board Commission as required by NBIC Part 3, 1.3 and shall be a Registered Inspector meeting the requirements of the Competent Authority.

S6.8.1 INSPECTOR DUTIES FOR REPAIRS, ALTERATIONS, AND MODIFICATIONS

Inspectors performing repair, alteration, or modification inspections under the requirements of this supplement shall satisfy the requirements of S6.8.1 to be authorized to sign the Form R-1, *Repairs* and Form R-2, *Alterations*.

- a) For repairs, alterations, and modifications of transport tanks, the duties of the Registered Inspector performing inspections are detailed in Part 2, S6.10 through S6.15, as required by the Competent Authority.
- a) The Registered Inspector shall meet the rules of NB-263, RCI-1, Rules for Commissioned Inspectors. Additional duties are summarized below:
 - 1) Verify the organization performing the repair, alteration or modification activity is properly accredited and in possession of a current valid *Certificate of Authorization* to apply the "R" Stamp issued by the National Board and is working to an accepted Quality Control System;
 - 1) Verify that the design, if required, for the modification of the vessel is approved by a Design Certifying Engineer, or Designated Approval Agency or other applicable individual;
 - 1) Verify the materials to be used to make the repair, alteration, or modification are approved for use and comply with applicable code requirements;
 - 1) Verify the welding procedures and welders or welding operators are properly qualified;
 - 1) Verify that all heat treatments, if required, including PWHT have been performed in accordance with the applicable standards and that the results are acceptable;
 - 1) Verify that all NDE, impact tests, and other tests have been performed when required, and that they are acceptable;
 - 1) Make a visual inspection of the work performed to confirm there are no visible defects or deviations from code requirements;
 - 1) Perform external and internal visual inspections, if the vessel is equipped with a manway, and witness the hydrostatic or pneumatic pressure test and/or leak tightness test when they are required;
 - 1) Verify the correct nameplate is properly attached to the vessel and that the current test and inspection markings are properly attached and displayed on the proper vessel;
 - 1) Sign the Form R-1 and, as appropriate, form R-2 when work is completed.

S6.9-11 WELDING

a) Welding, including procedure specification qualification, performance qualification, qualification records, qualified personnel identification, continuity of qualified personnel, and process continuity records shall be performed in accordance with the requirements of the original code of construction used for the fabrication of the pressure ~~vessel~~ retaining item and Part 3, Section 2.

a)b) For hydrogen control when low alloy steel filler metals are used, the filler metal classification shall include an H4 supplemental diffusible hydrogen designator (maximum 4 ml [H₂]/100 g deposited metal) for each of the following welding processes:

- 1) electrodes for shielded metal arc welding (SMAW) conforming to SFA-5.5;
- 2) electrodes and fluxes for submerged arc welding (SAW) conforming to SFA-5.26;
- 3) electrodes and rods for gas shielded metal arc welding (GMAW) conforming to SFA-5.28;
- 4) electrodes for flux-cored arc welding (FCAW) conforming to SFA 5.29.

c) Practices used for controlling storage and exposure of filler metals shall be those developed by the "R" Certificate Holder or those recommended by the filler metal manufacturer.

b)

S6.9.1 WELDING PROCEDURE SPECIFICATION

~~Welding shall be performed in accordance with a Welding Procedure Specification (WPS) qualified in accordance with the original code of construction. When this is not possible or practicable, the WPS may be qualified in accordance with ASME Section IX.~~

S6.9.2 STANDARD WELDING PROCEDURE SPECIFICATIONS

~~A "R" Certificate Holder may use one or more applicable Standard Welding Procedure Specifications shown in NBIC Part 3, 2.3 without supporting Procedure Qualification Records (PQRs) since SWPS are pre-qualified and the PQR will not be supplied.~~

S6.9.3 PERFORMANCE QUALIFICATION

~~Welders or welding operators shall be qualified for the welding processes that are used. Such qualification shall be in accordance with the requirements of the original code of construction or ASME Section IX. Use of Standard Welding Procedure Specification shown in NBIC Part 3.2.3 is permitted for performance qualification testing.~~

S6.9.4 WELDING RECORDS

~~The "R" Certificate Holder shall maintain a record of the results obtained in welding procedure qualification, except for those qualifications for which the provisions of NBIC Part 3, S6.8.2 are used and of the results obtained in welding performance qualifications. These records shall be certified by the "R" Certificate Holder and shall be available to the inspector.~~

S6.9.5 WELDERS' IDENTIFICATION

~~The "R" Certificate Holder shall establish a system for the assignment of a unique identification mark to each welder/welding operator qualified in accordance with the requirements of the NBIC. The "R" Certificate Holder shall also establish a written procedure whereby all welded joints can be identified as to the welder or welding operator who made them. This procedure shall use one or more of the~~

~~following methods and be acceptable to the Inspector. The welder's or welding operator's identification mark may be stamped (low stress stamp) adjacent to all welded joints made by the individual or, in lieu of stamping, the "R" Certificate Holder may keep a record of the welded joints and the welders or welding operators used in making the joint.~~

S6.9.6 — WELDERS' CONTINUITY

~~The performance qualification of a welder or welding operator shall be affected when one of the following conditions occurs:~~

- ~~) When the welder or welding operator has not welded using a specific process during a period of six months or more, their qualifications for that process shall expire;~~
- ~~) When there is specific reason to question their ability to make welds that meet the specification, the qualification which supports the welding that is being performed shall be revoked. All other qualifications not questioned remain in effect.~~

S6.10-12 HEAT TREATMENT

S6.1012.1 PREHEATING

~~Preheating may be employed during welding use of a process to assist in completion of the welded joint. Preheating shall comply with the requirements in NBIC Part 3, 2.5.1. (see NBIC Part 3, 2.5.1). The need for and the temperature of preheat are dependent on a number of factors such as chemical analysis, degree of restraint of the items being joined, material thickness, and mechanical properties of the base metals being joined. The Welding Procedure Specification for the material being welded shall specify the preheat temperature requirements.~~

S6.1012.2 POSTWELD HEAT TREATMENT (PWHT)

~~Postweld heat treatment may used in repairs, alterations, and modifications of DOT TransportTransport Tanks shall comply with the requirements provided in NBIC Part 3, 2.5.2. be performed as required by the original code of construction in accordance with a written procedure. The procedure shall contain the parameters for postweld heat treatment. Local PWHT that is not specified by the original code of construction may be performed in accordance with an Alternative Postweld Heat Treatment Method described in NBIC Part 3, 2.5.2 with acceptance by the Inspector and required by the Competent Authority.~~

S6.1012.3 ALTERNATIVES TO POSTWELD HEAT TREATMENT

- a) Under certain conditions, postweld heat treatment in accordance with the original code of construction may be inadvisable or impractical. In such instances, alternative methods of postweld heat treatment or special welding methods in accordance with NBIC Part 3, 2.5.3, and acceptable to the Inspector and Competent Authority may be used.
- b) When the standard governing the original construction is the Code of Federal regulation for DOT/MC 331 eargetransport tanks for propane, butane, anhydrous ammonia, and other DOT permitted commodities, and the tanks are made to the ASME Code, Section VIII, Division 1, Part UHT, repairs, alterations, or modifications shall conform insofar as possible, to the edition of the construction standard or specification most applicable to the work. Where this is not possible or practicable, it is permissible to use other codes, standards, or specifications provided the "R" Certificate Holder has the concurrence of the DOT. Shells and heads of MC 331 eargetransport tanks were made from quenched and tempered

alloy steel plate, SA517, Grade E (originally Code Case 1298) and Grade F (originally Code Case 1204) prior to 1994.

- c) The 1994 ASME Code Addenda revised UHT-5(b) to permit the joining of UHT materials to UCS or UHA materials in head and shell sections. Propane, butane, and anhydrous ammonia are the most common transported commodities and the shipper is required by DOT to comply with certain composition limitations. Propane and butane transported must have sufficiently low hydrogen sulfide content so as not to exceed the limitations for Classification One of the ASTM D1838-74 copper strip test, and the anhydrous ammonia transported must be inhibited with a minimum water content of 0.2% by weight. In addition, such [cargotransport](#) tanks made for propane, butane, and anhydrous ammonia service must be postweld heat treated, unless specifically exempted by a DOT special permit that exempts PWHT.

S6.13 REPAIRS OF DEFECTS

- a) Before a repair is made to a defect in a welded joint or base metal, care should be taken to investigate its cause and to determine its extent and likelihood of recurrence. This information shall be made available to the Inspector.
- b) For MC 330 and MC 331 ~~transport~~ tanks, when a repair is made to defects revealed by the wet fluorescent magnetic particle examination, including those repaired by grinding, the affected area of the ~~cargotransport~~ tank must again be examined by the wet fluorescent magnetic particle method after hydrostatic testing to assure that all defects have been removed.

S6.14 NONDESTRUCTIVE EXAMINATION

- a) ~~The nondestructive examination (NDE) requirements, including qualification of NDE personnel shall comply with the requirements in NBIC Part 3, 4.2., including technique, extent of coverage, procedures, personnel qualification, and acceptance criteria, shall be in accordance with the original code of construction used for the pressure vessel, and repairs, alterations, and modifications shall be subjected to the same nondestructive examination requirements as the original welds. Where this is not possible or practicable, alternative NDE methods acceptable to the Inspector and the Competent Authority may be used on a case-by-case basis.~~
- a) ~~NOE personnel shall be qualified and certified in accordance with the requirements of the original code of construction. When this is not possible or practicable, NDE personnel may be qualified and certified in accordance with their employer's written practice. ASNT SNT-TC-1A, *Recommended Practice for Nondestructive Testing Personnel Qualification and Certification (2006 Edition)*, or ANSI/ASNT CP-189, *Standard for Qualification and Certification of Nondestructive Testing Personnel (2006 Edition)*, shall be used as a guideline for employers to establish their written practice. The ASNT Central Certification Program (ACCP) may be used to fulfill the examination and demonstration requirements of the employer's written practice. Provisions for training, experience, qualification and certification of NDE personnel shall be described in the "R" Certificate Holder's written quality system.~~

S6.12 COATINGS AND LININGS

~~When coatings or linings are to be inspected, such inspections shall be done in accordance with the Structural Steel Painting Council, SSPC publication, No. 91-12, *Coating and Lining Inspection Manual*.~~

S6.15 MEASUREMENT, EXAMINATION, AND TEST EQUIPMENT

The calibration of pressure gages, measurement, examination, and test equipment, and documentation of calibration shall be performed, as required, by the applicable standard used for construction. This system shall be documented.

S6.16 PRESSURE TESTS FOR REPAIRS AND ALTERATIONS

The following requirements shall apply to all repairs, alterations, or modifications to DOT ~~Transport~~ Tank pressure-retaining items:

- a) The integrity of repairs alterations, modifications, and replacement parts used in repairs, alterations, or modifications shall be verified by- a pressure test;
- b) Pressure testing shall be conducted in accordance with the original code of construction and the regulations of the Competent Authority.
- c) The "R" Certificate Holder is responsible for all activities relating to the pressure test of repairs, alterations, or modifications;

S6.16.1 PRESSURE TEST METHODS APPLICABLE TO REPAIRS PRESSURE TEST METHODS

~~The integrity of repairs, alterations and modifications of DOT Transport Tanks shall be verified by a pressure test as described below. The test method used shall be subject to acceptance of the Inspector and the Competent Authority, when required.~~

a) Liquid Pressure Test

~~Liquid p~~Pressure testing of repairs ~~to, alterations, and modifications of~~ DOT ~~Transport~~Transport Tanks shall comply with ~~NBIC Part 3, 4.4.12(a)~~ and the following requirements:

- 1) Liquid pressure tests shall be conducted in accordance with the requirements of the original code of construction and the regulations of the Competent Authority at pressures established in Table S6.16-a. When original test pressure included consideration of corrosion allowance, the test pressure may be further adjusted based on the remaining corrosion allowance;

TABLE S6.16-a
PRESSURE TEST TEST PRESSURE REQUIREMENTS FOR REPAIRS

<u>CargoTransport Tank Specification</u>	<u>Test Pressure</u>
<u>MC 300, MC301, MC302, MC303, MC305, and MC306</u>	<u>The test pressure on the name plate or specification plate, 20.7 kPa (3 psig) or design pressure, whichever is greater.</u>
<u>MC 304, and MC307</u>	<u>The test pressure on the name plate or specification plate, 275.8 kPa (40 psig) or 1.5 times design pressure, whichever is greater.</u>
<u>MC 310, MC3311, and MC312</u>	<u>The test pressure on the name plate or specification plate, 20.7 kPa (3 psig) or 1.5 times design pressure, whichever is greater.</u>
<u>MC 330 and MC, -331</u>	<u>The test pressure on the name plate or specification plate, 1.5 times either MAWP or the re-rated pressure, whichever is applicable.</u>
<u>MC 338</u>	<u>The test pressure on the name plate or specification plate, 1.25 times either MAWP or the re-rated pressure, whichever is applicable.</u>

DOT 406	The test pressure on the name plate or specification plate, 34.5 kPa (5 psig) or 1.5 times the MAWP, whichever is greater.
DOT 407	The test pressure on the name plate or specification plate, 275.8 kPa (40 psig) or 1.5 times the MAWP, whichever is greater.
DOT 412	The test pressure on the name plate or specification plate, 1.5 times the MAWP, whichever is greater.

[Note: DOT Transport Tanks constructed in accordance with Part UHT in Section VIII, Division I of the ASME Code shall be tested at a pressure at least twice the transport tank design pressure.](#)

[b\) Pneumatic Test](#)

[A pneumatic test may be conducted in accordance with the requirements of the original code of construction and the regulations of the Competent Authority at pressures established in Table 6.16-a8. Concurrence of the owner shall be obtained in addition to that of the Inspector and the Competent Authority, where required. Precautionary requirements of the original code of construction and NBIC Part 2, S6.13.6.1\(c\) shall be followed.](#)

[S6.16.2 PRESSURE TEST METHODS APPLICABLE TO ALTERATIONS AND MODIFICATIONS](#)

[a\) Liquid Pressure Test](#)

[Liquid pressure testing of alterations and modifications to DOT Transport Tanks shall comply with NBIC Part 3, 4.4.2\(a\) and the following requirements:](#)

- [1\) Liquid pressure tests shall be conducted in accordance with the requirements of the original code of construction and the regulations of the Competent Authority at pressures established in Table S6.16-b. When original test pressure included consideration of corrosion allowance, the test pressure may be further adjusted based on the remaining corrosion allowance;](#)

[TABLE S6.16-b](#)
[TEST PRESSURE REQUIREMENTS FOR ALTERATIONS AND MODIFICATIONS](#)

Transport Tank Specification	Test Pressure
MC 300, 301, 302, 303, 305, 306	The test pressure on the name plate or specification plate, 20.7 kPa (3 psig) or design pressure, whichever is greater.
MC 304, 307	The test pressure on the name plate or specification plate, 275.8 kPa (40 psig) or 1.5 times design pressure, whichever is greater.
MC 310, 311, 312	The test pressure on the name plate or specification plate, 20.7 kPa (3 psig) or 1.5 times design pressure, whichever is greater.
MC 330, 331	The test pressure on the name plate or specification plate, 1.5 times either MAWP or the re-rated pressure, whichever is applicable. DOT Transport Tanks constructed in accordance with Part UHT in Section VIII, Division I of the ASME Code shall be tested at a pressure at least twice the design pressure.
MC 338	The test pressure on the name plate or specification plate or 1.5 times the design pressure, plus static head of lading, plus 101.3 kPa (14.7 psi) if subjected

	to external vacuum. DOT Transport Tanks constructed in accordance with Part UHT in Section VIII, Division I of the ASME Code shall be tested at a pressure at least twice the design pressure.
DOT 406	The test pressure on the name plate or specification plate, 34.5 kPa (5 psig) or 1.5 times the MAWP, whichever is greater.
DOT 407	The test pressure on the name plate or specification plate, 275.8 kPa (40 psig) or 1.5 times the MAWP, whichever is greater.
DOT 412	The test pressure on the name plate or specification plate, 1.5 times the MAWP, whichever is greater.

[c\) Pneumatic Test](#)

[A pneumatic test may be conducted in accordance with the requirements of the original code of construction and the regulations of the Competent Authority at pressures established in Table 6.16-b. Concurrence of the owner shall be obtained in addition to that of the Inspector and the Competent Authority, where required. Precautionary requirements of the original code of construction and NBIC Part 2, S6.13.6.1\(c\) shall be followed.](#)

S6.174 ACCEPTANCE INSPECTION

The Inspector making the acceptance inspection shall be the same Inspector who authorized the repairs, alterations, or modifications. Where this is not possible or ~~practical~~ [practicable](#), another Inspector may perform the acceptance inspection; however, in all cases, the Inspector who performs the acceptance inspection shall be an employee of the same organization as the Inspector who authorized the repairs, alterations, or modifications.

S6.185 GENERAL STAMPING REQUIREMENTS

The stamping of or attaching of a nameplate to a pressure-retaining item shall indicate that the work was performed in accordance with the requirements of this code and any requirements of the Competent Authority. Such stamping or attaching of a nameplate shall be done only with the knowledge and authorization of the Inspector ~~and Competent Authority~~. The "R" Certificate Holder responsible for the repair or the construction portion of the modification/alteration shall apply the stamping. For a re-rating where no physical changes are made to the pressure-retaining item, the "R" Certificate Holder responsible for the design shall apply the stamping. Requirements for stamping and nameplate information are shown in NBIC Part 3, Section 5.

S6.185.1 SPECIFIC "R" STAMPING AND NAMEPLATE REQUIREMENTS

The holder of a "R" *Certificate of Authorization* is required to affix a stamping or nameplate on the ~~Trans-~~ [Transport](#) Tank that indicates, the repair, alteration, or modification has been performed in accordance with the requirements of NBIC Part 3, Supplement 6 and the additional requirements of the code of construction. All repairs, alterations, and modifications, after acceptance by the ~~Registered~~ Inspector, shall have the "R" Symbol affixed to the stamping or the nameplate. The stamping or nameplate information shall satisfy the requirements of ~~a) thru g) below~~ [NBIC Part 3, 5.7.:](#)

- ~~a) The required data shall be in characters at least 4 mm (5/32 in.) high;~~
- ~~a) The markings may be produced by casting, etching, embossing, debossing, stamping, or engraving;~~
- ~~a) The selected method shall not result in any harmful contamination or sharp discontinuities to the pressure-retaining boundary of the Transport Tank;~~

- ~~a) Stamping directly on the Transport Tank, 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 and the embossed Code Symbol stamping may appear on a nameplate affixed to the Transport Tank;~~
- ~~a) The "R" Certificate Holder shall use its full name as shown on the *Certificate of Authorization* or use an approved abbreviation acceptable to the National Board;~~
- ~~a) The non-embossed Code Symbol stamping, when directly applied on the item or when a nameplate is used shall be applied adjacent to the original manufacturer's stamping or nameplate. A single repair stamping or nameplate may be used for additional activities performed, provided the repair activity is carried out by the same "R" Certificate Holder;~~
- ~~a) The date of each repair, alteration, or modification corresponding with the date on the applicable "R" form shall be applied to the existing stamping or nameplate.~~

S6.185.2 REMOVAL OF ORIGINAL STAMPING OR NAMEPLATE

~~Removal of the original stamping or nameplate shall comply with the requirements of NBIC Part 3, 5.11. If it becomes necessary to remove the original stamping, the Inspector shall, subject to the approval of the Competent Authority, witness the making of a facsimile of the stamping, the obliteration of the old stamping, and the transfer of the stamping. When the stamping is on a nameplate, the Inspector shall witness the transfer of the nameplate to the new location. Any relocation shall be described on the applicable NBIC "R" Form. The restamping or replacement of a code symbol stamp shall be performed only as permitted by the governing code of construction.~~

S6.18.3 REPLACEMENT OF STAMPING OR NAMEPLATE

~~Replacement of indistinct stamping or lost, illegible, or detached nameplates shall comply with the requirements provided in NBIC Part 2, 5.2.~~

S6.196 FORM "R" REPORTS ~~"R" FORMS~~

S6.196.1 DOCUMENTATION OF FORM "R" REPORTS

Repairs, alterations, or modifications that have been performed in accordance with the NBIC shall be documented on Form R-1, *Report of Repair* or Form R-2, *Report of Alteration* as shown in NBIC Part 3, Section 5. Form R-4, *Report Supplementary Sheet*, shall be used to record additional data when space is insufficient on Form R-1 or R-2.

S6.196.2 PREPARATION OF FORM "R" FORMS ~~REPORTS~~

Preparation of "R" Forms shall be the responsibility of the "R" Certificate Holder performing the repairs, alterations, or modifications and shall comply with the requirements provided in NBIC Part 3, 5.2.1, 5.2.2 and 5.2.4. ~~An Inspector shall indicate acceptance by signing the appropriate "R" form.~~

S6.1946.3 DISTRIBUTION OF FORM "R" REPORTS

Distribution of Form "R" Reports shall comply with the requirements provided in NBIC Part 3, 5.3 and 5.4

~~b) Legible copies of the completed "R" forms together with attachments shall be distributed to the owner or user, the Inspector, the Competent Authority as required, the Authorized Inspection Agency responsible for the inspection, and the National Board for registration.~~

~~c) Distribution of the "R" forms and attachments shall be the responsibility of the "R" Certificate Holder performing the work.~~

S6.1916.4 REGISTRATION OF FORM R-1 AND FORM R-2"R" REPORTS

~~a) Organizations Repair organizations performing repairs, alterations, or modifications required by this supplement shall register such repairs, alterations, or modifications with the National Board, submit the completed "R" Form, meeting the requirements of the NBIC, to the National Board.~~

~~b) The repair organization shall maintain a sequential Form "R"Registration Log Log that shall identify the following: as described in Part 3, 5.6.~~

~~1) Form number assigned for Form R-1;~~

~~2) Identify if the activity was a repair, alteration, or modification;~~

~~3) When the repair, alteration, or modification was completed, and~~

~~4) Date sent to the National Board.~~

S6.17 ADDITIONAL REQUIREMENTS FOR REPAIRS, ALTERATIONS, OR MODIFICATIONS

S6.17.1 SCOPE

~~This section provides additional requirements for repairs, alterations, or modifications to DOT Transport Tank pressure retaining items and shall be used in conjunction with NBIC Part 3.~~

S6.17.2 REPAIRS OF DEFECTS

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

S6.17.3 MODIFICATIONS

~~All modifications to the pressure retaining item shall meet the requirements of NBIC Part 3 for alterations.~~

S6.17.4 DRAWINGS

~~Drawings or instructions shall be prepared to describe the repair, alterations, or modification. Drawings shall include sufficient information to satisfactorily perform the activity.~~

S6.17.5 AUTHORIZATION

~~Repairs, alterations, or modifications to a pressure retaining item shall not be initiated without the authorization of the Inspector, who shall determine that the methods are acceptable.~~

S6.18 — EXAMINATION AND TEST

The following requirements shall apply to all repairs, alterations, or modifications to DOT Transport Tank pressure retaining items:

- a) The integrity of repairs and replacement parts used in repairs, alterations, or modifications shall be verified by examination and test;
- b) The "R" Certificate Holder is responsible for all activities relating to examination and test of repair, alterations, or modifications;
- c) Examination and tests to be used shall be subject to acceptance of the Inspector and the Competent Authority when required.

S6.18.1 — METHODS

One, or a combination of the following examination methods, shall be applied to DOT Transport Tank pressure retaining items with the concurrence of the Inspector and the Competent Authority when required.

- a) Liquid Pressure Test

Pressure testing of repairs shall meet the following requirements:

- 1) Pressure tests shall be conducted using water or other suitable liquid. The test pressure shall be the minimum required to verify the leak tightness integrity of the repair, but not more than 150% of the maximum allowable working pressure (MAWP) stamped on the pressure retaining item, as adjusted for temperature. When original test pressure included consideration of corrosion allowance, the test pressure may be further adjusted based on the remaining corrosion allowance;
- 2) During a pressure test where the test pressure will exceed 90% of the set pressure of the pressure relief device, the device shall be removed whenever possible. If not possible, a test gag should be used using the valve manufacturer's instructions and recommendations; and
- 3) Hold time for the pressure test shall be a minimum of 10 minutes prior to examination by the Inspector. Where the test pressure exceeds the MAWP of the item, the test pressure shall be reduced to the MAWP for close examination by the Inspector. Hold time for close examination shall be as necessary for the Inspector to conduct the examination.

- b) Pneumatic Test

A pneumatic test may be conducted. Concurrence of the owner shall be obtained in addition to that of the Inspector and the Competent Authority where required. The test pressure shall be the minimum required to verify leak tightness integrity of the repair, but shall not exceed the maximum pneumatic test pressure of the original code of construction. Precautionary requirements of the original code of construction shall be followed.

- c) Nondestructive Examination

Nondestructive examination (NDE) may be conducted. NDE methods shall be suitable for providing meaningful results to verify the integrity of the repair.

S6.19 — REPAIRS, ALTERATIONS, OR MODIFICATION REPORTS

- a) When repairs, alterations, or modifications are performed on a transport tank, i.e., cargo tank, portable tank, or ton tank, the owner or User shall have the activity performed by a Repair Organization that has a valid "R" *Certificate of Authorization* issued by the National Board. "R" forms shall be completed and certified by the "R" Certificate Holder and received and certified by the Inspector.
- b) For the purposes of documentation and stamping, modification shall be considered an alteration.

Item No.: 21-02
Subject Title: Define "Fuel Loading" as it pertains to NR activities.
NBIC Location: Part 3 Repairs and Alterations: 1.6.2 a)
Project Manager and Task Group: Raymond Spuhl, NR TG
Source Name and Email: Terrence Hellman, thellman@nationalboard.org
Statement of Need: The NR TG would like to clarify "Fuel Loading" as used to determine Category 1, 2 or 3 NR activities.
Background Information:
Existing Text: 1.6.2 a) 1) Category 1 Any ASME Section III Code certified item or system requiring repair/replacement activities irrespective of physical location and installation status prior to fuel loading. 2) Category 2 After fuel loading, any item or system under the scope of ASME Section XI requiring repair/replacement activities irrespective of physical location. Based on regulatory or jurisdictional acceptance, Category 2 may be used prior to fuel loading. 3) Category 3 Items other than those covered by Category 1 or Category 2, requiring repair/replacement activities irrespective of physical location, installation status and fuel loading.
Proposed Text: 1.6.2 a) 1) Category 1 Any ASME Section III Code certified item or system requiring repair/replacement activities irrespective of physical location and installation status prior to fuel loading <u>prior to signing the N-3 Data Report, or not under the scope of ASME Section XI.</u> 2) Category 2 After fuel loading, a Any item or system under the scope of ASME Section XI requiring repair/replacement activities irrespective of physical location <u>under the scope of ASME Section XI</u> b Based on regulatory or jurisdictional <u>requirements</u> acceptance, Category 2 may be used prior to fuel loading. 3) Category 3 <u>Any item or system</u> , other than those covered by Category 1 or Category 2, requiring repair/replacement activities irrespective of physical location or installation status.



**THE NATIONAL BOARD
OF BOILER AND PRESSURE VESSEL INSPECTORS**

PROPOSED REVISION OR ADDITION

Item No.
21-37
Subject/Title
Parts used in NR activities
NBIC Location
Part: Repairs and Alterations & Repairs and Alterations; Section: 5; Paragraphs: 5.2.5 & 5.2.6
Project Manager and Task Group
Robert Wielgoszinski
Source (Name/Email)
TG NR Committee generated
Statement of Need
Action Item 21-37 is proposing revisions/additions to Part 5 regarding completion of the Forms NR-1 and NVR-1. Particularly including provision to assure that parts or items meeting ASME Code and reported on appropriate ASME Forms are certified by an Inspector holding the proper endorsements. That is the N, I, and/or C endorsements.as appropriate.
Background Information
Current text in the NBIC does not specify any special rules for parts or other items to be used in NR work. This change will assure that any work performed on parts or other items to be used in NR activities is inspected and certified by an appropriate ANI, ANII, or ANI-C
Existing Text
Proposed Text
See attached proposal

COMMITTEE	VOTE:				Passed	Failed	Date
	Appr oved	Disappr oved	Abs taine d	Not Voting			

(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.

- a) 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.
- b) 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.

(21) **5.1.1 PREPARATION OF FORM R-3 REPORT OF PARTS FABRICATED BY WELDING**

Using the instructions found 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.

(21) **5.1.2 PREPARATION OF FORM R-4 REPORT SUPPLEMENT SHEET**

Using the instructions found 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.

(21) **5.1.3 PREPARATION OF FORM NR-1, REPORT OF REPAIR/REPLACEMENT ACTIVITIES FOR NUCLEAR FACILITIES**

~~Using the instructions found in Table S9.6 of Supplement 9, preparation of Form NR-1 shall be the responsibility of the "NR" Certificate Holder responsible for performing the work.~~

- (21)
- a) Using the instructions found in Table S9.6 of Supplement 9, preparation of Form NR-1 shall be the responsibility of the "NR" 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 NR-1 and extended to a Form R-4 as needed to fully describe the repair activities completed per the instructions in Table S9.6 of Supplement 9. NOTE: when a Form R-4 is utilized, reference to the "R" Certificate Holder and "R Stamp shall mean the "NR" Certificate Holder and "NR" Stamp.
 - c) An Inspector holding appropriate endorsements shall indicate acceptance by signing Form NR-1, and Form R-4, if attached.
 - d) The Form R-3, *Report of Parts Fabricated by Welding*, an ASME Manufacturer's Data Report, or other certifications/documentation as required by the Design Specification shall be a part of the completed Form NR-1 and shall be attached thereto. NOTE: when a Form R-3 is utilized, reference to the "R" Certificate Holder and "R Stamp shall mean the "NR" Certificate Holder and "NR" Stamp.

5.2.6 PREPARATION OF REPORT OF REPAIR/REPLACEMENT ACTIVITIES FOR NUCLEAR PRESSURE RELIEF DEVICES

~~Using the instructions found in Table S9.7 of Supplement 9, preparation of Form NVR-1 shall be the responsibility of the "NR" Certificate Holder, possessing the "VR" Certificate denoting the repair of nuclear pressure relief valves, responsible for performing the work.~~

Using the instructions found in Table S9.7 of Supplement 9, preparation of Form NVR-1 shall be the responsibility of the "NR" Certificate Holder, who possesses a "VR" Certificate. The "NR" Certificate scope shall include the repair of nuclear pressure relief devices.

- a) Information describing the scope of work used to repair pressure relief devices shall be documented on a Form NVR-1 and extended to a Form R-4 as needed to fully describe the repair activities completed per the instructions in Table S9.7 of Supplement 9. NOTE: when a Form R-4 is utilized, reference to the "R" Certificate Holder and "R Stamp shall mean the "NR" Certificate Holder and "NR" Stamp.
- b) An Inspector holding appropriate endorsements shall indicate acceptance by signing Form NVR-1, and Form R-4, if attached.
- c) The Form R-3, Report of Parts Fabricated by Welding, an ASME Manufacturer's Data Report, or other certifications/documentation as required by the Design Specification shall be a part of the completed Form NVR-1 and shall be attached thereto. NOTE: when a Form R-3 is utilized, reference to the "R" Certificate Holder and "R Stamp shall mean the "NR" Certificate Holder and "NR" Stamp.

Item 22-12: Lost or Destroyed UDS (Part 3, 3.3.5.2 & 3.4.5.1)

Explanation of Need: To provide the ability to repair/alter these vessels with a reconstructed UDS.

Background Information: This addition is based on the comments received at the task group level for Interpretation 21-60.

Proposed Changes:

3.3.5.2 REPAIR PLAN

The user shall prepare, or cause to have prepared, a detailed plan covering the scope of the repair.

a) Engineer Review and Certification

The repair plan shall be reviewed and certified by an engineer meeting the criteria of ASME Section VIII, Division 2 or 3, as applicable, for an engineer signing and certifying a Manufacturer's Design Report. The review and certification shall be such as to ensure the work involved in the repair is compatible with the User's Design Specification and the Manufacturer's Design Report. The certifying requirement may be waived for ASME Section VIII, Division 2, Class 1 vessels that did not require the Manufacturer's Design Report to be certified during initial construction.

If the User's Design Specification (UDS) is lost or destroyed, the ASME nameplate, and the applicable ASME Section VIII, Division 2 and 3 forms Manufacturer's Data Reports, and Partial Data Reports, and/or the Manufacturer's Design Report shall be used to reconstruct the User's Design Specification such as Form A-1 Manufacturer's Data Report, Form A-2 Manufacturer's Partial Data Report for Section VIII, Division 2 vessels or Manufacturer's Data Reports for Section VIII, Division 3. The reconstructed UDS shall meet the requirements and be certified in accordance with the latest edition of ASME Section VIII, Division 2 or Division 3.

Note: The engineer qualification criteria of the Jurisdiction where the pressure vessel is installed should be verified before selecting the certifying engineer.

b) Authorized Inspection Agency Acceptance

Following review and certification, the repair plan shall be submitted for acceptance to the Authorized Inspection Agency/Owner-User Inspection Organization whose Inspector will make the acceptance inspection and sign the Form R-1.

3.4.5.1 ALTERATION PLAN

a) Engineer Review and Certification

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

Provided that the alteration does not introduce a condition that would require an engineer to sign the Manufacturer's Design Report for ASME Section VIII, Division 2, Class 1 vessels, the certifying requirement may be waived for vessels that did not require the Manufacturer's Design Report to be certified during initial construction.

If the User's Design Specification (UDS) is lost or destroyed, the ASME nameplate, and the applicable ASME Section VIII, Division 2 and 3 forms Manufacturer's Data Report, Partial Data Reports, and/or the Manufacturer's Design Report shall be used to reconstruct the User's Design Specification such as Form A-1 Manufacturer's Data Report, Form A-2 Manufacturer's Partial Data Report for Section VIII, Division 2 vessels or Manufacturer's Data Reports for Section VIII, Division 3. The reconstructed UDS shall meet the requirements and be certified in accordance with the latest edition of ASME Section VIII, Division 2 or Division 3.

~~**Note:** The engineer qualification criteria of the jurisdiction where the pressure vessel is installed should be verified before selecting the certifying engineer.~~

Item A22-29 – Schaefer – 01-09-2023 - NBIC NR Revisions

General Description: Removal of the requirements of AIA audits for the certificate holders QA Manual. This requirement cannot be enforced and is not defined by the NR Certificate Holder and therefore must be removed.

NBIC Location: Part 3, 1.6.6.2 s) 6), 1.6.7.2 s) 6) and 1.6.8.2 s) 6).

All three sections are identical. Text to be removed is struck through and red and applies to all three sections noted.

Existing Text for section 1.6.6.2 s) 6) – For Category 1

Existing Text for section 1.6.7.2 s) 6) – For Category 2

Existing Text for section 1.6.8.2 s) 6) – For Category 3

- 6) Audit records shall include as a minimum;
 - a. written procedures;
 - b. checklists;
 - c. reports;
 - d. written replies; and
 - e. Completion of corrective actions.

~~Performance of Authorized Inspection Agency audits required by ASME QAI-1 and NB-263, RCI-1 shall be addressed in the Quality Assurance Manual.~~

1.3.2

- b) Before signing the appropriate NBIC Report Form, the Inspector shall review the drawings, ensure the repair or alteration was performed in accordance with the accepted code of construction or standard, witness any pressure test or any acceptable alternative test method applied, ensure that the required nondestructive examinations have been performed satisfactorily, verify the stamping or nameplate is correct and where applicable, the nameplate has been properly attached, and that the other functions necessary to ensure compliance with the requirements of this code have been satisfactorily performed.
- ~~e) The Inspector shall verify the stamping or nameplate is correct and where applicable, the nameplate has been properly attached.~~

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. 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. 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) Form R reports shall not be certified until all applicable requirements of the NBIC, including the stamping requirements of 5.7, have been met.
- d) 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.

3.3.4.8 REPAIR OF PRESSURE-RETAINING ITEMS WITHOUT COMPLETE REMOVAL OF DEFECTS

- a) There may be cases where removal of a defect in a pressure-retaining item is not practical at the time the defect is found. In such cases, with approval of the Inspector and, when required, the Jurisdiction, an engineering evaluation shall be performed to determine the scope of the repair and impact to safety prior to returning the pressure-retaining item to service for a specified period of time. The engineering evaluation shall be performed by an organization with demonstrated competency in defect (and flaw) characterization of pressure-retaining items. The method of defect evaluation and time interval for returning the pressure-retaining item back to service shall be as agreed upon by the Inspector, and when required, the Jurisdiction. The specified period of time the defect can remain in service after weld repair shall be based on no ~~measurable~~measurable defect growth during subsequent inspections, or a period of time as specified by the Jurisdiction, if applicable. This repair method is not permitted for vessels used in lethal service, vessels designed for high-cycle operation or fatigue service, compressed air storage, and in cases where high stress concentration cannot be reduced by weld repair. This repair method is not permitted for DOT vessels.
- b) One or more fitness-for-service engineering evaluation methods as described in NBIC Part 2, 4.4 shall be used to determine whether the defect may remain, either in part or in whole, in the pressure-retaining item. If it is determined that the defect can remain in the item, a risk-based inspection program shall be developed as described in NBIC Part 2, 4.5 to assure inspection of the defect and monitoring of defect growth over time. This program shall be a controlled and documented inspection program that specifies inspection intervals as agreed upon with the Inspector and, when required, the Jurisdiction, and shall be maintained until the defect can be completely removed and the item repaired.
- c) The following requirements shall apply to the weld repair of pressure-retaining items without complete removal of defects:
- 1) Engineering evaluation of the defect in the pressure-retaining item shall be conducted using one or more fitness-for-service condition assessment method(s) as described in NBIC Part 2, 4.4. Engineering evaluation of the condition assessment results shall be performed by an organization that has demonstrated industry experience in evaluating pressure-retaining items, if the fitness-for-service engineering evaluation requires finite element analysis (FEA), the requirements in NBIC Part 2, 4.6 and NBIC Part 2, Supplement 11 shall be met.
 - 2) If engineering evaluation indicates a defect can remain in the pressure-retaining item, a risk-based inspection program shall be developed and implemented based on review and acceptance by the Inspector and, when required, the Jurisdiction. The risk-based inspection program shall be in accordance with the requirements in NBIC, Part 2 4.4.
 - 3) The fitness-for-service condition assessment and risk-based inspection programs shall remain in effect for the pressure-retaining item until such time that the defect can be completely removed and the item repaired. The fitness-for-service condition assessment method, results of assessment, and method of weld repair, if applicable, shall be documented on a Report of Fitness for Service Assessment (FFSA) Form as described in NBIC Part 2, 4.4.1 and shall be filed with the Jurisdiction, when required.
 - 4) When weld repairs are performed without complete removal of the defect(s), this shall be noted on the Form R-1 in the description of the work. The "R" Stamp Holder performing the weld repairs shall provide detailed information on the Form R-1, describing the method, extent, and include the specific location of the weld repair on the item.
 - 5)j. The interval to re-inspect or remove the item from service or perform weld repair shall be determined based on a risk-based inspection program developed and implemented as required by NBIC Part 2, 4.5. The inspection interval shall not

exceed the remaining life of the item, and shall be documented on the Form NB-403 and in the Remarks section of the Form R-1. The Form NB-403 shall be affixed to the Form R-1. A National Board Commissioned Inspector holding an "R" endorsement as described in NB-263, RCI-1 shall sign both the Form R-1 and the attached Form NB-403.

6)ii. A copy of the completed Form R-1 with the completed Form NB-403 attached may be registered with the National Board, and when required, filed with the Jurisdiction where the item was installed.