Contents

Subcommittee Repairs/Alterations

Last Name	First Name	Interest Category	Role	Exp. Date	More
Galanes	George	Users	Chair	08/30/2018	Details
Pillow	James	General Interest	Vice Chair	07/30/2019	Details
Vallance	William		Secretary	01/30/2099	Details
Amato	Joel	Jurisdictional Authorities	Member	01/30/2021	Details
Boseo	Brian	National Board Certificate Holders	Member	08/30/2018	Details
Edwards	Paul	National Board Certificate Holders	Member	08/30/2018	Details
Hopkins	Craig	National Board Certificate Holders	Member	01/30/2019	Details
Jones	Wayne	Authorized Inspection Agencies	Member	01/30/2021	Details
Miletti	Ray	Manufacturers	Member	07/30/2019	Details
Moedinger	Linn	Users	Member	01/30/2019	Details
Moore	Kathy	National Board Certificate Holders	Member	01/30/2021	Details
Morelock	Brian	Users	Member	03/30/2020	Details
Schaefer	Benjamin	National Board Certificate Holders	Member	01/30/2019	Details
Sekely	James	General Interest	Member	08/30/2018	Details
Sturm	Rick	Jurisdictional Authorities	Member	07/30/2020	Details
Toth	Marty	National Board Certificate Holders	Member	01/30/2019	Details
Troutt	Robby	Jurisdictional Authorities	Member	08/30/2020	Details

Michael J. Quisenberry

806.316.7174 6117 Yale St., Amarillo, TX 79109 michael@allentri.com

Education:

West Texas A&M University — Canyon, TX
~ Bachelors of Business Administration in Finance
~ Bachelors of Business Administration in Economics
Pi Gamma Mu Honor Society (Economics)
Omnicron Delta Epsilon Honor Society (Finance)

Texas A&M University — College Station, TX
~ Masters of Business Administration
Organizational Leadership

Qualifications:

- ~ Microsoft Office Certified (Extensive Experience with Excel, Word, and Power Point)
- ~ Experience working in manufacturing and building trades environment
- ~ Skilled in managing employees and delegating responsibilities
- ~ Adept in sourcing equipment and materials and issuing / tracking purchasing documentation
- ~ Extensive Project Management experience with a focus on repair / maintenance jobs
- ~ Tradesman Limited Plumbing License – State of Texas
- ~ Texas State Certified Class III Water Treatment Specialist

Experience:

Allen's Tri-State Mechanical, Inc

Deputy Division Manager – Heavy Industrial — Amarillo, TX

Manage crew of plumbers, pipefitters, and welders. Work in a division that focuses on serving large commercial, industrial, and institutional mechanical systems. Extensive knowledge in steam plant piping and design; intimately familiar with Scotch Marine Boilers, packaged water-tube boilers, and ancillary boiler room equipment. Knowledgeable in domestic potable water piping, closed loop systems, condensate return systems, air handler units (AHU's) and roof top units (RTU's). Extensively experienced in water treatment systems such as water softeners, Reverse Osmosis (RO) machines, carbon filters, green sand filters, and sediment filtration.

Bid and quoted scheduled work to customers on a regular basis, always coming in on budget. Managed technicians to respond to unscheduled and emergency repairs. Coordinated subcontractors, material procurement, labor schedules, and out of town travel accommodations (i.e. per diem, lodging, and travel expenses).

ASME /NBIC Code Welding Quality Control Manager

Managed crew of NBIC and ASME qualified code welders who repair and alter ASME rated pressure vessels. Developed from the ground up and implemented new quality control program with certified manual. Conducted and passed Joint Reviews from both the National Board of Boiler and Pressure Vessel Inspectors

(NBIC) and the American Society of Mechanical Engineers (ASME). Currently a sitting committee member of the National Board Code Committee which develops and implements new legislation for construction, repair, and alteration of boilers and pressure vessels. (Youngest person to ever sit on this committee in it's 98 year history)

Plains Plumbing Co., LLC — Amarillo, TX

Purchasing Agent / Service Manager — Nov. 2012 – February 2016 / May 2003 - 2008

Source and procure materials for construction and service jobs. Maintain relationships with numerous vendors in the manufacturing and building trades industries. Proactively search for best prices and anticipate needs of the company to perform upcoming work. Schedule work to be performed for customers and dispatch service technicians to jobsites. Ensure that projects meet deadlines and expected budgetary constraints.

Journeyman Licensed Plumber

Managed crew of men in bid project work as well as service and repair work on piping and large mechanical systems. Worked primarily on steam and domestic potable water applications in large commercial, industrial, and institutional applications. Took rotational on-call schedule with other technicians and ensured that jobs came in on time and within budget.

Plumber's Apprentice

Worked various Journeyman plumbers in plan built construction, design build construction, and service and repair capacities. Learned fundamental principles of plumbing and pipefitting. Became knowledgeable in all manner of mechanical systems including engineered equipment such as SMFT boilers, centrifigul chillers (screw & scroll), closed loop piping systems, water treatment equipment, and both process heating and cooling as well as environmental.

Ruby Tequila's Mexican Kitchen — Amarillo, TX

Assistant Manager

Oversaw staff of over 50 employees. Managed day to day financials of the company. Responsible for anticipating inventory needs and ordering accordingly. Learned to develop and foster relationships with individuals to increase revenues for the company.

Leal's Mexican Restaurant — Amarillo, TX

Bar and Assistant Manager

Responsible for anticipating the needs of the bar area and ordering inventory as needed. Managed small staff of 3-5 bartenders and shift scheduling. Developed new recipes for the bar and supplemented other management staff when needed.

Michael J. Quisenberry

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References:

Howard E. Allen
President/CEO
Allen's Tri-State Mechanical, Inc.
404 S. Hayden St.
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(806) 376-8345
Supervisor – 3 years

Simmie Callahan
Service Manager
Plains Plumbing Co.
1301 W. 7th St
Amarillo, TX 79101
806-679-6450
Supervisor - 4 years

Gary Guinn
Energy Service Project Manager
DOE and DOHS Security Clearance
Noresco / Pantex
6203 Rutgers
Amarillo, TX 79109
806-336-4281
Business Associate & Friend, 10 years

Dr. Anne Macy
Professor in the College of Business
West Texas A&M University
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Former Professor, 3 years

Libby Leal
General Manager
Leal's Mexican Restaurant
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806-444-6860
Manager - 2 years

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Ph. 806.376.8345

TMPL # 38082

TACL # A26434C

February 20, 2018

National Board Code Committee
Attn: Mr. George Galanes P.E.
4 Territorial Ct.
Bollingbrook, IL 60440

Mr. Galanes,
This letter is to confirm my willingness to serve in an appointment to the National Board Inspection Code Committee Sub-Committee and Sub-Group for Repairs & Alterations. I have attended meetings for the last year and a half and have found them not only informative but personally edifying. I would be honored for the opportunity to become even more actively involved in the process of interpreting, refining, and adding to the Boiler and Pressure Vessel Code.

A little information about myself, I have worked in the power steam boiler industry for over 12 years now. I began my career as a plumber/pipefitter's apprentice where I learned to work on a variety of boilers and ancillary steam plant equipment as well as SMAW. While serving my apprenticeship I worked through college and graduated with two Bachelor's degrees one Bachelor's of Business Science – Economics, and another Bachelor's of Business Science – Finance. After graduation I found that I was unable to make a comparable financial living in a degree related fields as I was working in the trades and continued to work in the field until I was promoted to a Service Manager position at my last company. I left my former employer and moved to Allen's Tri-State Mechanical, Inc. where I was tasked with starting a new Quality Control program in order to obtain the NBIC R-Stamp.

Allen's Tri-State Mechanical, Inc. is a mechanical service and repair company located in Amarillo, TX. In business since 1946, Allen's has always taken pride in fielding the most knowledgeable and qualified craftsmen in their area. Allen's takes great pride in the longevity of their staff and employees and greatly attributes this to their dedication to train and provide opportunities to their employees for personal and professional growth.

This letter affirms Allen's Tri-State Mechanical, Inc's commitment to endorse and sponsor Michael Quisenberry's continued service on the National Board Inspection Code Committee.

President/CEO
Howard E. Allen

2/20/2018
Date

Michael Quisenberry

2/20/2018
Date

John A. Siefert

jsiefert@epri.com

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Huntersville, NC, 28078
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Charlotte, NC, 28262
(704) 595-2886

OBJECTIVE

Welding engineering occupation applying hands on problem solving, leadership, and teamwork skills; no geographic limitations

EDUCATION

The Ohio State University, Columbus, OH — Graduation Date: March 16, 2008
Bachelor of Science in Welding Engineering — GPA upon Graduation: 3.24

Loughborough University, Leicestershire, United Kingdom — Graduation Date: March 2019
Doctor of Philosophy through the Department of Materials
First year report approved July 2016
Second year report approved 2017

EXPERIENCE

Electric Power Research Institute (EPRI), July 2011 – Present

Principal Technical Leader – responsibilities include managing approximately ten projects per year through Program 87 Fossil Materials and Repair, Technology Innovation and Supplemental Projects. Project execution includes conducting and coordinating efforts within EPRI using facilities such as the machine shop, metallography lab, welding lab, heat treatment lab and generation lab. Contractors are utilized when EPRI facilities or expertise are not available to properly complete a given project; coordination with contractors includes interaction with testing labs (i.e. destructive evaluation), universities, independently employed individuals and engineering-based organizations. Project management skills also required included budgeting, reporting, task layout of projects with key goals and objectives, planning/road-mapping, basic knowledge of SAP, reporting of results to membership, etc.

1. ***Program 87 Fossil Materials and Repair*** – Program 87 assists membership organizations in the welding, corrosion, high temperature behavior and characterization of fossil fired power plant materials. Within this program, responsibilities are generally focused in the management of day to day welding activities and coordinating projects within EPRI's state-of-the-art facilities. Past projects and efforts include: development of EPRI P87 filler metal, assembling the creep strength enhanced ferritic welding guide, leading the effort to address innovative report delivery in the form of a specialized web application, residual stress examination in bainitic and martensitic creep strength enhanced ferritic (CSEF) steels, and assessing the weldability of advanced stainless steels.
2. ***Technology Innovation*** – Technology Innovation provides EPRI membership with long-term research and development separate from the efforts in the base programs. Past projects include the examination of wear behavior of candidate Co-free hardfacing materials, assessing the integrity of powder metallurgy and hot isostatic pressed (PM/HIP) components for stainless steel 316L and CSEF steel Grade 91, materials scouting for EPRI Materials Strategic Program, behavior of 10-12Cr high oxidation resistant CSEF steels in creep, stress relaxation cracking behavior across multiple alloy systems and dissimilar metal welds between ferritic and austenitic stainless steels.
3. ***Supplemental Projects*** – Supplemental projects are established at EPRI to involve non-traditional members in critical projects and provide a second funding mechanism in the case that insufficient funds are available in a base program. There has been substantial participation and coordination in several projects including: Weld Repair of Grade 91 Piping and Components; Life Management of Boiler and Piping Components fabricated from Grade 92 Steels; Non-Destructive Methods for Detection of High-Temperature Damage in Creep Strength Enhanced Ferritic Steels and Cracking and Disbonding of Hardfacing Alloys in Combined Cycle Plant Valves and Weld Repair of Conventional CrMo Steels to New Code Requirements. Managed several projects including: Tempering Behavior and Characterization of Grades 23/24 Steels; and Application of Well-Engineered Weld Repairs for Grade 91 and other Creep Strength-Enhanced Ferritic (CSEF) Steels.
4. ***DOE-sponsored Projects*** – In rare cases, EPRI will submit proposals for government funding. One such project, "Optimization of Advanced Steels for Cyclic Operation through an Integration of Material Testing, Modeling and Novel Component Test Validation" involved the project management and coordination of ~$900k in funding across three institutions in the 2015 to 2018 timeframe.

Babcock and Wilcox Research Center (BWRC), April 2008 – June 2011

Welding Engineer – Project management responsibilities include running the welding lab on a day-to-day basis (including the welding of necessary weldments), and tracking multiple research projects including the results, purchase orders, additional paperwork, reporting/project updates and costs. The goal of the welding lab is to adequately and arduously research and develop the necessary welding process(es) to join new, emerging and existing alloys regardless of the technical challenge, timeframe or project cost restriction. A couple of key projects spanning the listed timeframe at BWRC are described below:

1. ***Development of EPRI P87 solid wire*** – 'EPRI P87' is the trade name for an improved, nickel-base filler metal, which has primary use in dissimilar metal weldments (DMWs). Following EPRI's development of a SMAW product, B&W approached EPRI and co-developed a solid wire product with EPRI and Euroweld, LTD. The details of this work were reported in several papers and conferences, and an EPRI report was authored by B&W, EPRI and Euroweld detailing this several year effort.
2. ***A-USC*** – The department of energy (DOE) has sponsored the advanced ultrasupercritical (A-USC) project for several years. BWRC has been intimately involved in this research and the welding lab has been responsible for solving welding issues associated with thick-section, nickel-based, solid-solution strengthened and gamma prime strengthened alloys. The welding lab successfully solved welding issues associated with INCONEL® 740 and welded many other alloys as a part of this project including HAYNES® 230®, INCONEL® 617, and HAYNES® 282®.
3. ***Waterwall Panel Research*** – BWRC did preliminary investigations into new waterwall panel materials for existing boiler designs as well as for future A-USC boilers. This initial research resulted in the fabrication and on-site management of a full-sized production waterwall panel section constructed over the course of four weeks in Beijing, China at the Babcock and Wilcox Beijing Company facility. Following the production of the waterwall panel, it was shipped back to BWRC where it was dissected and analyzed for flaws and defects. A large piece of the panel was kept intact to develop PWHT procedures that would be applicable in the field construction of large waterwall panels.
4. ***Welding Process Development*** – New processes or approaches to the welding of existing parts in boilers are developed at BWRC. Full penetration stub to header welds was developed over the course of a year and involved the selection of adequate equipment, procedures and acceptable welding parameter windows to be applied in B&W fabrication shops. This project was conducted as B&W normally welds a stub to a header utilizing a socket weld, but Europeans and others utilities in Asia require full penetration stub to header welds if the plant is to be cycled often. Full penetration welds help reduce failure due to a corrosion fatigue mechanism caused by an oxide penetration and frequent cycling of the plant.

Construction and Repair Code Activities

ASME B&PV Code. Participation or membership in ASME B&PV Code activities requires attendance at four meetings per year. As a part of active, future and relevant research within EPRI, it is typical to make presentations and provide technical guidance at key meetings to the relevant working groups, subgroups, task groups or main committees in ASME B&PV Sections I and II.

1. Secretary, WG-Creep Strength Enhanced Ferritic Steels (since 2014).
2. Participation, SG-Strength of Weldments (since 2015)
3. Participation, B&PV Section I SG-Design (since 2015)
4. Participation, B&PV Section I SG-Fabrication and Examination (since 2014)
5. Participation, B&PV Section I SG-Materials (since 2015)
6. Participation, B&PV Section I TG-Modernization (since 2015)

National Board Inspection Code (NBIC). Participation in the NBIC requires attendance at two meetings per year. As a part of active, future and relevant research within EPRI, it is typical to make presentations and provide technical guidance at key meetings to Part 3 Repairs and Alterations and the Main Committee.

1. NBIC Part 3 Repairs and Alterations Subgroup Repairs and Alterations (since 2012)
2. NBIC Part 3 Repairs and Alterations Subcommittee Repairs and Alterations (since 2012)

Awards and Recognition

Electric Power Research Institute Technology Transfer Award – 2009
For "P87 Weld Filler Metal for Dissimilar Metal Weld Joints"

Performance Recognition Award – 2011
"For an immediate impact at EPRI in updating and substantially improving the Creep Strength-Enhanced Ferritic (CSEF) steel welding guide"

Performance Recognition Award – 2012
For "Successful creation of the EPRI CSEF Welding App"

Performance Recognition Award – 2013
For "Outstanding generation council presentation on the CSEF welding web application demonstrating an improved approach to transferring EPRI technology"

Performance Recognition Award – 2014
"For above and beyond support of EPRI member engagement and Program 87 European members"

Performance Recognition Award – 2014
For "Exemplifying research excellence in the development and publication of the effect of optimization in Vickers hardness parameters for micro- and macro- indentation of Grade 91 steel and receiving the ASTM international 2013 Committee on publications award for outstanding article in the Journal of Testing and Evaluation"

ASTM International Committee on Publications 2013 Award for Outstanding Article in the Journal of Testing and Evaluation – 2014
"For your outstanding manuscript JTE20120290, Optimization of Vickers Hardness Parameters for Micro- and Macro-Indentation of Grade 91 Steel"

EPRI Chauncey Award – *2016*
"Development and Industry Implementation of Innovative Repairs for Advanced 9Cr Steels"

EPRI Chauncey Award – *2017*
"Powder Metallurgy-Hot Isostatic Pressing Manufacturing Technology"

SUMMARY OF PUBLICATIONS

Type of Publication	Number
Trade Journal Articles	7
Refereed Conference Publications	35
Journal Articles	20
EPRI Reports – Primary Author	16
EPRI Reports – Contributing Author or Managed	44
EPRI Success Stories – Primary Author	5
Total	127

TRADE JOURNAL ARTICLES

1. J. P. Shingledecker, D. Purdy, **J. A. Siefert,** J. Tedesco and A. Szafarczyk. “Advantages of 3D Laser Scanning Confocal Microscopy.” *Advanced Materials and Processes 174* (10), 2016. pp. 22 to 25.
2. **J. A. Siefert** and J. D. Parker. “Improved Weld Repair Options for Grade 91 Steel.” *Energy Tech Magazine*, September 2015.
3. **J. A. Siefert**, D. W. Gandy, D. Purdy, J. P. Shingledecker, R. Smith, T. Lolla, S. S. Babu, L. Lherbier, and D. Novotnak. “Development of Hardfacing Alloys for Power Generation Applications.” *Advanced Materials & Processes 172* (1)*, 2014.* pp. 21-24.
4. **J. A. Siefert** and J. P. Shingledecker. “New Web-based App for Welding CSEF Steel.” *Energy Tech Magazin*e, 2013.
5. J. D. Parker, K. Coleman, **J. A. Siefert** and J. P. Shingledecker. “Challenges with NDE and Weld Repair of Creep-Strength Enhanced Ferritic Steels.” *Advanced Materials & Processes 170* (10)*, 2012.* pp. 20-23.
6. D. W. Gandy, J. P. Shingledecker and **J. A. Siefert.** “Overcoming Barriers for Using PM/HIP Technology to Manufacture Large Power Generation Components.” *Advanced Materials & Processes 170* (1)*,* 2012. pp. 19-23.
7. W. F. Newell, J. P. Shingledecker, **J. A. Siefert.**, and J. M. Tanzosh. “EPRI P87: A Promising New Filler Metal for Dissimilar Metal Welding.” *Welding Journal 90* (3), 2011. pp. 30-37.

REFEREED CONFERENCE PUBLICATIONS

1. Y. Takahashi, H. Shigeyama, **J. A. Siefert** and J. D. Parker. “Creep Deformation Analyses for Grade 91 Steels Considering Heat-to-Heat Variation.” *Proceedings of the ASME 2018 Pressure Vessels and Piping Conference*, July 2018. PVP2018-85058.
2. Y. Takahashi, H. Shigeyama, **J. A. Siefert** and J. D. Parker. “Effect of Simulated Heat Affected Zone Thermal Cycle on the Creep Deformation and Damage Response of Grade 91 Steel including Heat-to-Heat Variation.” *Proceedings of the ASME 2018 Pressure Vessels and Piping Conference*, July 2018. PVP2018-85012.
3. **J. A. Siefert**, J. D. Parker, R. C. Thomson. “Effect of PWHT on the Fracture Toughness and Burst Test Response of Grade 91 Tube Weldments.” *Proceedings of the ASME 2018 Elevated Temperature Application and Materials Conference*, April 2018. ETAM2018-6714.
4. **J. A. Siefert**, J. D. Parker, R. C. Thomson. “Microstructure Features Contributing to Heat Affected Zone Damage in Grade 91 Steel Feature Type Cross-weld Tests.” *Proceedings of the ASME 2018 Elevated Temperature Application and Materials Conference*, April 2018. ETAM2018-6709.
5. **J. A. Siefert**, J. D. Parker, R. C. Thomson. “Factors Contributing to Heat Affected Zone Damage in Grade 91 Steel Feature Type Cross-weld Tests.” *Proceedings to the 4th International ECCC Conference on Creep and Fracture*, September 2017.
6. **J. A. Siefert** and J. D. Parker. “Best Practice Guidelines for Dissimilar Metal Welds between Grade 91 Steel and Austenitic Stainless Steel.” *Proceedings to the 4th International ECCC Conference on Creep and Fracture*, September 2017.
7. J. D. Parker and **J. A. Siefert**. “The Effect of Metallurgical Factors and Stress State on the Performance of High Energy Components Manufactured from Creep Strength Enhanced Steels.” *Proceedings to the 4th International ECCC Conference on Creep and Fracture*, September 2017.
8. **J. A. Siefert**, J. D. Parker and R. C. Thomson. “Linking Performance of Parent Grade 91 Steel to the Cross-weld Creep Performance using Feature Type Tests.” *Proceedings from the Eighth International Conference on Advances in Materials Technology for Fossil Power Plants*, ASM International, 2016. pp. 531 to 544.
9. **J. A. Siefert**, J. D. Parker and T. Totemeier. “Complexities of In-service Failures in Dissimilar Metal Welds between Grade 91 and Austenitic Stainless Steels.” *Proceedings of the 16th Pressure Vessels and Piping Conference*, July 17-20, Vancouver, BC, Canada. Paper PVP2016-63982.
10. **J. A. Siefert**, C. Libby and J. P. Shingledecker. “Concentrating Solar Power (CSP) Power Cycle Improvements through Application of Advanced Materials.” SOLARPACES 2015: International Conference on Concentrating Solar Power and Chemical Energy Systems 1734 (1).

11. **J. A. Siefert** and J. D. Parker. “Well-Engineered Weld Repair of Grade 91 Steel.” *Proceedings to the 11th EPRI International Conference on Welding and Repair Technology for Power Plants.* Naples, FL. June 25-27, 2014. EPRI, Palo Alto CA: 2014. Paper F5.

12. S. J. Pawel and **J. A. Siefert**. “Stress Corrosion Cracking of Ferritic Materials for Fossil Power Generation Applications.” *Proceedings to the 11th EPRI International Conference on Welding and Repair Technology for Power Plants.* Naples, FL. June 25-27, 2014. EPRI, Palo Alto CA: 2014. Paper F11.

13. J. Galler, J. N. DuPont and **J. A. Siefert**. “Residual Stress Accumulation in High-Temperature Alloys Used for Energy Applications.” *Proceedings to the 11th EPRI International Conference on Welding and Repair Technology for Power Plants.* Naples, FL. June 25-27, 2014. EPRI, Palo Alto CA: 2014. Paper F14.

14. D. Purdy, J. P. Shingledecker and **J. A. Siefert**. “Experiences in Valve Hardfacing Disbonding.” *Proceedings to the 11th EPRI International Conference on Welding and Repair Technology for Power Plants.* Naples, FL. June 25-27, 2014. EPRI, Palo Alto CA: 2014. Paper G8.

15. D. W. Gandy**, J. A. Siefert**, R. Smith, T. Lolla, S. S. Babu, D. Novotnak and L. Lherbier. “Development and Application of and Advanced Co-free Hardfacing Alloy for Nuclear Applications.” *Proceedings to the 11th EPRI International Conference on Welding and Repair Technology for Power Plants.* Naples, FL. June 25-27, 2014. EPRI, Palo Alto CA: 2014. Paper N20.

16. D. W. Gandy, **J. A. Siefert**, L. Lherbier and D. Novotnak. “PM-HIP Research, Applications and Technology Gaps for the Electric Power Industry.” *Proceedings of the 11th International Conference of Hot Isostatic Pressing*. June 9-13, 2014. Stockholm, Sweden.

17. **J. A. Siefert** and J. R. Foulds. “Cracking in Grade 23 Weldments at Elevated Temperatures.” *Proceedings of the ASME Symposium on Elevated Temperature Application of Materials for Fossil, Nuclear and Petrochemical Industries*. March 25-27, 2014, Seattle, WA.

18. **J. A. Siefert** and J. N. DuPont. “Material Behavior of T23 and T24.” *Proceedings from the Seventh International Conference on Advances in Materials Technology for Fossil Power Plants*, ASM International, 2014. pp. 513 to 524.

19. **J. A. Siefert** and J. R. Foulds. “Creep Crack Growth in T23.” *Proceedings from the Seventh International Conference on Advances in Materials Technology for Fossil Power Plants*, ASM International, 2014. pp. 1372-1387.

20. **J. A. Siefert** and J. D. Parker. “Weld Repair of Grade 91 Steel.” *Metal 2013*, Brno, Czech Republic, May, 2013.

21. J. P. Shingledecker, H. Hendrix, J. Phillips, **J. A. Siefert**, R. Purgert and P. Rawls. “U.S. Program on Advanced Ultrasupercritical Power Plant Materials – The Economy of Using Advanced Alloys.” *Proceedings to the IEA Clean Coal Centre Workshop: Advanced ultrasupercritical coal-fired power plants.* Vienna, Austria, 19-20 Sept. 2012.

22. **J. A. Siefert** and J. P. Shingledecker. “Repair without PWHT of T91 – Use of EPRI P87 and Temperbead Welding Approach.” *Proceedings to IIW Conference.* July 11-13, 2012. Denver, CO, USA.

23. **J. A. Siefert** and J. P. Shingledecker. “Repair without PWHT of T91 – Use of EPRI P87 and Temperbead Welding Approach.” *Proceedings to the EPRI International Conference on Welding and Repair Technology for Power Plants.* Marco Island, FL. June 27-29, 2012. EPRI, Palo Alto CA: 2012. Paper F13.

24. S. R. Paterson, **J. A. Siefert** and J. P. Shingledecker. “Steam Turbine Casing and Valve Body Repair Guide.” *Proceedings to the EPRI International Conference on Welding and Repair Technology for Power Plants.* Marco Island, FL. June 27-29, 2012. EPRI, Palo Alto CA: 2012. Paper G9.

25. **J. A. Siefert** and J. P. Shingledecker. “Temperbead Repair of T91 Using EPRI P87 Filler Metal.” *Proceedings of the 9th International Conference on Trends in Welding Research*. *Ed. T. DeRoy, S. A. David, T. Kosecki, and H. Basdeshia.* ASM International, 2012. pp. 235-241.

26. W. F. Newell, J. P. Shingledecker., **J. A. Siefert**, K. Coleman, and J. M. Tanzosh. “High-Temperature Performance of a New Nickel-Based Filler Metal for Power Generation Applications.” *Proceedings: 9th Liege Conference: Materials for Advanced Power Engineering 2010. Ed. J. Lecomte-Beckers, Q. Contrepois, T. Beck, and B. Kuhn.* September 27-29, 2010. pp. 340-348.

27. J. P. Shingledecker, **J. A. Siefert,** and J. M. Tanzosh. “Weldability of EPRI P87.” *Proceedings from the Sixth International Conference on Advances in Materials Technology for Fossil Power Plants*, ASM International, 2011. pp. 995 to 1013.

28. J. E. Ramirez, **J. A. Siefert**, and J. M. Tanzosh. “Weldability of INCONEL Alloy 740.” *Proceedings from the Sixth International Conference on Advances in Materials Technology for Fossil Power Plants*, ASM International, 2011. pp. 1045 to 1066.

29. B. T. Alexandrov, J. C. Lippold, J. M. Sanders, **J. A. Siefert**, and J. M. Tanzosh. “An Update of Phase Transformations during PWHT of Grade 91.” *Materials Science and Technology 2009 Conference and Exhibition*, Pittsburgh, PA, October, 2009.

30. W. F. Newell, J. M. Sanders, J. P. Shingledecker, **J. A. Siefert**, and J. M. Tanzosh. “Development of EPRI P87 Solid Wire.” *International Conference WELDS 2009*, Fort Myers, FL, June, 2009.

31. B. T. Alexandrov, J. C. Lippold, J. M. Sanders, **J. A. Siefert**, and J. M. Tanzosh. “An Update of Phase Transformations during PWHT of Grade 91.” *EPRI Welding and Fabrication Technology for New Power Plants, 1st International Conference*, Fort Myers, FL, June, 2009.

32. **J. A. Siefert**, W. F. Newell, J. M. Sanders, J. P. Shingledecker, and J. M. Tanzosh. “Development of EPRI P87 Solid Wire.” *EPRI Welding and Fabrication Technology for New Power Plants, 1st International Conference*, Fort Myers, FL, June, 2009.

33. B. A. Baker, R. D. Gollihue, J. M. Sanders and **J. A. Siefert**. “Elimination of Fissures in Thick Section INCONEL Alloy 740 Welds.” *34th International Technical Conference on Clean Coal and Fuel Systems*, Clearwater, FL, June, 2009.

34. **J. A. Siefert**, B. T. Alexandrov, J. C. Lippold, J. M. Sanders, and J. M. Tanzosh. “An Examination of Phase Transformations during PWHT of Grade 91.” *Proceedings of the IIW International Conference: Safety and Reliability of Welded Components in Energy and Processing Industry*, Graz University of Technology, 2008. pp. 75 to 80.

35. **J. A. Siefert**, B. T. Alexandrov, J. C. Lippold, J. M. Sanders, and J. M. Tanzosh. “An Examination of Phase Transformations during PWHT of Grade 91.” Welding and Repair Technology for Power Plants, 8th International Conference EPRI Conference, Fort Myers, FL, June 2008.

JOURNAL PUBLICATIONS

1. J. D. Parker and J. A. Siefert. “The Creep and Fracture Behaviour of Tempered Martensitic Steels.” *Materials at High Temperatures*, published online October 19, 2017.

2. X. X., G. West, **J. A. Siefert**, J. D. Parker and R. Thomson. “Microstructural Characterisation of the Heat Affected Zones in Grade 92 Steel Welds: Double Pass and Multi-Pass Welds.” *Metallurgical and Materials Transactions A*, manuscript E-TP-16-1684-A submitted March 21, 2017.

3. X. X., G. West, **J. A. Siefert**, J. D. Parker and R. Thomson. “The Influence of Thermal Cycles on the Microstructure of Grade 92 Steel.” *Metallurgical and Materials Transactions A* 48A (11), 2017. pp. 5396 to 5414.

4. P. Mayr, C. Schlacher, **J. A. Siefert** and J. D. Parker. “Microstructural Features, Mechanical Properties and High Temperature Failures of Ferritic to Ferritic Dissimilar Welds.” *International Materials Review*, accepted for publication, manuscript YIMR 1410943.

5. J. N. DuPont, **J. A. Siefert** and J. P. Shingledecker. “A Review of Microstructural Evolution and Mechanical Properties of Grades 23 and 24 Creep Strength Enhanced Ferritic Steels.” *International Materials Review 62* (1), 2016. pp. 32 to 56.

6. D. H. Bechetti, J. N. DuPont, **J. A. Siefert** and J. P. Shingledecker. “Microstructural Evolution and Creep-Rupture Behavior of A-USC Alloy Fusion Welds.” *Metallurgical and Materials Transactions A* 47 (9), 2016. pp. 4502 to 4518.

7. **J. A. Siefert**, J. P. Shingledecker, J. N. DuPont and S. A. David. “Weldability and Weld Performance of Candidate Nickel Base Superalloys for Advanced Ultrasupercritical Fossil Power Plants Part II: Weldability and Cross-weld Creep Performance.” *Science and Technology of Welding and Joining* 21 (5), 2016. pp. 397 to 427.

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March 23, 2018

The National Board of Boiler & Pressure Vessel Inspectors
1055 Crupper Avenue
Columbus, OH, 43229-1183

Subject: Support & Sponsorship for Participation of John Siefert on the NBIC Subgroup and Subcommittee Repairs and Alterations

Dear Jonathan Ellis:

John Siefert has attended the National Board Inspection Code regularly since 2012. He has the full support of the Electric Power Research Institute to continue this participation as a member on the Subgroup and Subcommittee and Repairs and Alterations. If you need any additional information EPRI will be happy to provide. Please find John's attached resume to this letter.

Sincerely,

Neva Espinoza
Director, Generation, EPRI

1 Attachement; John A. Siefert resume
cc. Brian Boseo and George Galanes

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Action Item 18-30: Inquiry

Inquirer: Veera Kommisetti veera_kommisetti@oxy.com

Question: Does the NBIC prohibit interchanging the convection section of one OSTG with another OSTG?

Background information: Occidental of Oman has installed about 85 Nos OTSG (Once through steam generator) in one of oil concession. All OTSG are of similar configuration and they comprise of two main parts i.e. Radiant section and Convection section. Now, OTSGs have aged and Occidental intends to replace a few tubes of the convection section, which require dismantling of the convection section and shipping to repair shop ("R" stamp holder) for repair. We have shipped two convection sections of OTSG 100 and OTSG 200 to a fabrication shop and after repair we intend to use convection sections of OTSG 100 on OTSG 200 due to operational constraints.

Action Item 18-31: Inquiry

Inquirer: Roderick Kaiser rjk834@cox.net

Subject: NBIC 2013 PART 3, SECTION 2 (PARA. 2.5.2 POST WELD HEAT TREATMENT) (a.) Postweld heat treatment shall be performed as required by the original code of construction.

Question 1: A full penetration groove weld repair was made on a 1" schedule 160 (0.250") flanged nozzle pipe section. When the vessel was originally fabricated it received PWHT per ASME BPVC. SECT. 1 PW-39-1 for P-No. 1 Group No. 1, 2, 3. Due to the nozzle thickness of 0.250" it was exempt from PWHT, but it went through the PWHT cycle with the vessel. Would the new full penetration groove pipe nozzle neck repair weld require PWHT?

Question 2: Would the repair to the nozzle pipe require the Preheat requirements of Method 1?

Question 3: Would the repair to the nozzle pipe be exempted from PWHT?

Action Item 18-32: Inquiry

Inquirer: Melwin Dsouza melwin@uesoman.com

Purpose	Code Interpretation – Interchange of convective box (Economizers) in Once through steam Generators (OTSG).
Background Information	During the repair of Convictive box of Once through steam Generators, to meet the site requirement user would like to use Convictive box of other OTSG.
Inquiry	Is the interchange of Convective Box on the OTSG is allowed if we record the same on the R Form?
NBIC Reply	

Action Item 18-33: Inquiry

Inquirer: Mohammed Sirajudeen sirajudeenin@gmail.com

Subject: 3.4.4 c) Alteration of corroded Pressure Vessel

Edition: 2017 edition

Inquiry

1) The entire vessel corroded its corrosion allowance given data report. However by providing additional external stiffener ring the vessel meets design condition as per original code of construction. Is it considered as an alteration ?

2) if answer "yes" for the question 1 New corrosion allowance other than the one given in original data report can be considered if proposed by owner ?

Background: The vessel is governed by external pressure. Thickness survey carried out for complete vessel. Even in corroded condition still the vessel has required thickness plus corrosion allowance for internal pressure. By providing external stiffener ring vessel meets original design condition.

Action Item 18-34: Inquiry

Inquirer: James Barlow jbarlow@performancepulsation.com

a) **Inquiry**

When an "R" Certificate Holder performs a repair on a vessel, does the Certificate Holder assume responsibility for the integrity or condition of the rest of the vessel outside the scope of the repair?

b) **Reply**

No.

c) **Background**

We received a vessel for repair of a cracked nozzle weld. The repair was performed per Part 3. During this work a discussion was started concerning the scope of responsibility for the "R" Certificate Holder. One side of the team said we should only be responsible for the requested repair. That our scope of work is defined by the owner/user and completion of the requested repair meets the requirements of NBIC Part 3. The other side, that I am on, feels we have a responsibility to inspect the vessel to ensure that what we are sending back into service is safe. As a licensed Engineer I am struggling with balancing wanting to ensure the vessel integrity is sound with the wants of a customer who may think that a repair means "the vessel" and not just what was in our scope of work.

Action Item 18-35: Inquiry

Inquirer: Doug Fowler lfowler@us.tuv.com

a) **Inquiry**

Can a vessel built to an ASME Section VIII Division 2 construction code, prior to 2017, that required a PE for design, be altered to the 2017 ASME Section VIII Division 2 Code for Class 1 vessels?

Action Item 18-37: Inquiry

Inquirer: Rob Cox rcox@matrixservice.com

a) **Inquiry**

The below referenced welding method is specific to Grade 91 material:

Subsection e) States: A martensitic, iron-base filler metal having a designation F-No. 4 or F-No. 6 and limited to the following consumables: E8015-B8, E8018-B8 or ER80S-B8.

Since this is specific to Grade 91 material, shouldn't the required filler metal (Fno4 or Fno6) be a closer metallurgical match? (i.e. E9015-B9, E9018-B9 or ER80S-B9)

b) Section for reference:

2.5.3.6 WELDING METHOD 6

This welding method provides requirements for welding only Grade 91 tube material within the steam boiler setting and when it is impracticable to perform local postweld heat treatment (PWHT). When using this welding method, the following applies:

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

b. Application shall be limited to only boiler tube repairs at a location internal to the boiler setting;

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

1. The material shall be limited to P-No 15E, Group 1, Grade 91, creep strength enhanced ferritic steel (CSEF).

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

3. The welding procedure qualification test coupon shall be P-No 15 E, Group 1, Grade 91.

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

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

a. The minimum preheat for the GTAW process shall be 200°F (100°C). The minimum preheat for the SMAW process shall be 300°F (150°C). The preheat temperature shall be checked to ensure the minimum preheat temperature is maintained during welding and until welding is completed. The maximum interpass temperature shall be 550°F (290°C).

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

c. Regardless of the welding process (SMAW or GTAW), only the use of stringer beads shall be permitted.

d. The filler metal shall be limited to an austenitic, nickel-base filler metal having a designation F-No. 43 and limited to the following consumables: ERNiCr-3 (e.g., Filler Metal 82), ENiCrFe-3 (e.g., INCONEL Welding Electrode 182), ENiCrFe-2 (e.g., INCO-WELD A), ASME B&PV Code Cases 2733 and 2734 (e.g. EPRI P87); or

e. A martensitic, iron-base filler metal having a designation F-No. 4 or F-No. 6 and limited to the following consumables: E8015-B8, E8018-B8 or ER80S-B8

CODE INTERPRETATION REQUEST

Submitted by:
Willie A. Curry , Quality Management Team Lead Maintenance & Reliability
Chevron Products Company
250 Industrial Road
Pascagoula, MS 39581
williecurry@chevron.com
O: 228-938-4728
C: 228-990-4511

Subject: Part 3, 2.5.2

Edition: 2017

Question: A follow-up question in continuation of Interpretation 13-06 (PWHT of vessel not originally PWHT'd): If the original welding procedures used for construction of the vessel are not available, is it acceptable to PWHT the original welds if the R-certificate holder or client can demonstrate with sufficient PQRs that the entire range of reasonably plausible essential variables are supported in the PWHT'd condition?

Reply: Yes

Background Information: This demonstration would be limited to P1-P1 (groups 1 and 2) with A1 weld deposits where original code did not require impact toughness testing. It would cover common welding procedures such as SAW, SMAW, GTAW, GMAW, and FCAW. It would not specifically cover all possible unlisted flux materials, use of recrushed slag, uncommon combinations of inert shielding gases, but would support the vast majority of likely variables used in original fabrication.

PWHT is recommended by industry standards and recommended practices for prevention of environmentally assisted cracking in many cases even if the vessel was not originally PWHT'd (NACE SP0472, API RP 945, NACE Publications 34108, 5A192). PWHT is done to reduce hardness and residual stress. A local "bulls-eye" PWHT can cause severe damage to equipment as documented in API 510, ASME PCC-2, and WRC Bulletin 452. NBIC Part 3 section 2.5.2 states that the PWHT shall be of the entire item or a circumferential band around the item unless it is impractical or detrimental to do so. Local PWHT can also leave high residual stresses that may still render the vessel prone to environmentally assisted cracking mechanisms. Engineering assessments, as prescribed by these standards, typically conclude that the bulls-eye PWHT layout is unacceptable and full vessel heat treatment or a circumferential band is required to prevent damage to the vessel.

For low strength plain carbon steels, the effect of stress relieving heat treatments on tensile strength of base metal and weldments is very minor. Section IX essential variable range allows any PWHT temperature or time below the lower transformation temperature to qualify any other when impact toughness testing is not required. Additionally, Section VIII UCS-85 (f) exempts testing of P1 Groups 1 and 2 base metal in PWHT condition (below lower transformation temperature). This is evidence that ASME does not consider PWHT below lower transformation temperature to be detrimental to strength of carbon steels. ASME BPVC Section VIII UCS-68 also provides credit for brittle fracture of P1 materials in PWHT'd condition, so it is treated as a benefit in mechanical properties.

REFERENCE:
INTERPRETATION 13-06
Subject: Part 3, 2.5.2

Edition: 2013

Question 1: An R-Certificate holder decides to perform post weld heat treatment (PWHT) of a vessel at the request of a client, where no PWHT was performed in the original construction. Is the performance of PWHT of the vessel considered an alteration and subject to documentation using a Form R2?

Reply: Yes.

Question 2: For the vessel described above, must the weld procedures used for construction of the vessel be qualified with PWHT?

Reply: Yes.

Question 3: Must the PWHT described above be performed by the R-Certificate holder?

Reply: No, the PWHT may be subcontracted; however the R certificate holder retains the responsibility for the performance of the PWHT.

Item 18-42: Interpretation Request
Submitted by: Kevin Kurtz (kevin.kurtz@enerfab.com)

Inquiry:

Would reducing a pressure vessel shell overall length be considered an Alteration?

Proposed Reply:

No, provided all other requirements of the original Code of Construction were met.

Background Information:

A pressure vessel shell overall length was reduced from 16'-6" down to 15'-10" (8" length reduction). All other requirements of the Original Code of Construction were meet including Spot RT on the Cat. B joint.

Action Item 18-53: Interpretation Request

Inquirer: Angel Rodriguez AGRodriguez@dow.com

Subject:
Definition of Alteration (NBIC Part 3, Section 9, 9.1)
Examples of Alteration (NBIC Part 3, 3.4.3)

Question:
Is changing the corrosion allowance noted on the original Manufacturer's Data Report considered an alteration per NBIC, when this task is performed solely for the purpose of establishing minimum required thicknesses on an internal Owner / User mechanical integrity database?

SUPPLEMENT 3
REPAIR AND ALTERATION OF GRAPHITE PRESSURE EQUIPMENT

S3.1 SCOPE (17)

a) This supplement provides requirements and guidelines for repairs to graphite pressure equipment ~~require~~ requiring the use of certified impregnated graphite and cement. The determining factor in establishing the desired material properties is the resin impregnation cycle. If the resin impregnation cycle is not controlled, it is not possible to meet the minimum design values.

b) The letter “G” shall be included on the “R” *Certificate of Authorization* for those organizations authorized to perform repairs/alterations of graphite pressure equipment except as permitted by Part 3, S3.5.4 f).

S3.2 REPAIRS (17)

The requirements provided in this supplement shall apply, insofar as they are applicable to graphite pressure equipment. Graphite specific requirements include:

a) When the original code of construction is other than ASME, replacement parts subject to internal or external pressure 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 to the original code of construction as required by the original code of construction or equivalent shall be supplied with the item. When this is not possible or practicable, the organization fabricating the part shall have a National Board *Certificate of Authorization*; replacement parts shall be documented on Form R-3 and the “R” Symbol Stamp applied as described in NBIC Part 3, Section 5

b) When the standard governing the original construction is not the ASME Code, repairs or alterations shall conform to the edition of the original construction standard or specification most applicable to the work. Where the original code of construction is unknown, the edition and addenda of the ASME Code most appropriate for the work shall be used, provided the “R” Certificate Holder has the concurrence of the Inspector and the Jurisdiction where the pressure-retaining item is installed.

c) The materials used in making repairs or alterations shall conform to the requirements of the original code of construction except as provided in NBIC Part 3, S3.2 j). The “R” Certificate Holder is responsible for verifying identification of existing materials from original data, drawings, or unit records and identification of the materials to be installed.

d) When ASME is the original code of construction, replacement parts subject to internal or external pressure, which 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. A completed ASME *Manufacturer’s Partial Data Report* shall be supplied by the manufacturer. Further, all impregnated graphite material subject to internal or external pressure shall be fabricated by an organization having the appropriate ASME *Certificate of Authorization*. The impregnated graphite material shall be inspected and stamped as required by the applicable section of the ASME Code. A completed ASME *Manufacturer’s Partial Data Report* with supplementary U1B shall be supplied by the impregnated graphite material manufacturer.

e) When the original code of construction is other than ASME, replacement parts subject to internal or external pressure 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 to the original code of construction as required by the original code of construction or equivalent 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 shall be documented on Form R-3 and the “R” Symbol Stamp applied as described in NBIC Part 3, Section 5.

e) Redrill a 7/8 in. (22 mm) hole at every other pilot hole. Holes must be drilled the full depth of the crack. The depth and direction of the crack can be checked with hydrophilic solvent.

f) A 7/8 in. (22 mm) diameter reamer may be used to true the drilled holes.

g) Dry fit a plug into the holes. There should be 0.005 in. to 0.010 in. (0.13 mm to 0.25 mm) clearance for the cement joint. At no time should there be a force fit of plugs into any drilled hole. Provisions shall be provided for venting trapped air.

h) Sand the outside surface of the plugs. Thoroughly clean all the surfaces of the repair, plugs, and drilled holes with hydrophilic solvent.

i) Apply graphite cement to both plugs and holes. All surfaces of plugs and holes to be joined are to be wetted with cement.

j) Insert the cemented plugs into the holes allowing 1/16 in. (1.5 mm) of the plug to extend beyond the surface of the graphite part.

k) Cure the graphite cement according to the cement manufacturer's instruction.

l) At this point, half of the plug stitch repair is completed. A row of plugs has been installed with 1/4 in. (6 mm) pilot holes between them.

m) Redrill the remaining pilot holes to 7/8 in. (22 mm) diameter. The drill will remove part of the plugs that were installed. It is important to have the plugs replace all of the fracture. If the new holes do not cut into the installed plugs, it will be necessary to repeat the procedure between these holes and plug locations to ensure that all of the crack has been repaired. The line of fracture is completely removed by the overlapping effect of the graphite plugs.

n) After the second set of holes have been drilled, repeat the plug cementing procedures.

o) Contour the plugs to provide a smooth transition into the adjoining surface area. The finished repair may be coated with a wash coat for appearance.

S3.5.3.2 FIGURES — TYPICAL PLUG STITCHING PROCEDURE

a) Step one: Layout hole centers.

b) Step two: Drilling pilot holes.

c) Step three: Drilling the first set of holes.

d) Step four: Cementing and curing the first set of plugs.

e) Step five: Drilling the second set of holes.

f) Step six: Plug stitching repair completed.

~~S3.5.4 REIMPREGNATION OF GRAPHITE PARTS (TUBESHEETS, HEADS, AND BLOCKS)~~

~~a) As a function of time, temperature, and chemical exposure, the resin used to impregnate graphite may shrink and/or degrade. As such, it is possible for voids to develop in impregnated graphite that has been in chemical service for a period of time. The resin loss can vary from slight to almost complete loss of impregnation. There is no practical way to determine the amount of resin remaining in the pores. However, a pressure test will determine if the graphite has continuous porosity~~.

b) Reimpregnation of a graphite component may be used to reduce porosity in an existing graphite component, which in turn will improve the performance and expected life of the existing graphite components. A written re-impregnation procedure acceptable to the Inspector is required. The reimpregnation procedure shall include as a minimum:

1) Decontamination and drying of the graphite component

2) Subjecting the component to a vacuum

3) Introducing resin under pressure

4) Curing the resin at a specified temperature and time

5) Leak test

S3.5.4.1 CONTROL OF IMPREGNATION MATERIAL

a) Impregnation material shall be the same as that specified in the Reimpregnation Procedure. Each impregnation material shall be traceable by the name of its manufacturer and the trade name or number of that manufacturer.

b) The impregnation material manufacturer shall supply the Certificate Holder a *Certificate of Analysis* for each material. It shall include the following:

1) Impregnation material identification

2) Batch number(s)

3) Date of manufacture

4) Shelf life

5) Viscosity per ASTM D 2393

6) Specific gravity

c) Prior to reimpregnation, and at subsequent intervals not to exceed 14 days, the Certificate Holder shall test each batch of impregnation material to assure that the characteristics of the material have not changed from values specified in the Reimpregnation Procedure. The values obtained for viscosity and specific gravity for the impregnation material shall be within the limits specified by the manufacturer and as listed in the Reimpregnation Procedure. The test values shall be made available to the Inspector.

S3.5.4.2 FINISHING THE REPAIR

a) The parts should be held in place to prevent movement while curing the cemented joint to achieve a proper repair. The repair firm should take care to ensure that the cement joint thickness is within the range recommended by the cement manufacturer. Care spent in precisely aligning the parts while clamping will avoid many finishing and machining operations later. Particular attention should be given to gasket and other bearing surfaces.

b) Gasket and bearing surfaces may have to be machined, filed, or sanded before the job is completed. Gasket serrations must be clean and continuous. Serrations can be easily re-cut into graphite and any repair plugs that cross the gasket surface.

S3.5.4

(17) ~~S3.5.5~~ PLUGGING OF LEAKING OR DAMAGED TUBES

a) The material used for plugging tubes shall comply with the requirements of the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, Part UIG.

b) The point(s) of leakage shall be verified, and the corresponding leak site(s) shall be marked/labeled on the tubesheet, and recorded.

c) A plug shall be used to plug each end of the tube(s) in question and each plug shall have a minimum length of 1 in. (25 mm). Multiple plugs may be used.

d) The tube(s) shall be prepared for plugging by enlarging the inside of the tube(s) with a suitable drill bit or reamer.

1) To ensure a sound cement joint between the tube sidewall and the plug, a slightly smaller diameter plug shall be selected. The maximum clearance between the tube inside diameter and the outside diameter of the plug shall not exceed 3/32 in. (2.4 mm).

2) As an alternative to d)1) a mandrel with an abrasive, such as sandpaper, may be used, as long as the maximum tube I.D. to plug O.D. clearance of 3/32 in. (2.4 mm) is not exceeded.

3) The minimum plug insertion depth of the prepared hole(s) shall meet the minimum combined plug length requirements of “c”. When the minimum plug length of “c” is exceeded, the total insertion depth of the plugs may exceed the combined length of the plugs; however, the longer plugs shall not project outside the face of the tube(s) being plugged.

e) Plugging of leaking or damaged tubes shall be performed by certified cementing technicians, using qualified cementing procedures, in accordance with the requirements of the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, Part UIG.

See below for new S3.5.4 f)

g) ~~f)~~ The cement shall be prepared per the cement manufacturer’s instructions.

h) ~~g)~~ When cementing the plugs, 100% of individual plugs, as well as the inside diameter of the tube opening(s), shall be coated with cement. The plugs shall then be inserted one by one, against each other, into each end of the tube(s) being plugged.

i) ~~h)~~ Once the plugging is completed, and before the cement cures, the endplugs may need to be held in place, as newly cemented plugs may exhibit a tendency to dislodge from the plugged tube(s) prior to final curing of the cement.

j) ~~i)~~ Curing time is dependent upon the cement manufacturer’s instructions, and is considered complete when the cement is hardened to the point that it cannot be indented with pressure from a flat screwdriver or other similar instrument.

k) ~~j)~~ After the cement is completely cured, the plugged, cemented area(s) on the tubesheet face may be dressed with sandpaper or other suitable abrasive.

l) ~~k)~~ Repaired tubes shall be tested in accordance with this code, using a method acceptable to the Inspector, with a written procedure as approved by the manufacturer’s internal quality system, to ensure leaks have been repaired.

m) ~~l)~~ The scope of the work completed shall be described and reported on a Form R-1.

See below for new Figure S3.5.4

S3.5.5 ~~S3.5.6~~ TUBE REPLACEMENT

Tube replacement should be performed with the unit preferably in the horizontal position. Avoid replacing adjacent tubes simultaneously because the replacement areas may overlap or reduce the ligament between

SUPPL. 3

holes and possibly damage the tubesheet. The general steps used in horizontal tube replacement follow below.

a) The material used for tube replacement shall comply with the requirements of the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, Part UIG.

b) Tube replacement shall be performed by qualified cementing technicians, using qualified cementing procedures, in accordance with the requirements of the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, Part UIG-79 and UIG-80.

c) Determine the thickness of each tubesheet and inside distance between the tubesheets to obtain tube and sleeve length.

d) Access each tubesheet face, clearly identify and mark each tube hole on each tubesheet of the tubes to be replaced.

e) Prepare/clean the existing tube hole in preparation for extracting the damaged tube. Some holes may contain plugs which require removal. A boring tool slightly larger than the outside diameter of the tube being replaced is required.

f) Drill/bore out the tube hole in each tubesheet to release the tube from the tubesheet. Exercise caution when centering and align cutting to the common axis of the tube.

g) The damaged tube should disengage and become loose. Using guides, remove the damaged tube. Ensure that no debris is trapped in the space where the tube was removed (Fig. ~~S3.5.6 a~~). S3.5.5-a

h) Replacement tube shall have sleeves at the ends cemented in the bored holes to replace the material in the tubesheet that was bored out to access the damaged tube (Fig. ~~S3.5.6 b and S3.5.6 c~~).

1) Dry-fit a new tube and sleeve. S3.5.5-b and S3.5.5-c

2) The sleeve length may vary.

3) Prior to applying cement, prepare and clean all surfaces to be cemented.

i) Cement the ID of the prepared bore in the floating tubesheet and the tube end OD at the fixed tubesheet. (~~Fig. S3.5.6 b~~). S3.5.5-b

j) Insert the tube through the fixed tubesheet and through the floating tubesheet cemented bore so that it protrudes. Cement the ID of the fixed tubesheet bore as shown in (Fig. ~~S3.5.6 c~~). The use of alignment dowels can assist/guide in tube handling. S3.5.5-c

k) Cement the OD of the tube end protruding from the floating tubesheet. Cement the ID of the mating sleeve end, fit it to the cemented tube end and push the assembly part-way into the floating tubesheet. Cement the remainder of the OD of the floating tube end sleeve. Push this cemented assembly the rest of the way into the floating tubesheet (Fig ~~S3.5.6 c~~). S3.5.5-c

l) Cement the ID and OD of the sleeve for the fixed tubesheet and insert it until it mates with the tube end inside. Push together cemented tube/sleeve assemblies. (Fig ~~S3.5.6 d~~). Clean/wipe away any excess cement. S3.5.5-d

m) Apply slight pressure on the sleeves to seat the joints. Remove excess cement.

n) Maintain pressure and cure both ends of the cemented assembly according to the cement manufacturer's instructions.

o) Sleeves may be trimmed after curing.

p) Replaced tubes shall be tested in accordance with this code per a written procedure acceptable to the Inspector.

q) The scope of work completed shall be described and reported on a Form R-1.

FIGURE ~~S3.5.6-a~~ S3.5.5-a

CLEANED AND PREPARED TUBESHEETS

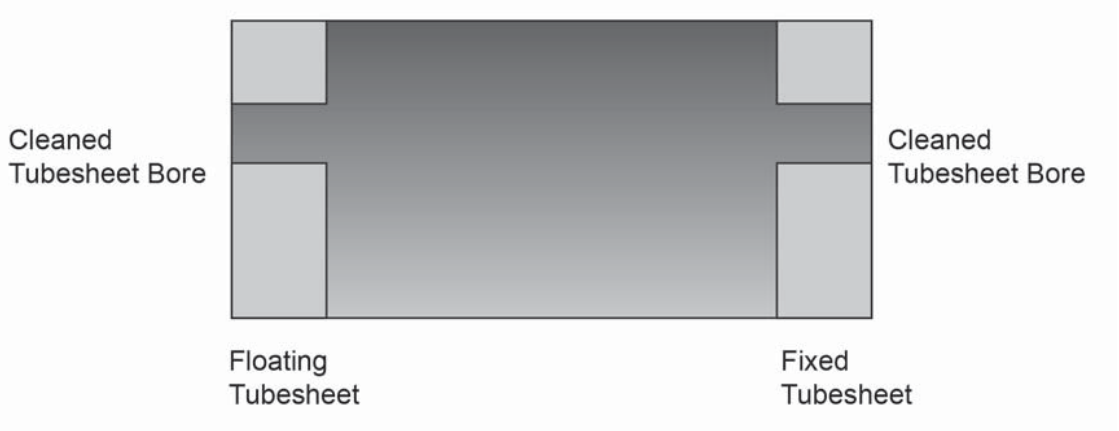


FIGURE ~~S3.5.6-b~~ S3.5.5-b

STARTING TUBE REPLACEMENT

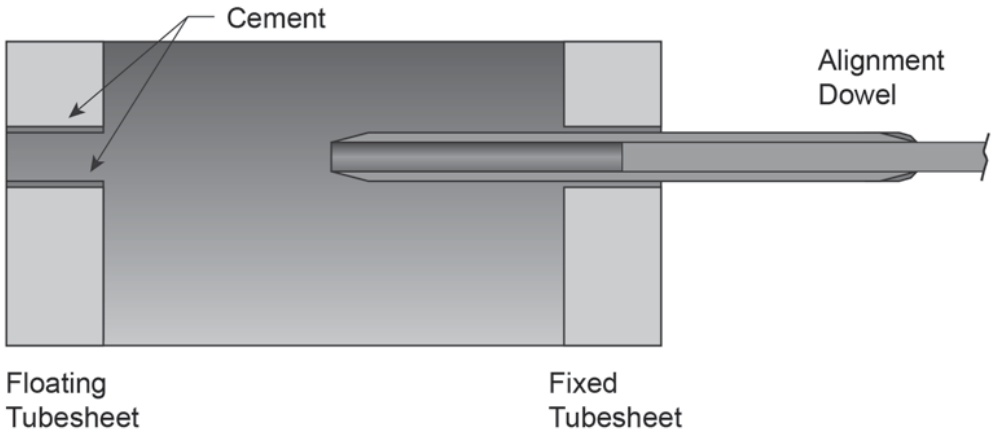


FIGURE ~~S3.5.6-c~~ S3.5.5-c
SLEEVE CEMENTING

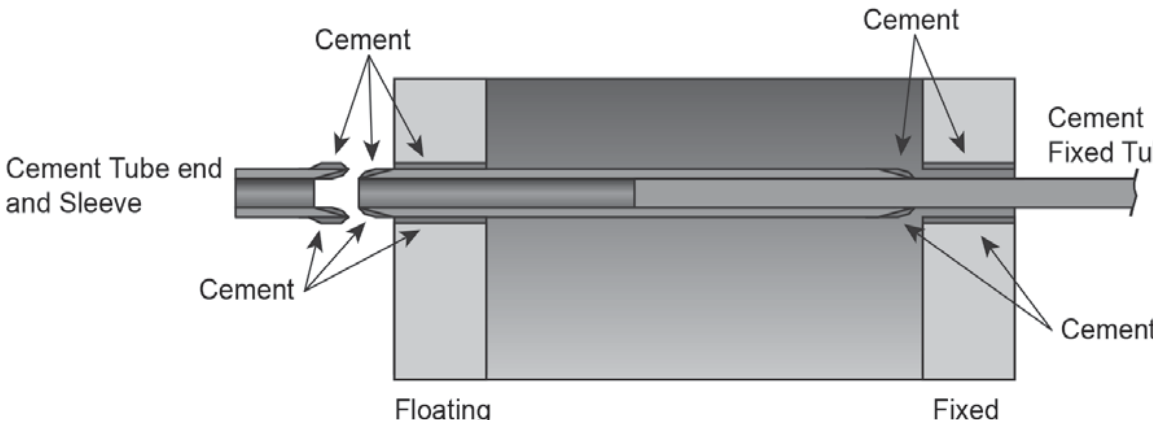
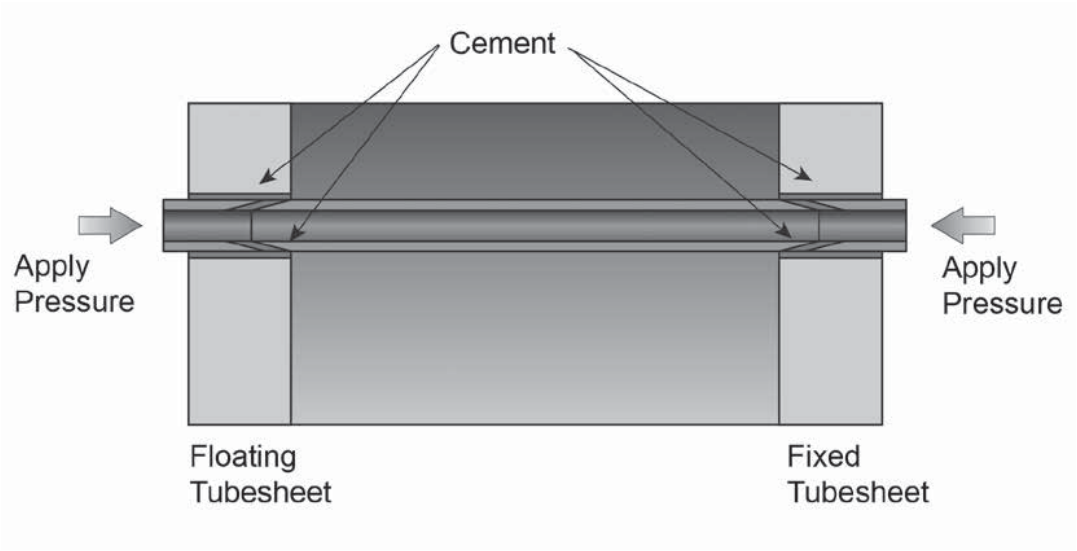


FIGURE ~~S3.5.6-d~~ S3.5.5-d
COMPLETED TUBE REPLACEMENT



S3.5.6 **~~S3.5.7~~ REIMPREGNATION OF GRAPHITE PARTS (TUBESHEETS, HEADS, AND BLOCKS)** (17)

a) As a function of time, temperature, and chemical exposure, the resin used to impregnate graphite may shrink and/or degrade. As such, it is possible for voids to develop in impregnated graphite that has been in chemical service for a period of time. The resin loss can vary from slight to almost complete loss of impregnation. There is no practical way to determine the amount of resin remaining in the pores. However a pressure test will determine if the graphite has continuous porosity.

b) Reimpregnation of a graphite component may be used to reduce porosity in an existing graphite component, which in turn will improve the performance and expected life of the existing graphite components. A written re-impregnation procedure acceptable to the Inspector is required. The reimpregnation procedure shall include as a minimum:

1) Decontamination and drying of the graphite component

2) Subjecting the component to a vacuum

3) Introducing resin under pressure

4) Curing the resin at a specified temperature and time

5) Leak test

S3.5.6.1

(17) ~~S3.5.7.1~~ **CONTROL OF IMPREGNATION MATERIAL**

a) Impregnation material shall be the same as that specified in the Reimpregnation Procedure. Each impregnation material shall be traceable by the name of its manufacturer and the trade name or number of that manufacturer.

b) The impregnation material manufacturer shall supply the Certificate Holder with a Certificate of Analysis for each material. It shall include the following:

1) Impregnation material identification

2) Batch number(s)

3) Date of manufacture

4) Shelf life

5) Viscosity per ASTM D 2393

6) Specific gravity

c) Prior to reimpregnation, and at subsequent intervals not to exceed 14 days, the Certificate Holder shall test each batch of impregnation material to assure that the characteristics of the material have not changed from values specified in the Reimpregnation Procedure. The values obtained for viscosity and specific gravity for the impregnation material shall be within the limits specified by the manufacturer and as listed in the Reimpregnation Procedure. The test values shall be made available to the Inspector.

New S3.5.4 f)

f) As an alternative to e) any R Certificate Holder, with or without the letter “G” included on the “R” Certificate of Authorization, may install graphite tube plugs provided the following conditions are met. The R Certificate Holder shall gain the concurrence of the Inspector, and shall utilize a tube plugging kit provided by an ASME Certificate Holder authorized to use the G designator. The kit shall include the following items:

1. Certified graphite plugs and certified cement ingredients, both accompanied by the appropriate documentation (Partial Data Report).

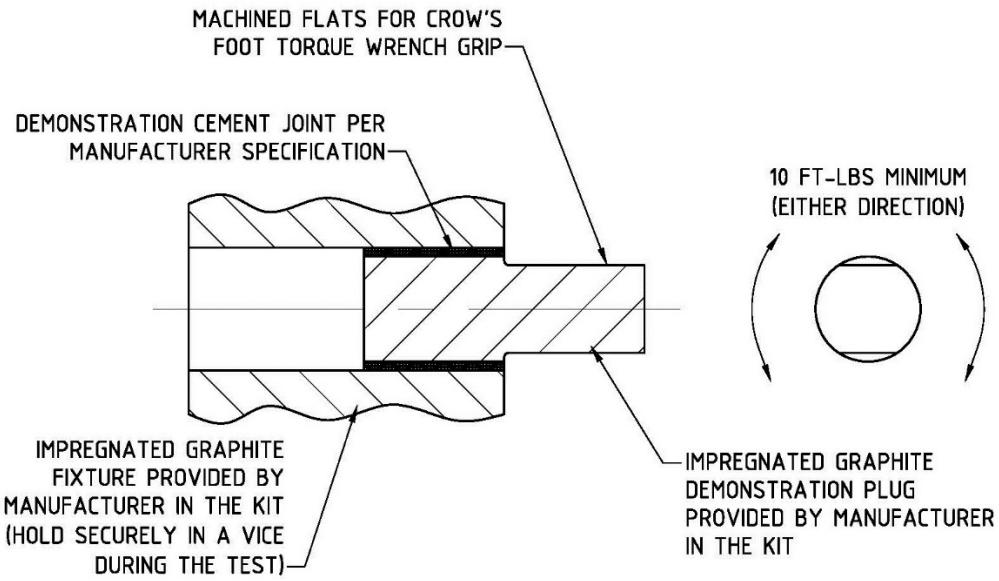
2. The qualified cementing procedure of the ASME Certificate Holder authorized to use the G designator, and a step-by-step procedural checklist that shall be followed explicitly. The procedure shall address the entire tube plugging process including plug configuration, tube hole cleaning and preparation, mixing and applying of the cement, application of the plugs, securing the plugs during the curing process, controlling the curing process, and leak testing, thereby meeting S3.3.

3. Additional materials and procedure shall be provided and used to prepare a demonstration plug joint prior to performing the repair. This demonstration plug joint shall be tested by a twist (torsional) test designed to demonstrate acceptable application and curing of the cement (Fig. S3.5.4). The test procedure shall include acceptance criteria, which may be based on a principle of breakage of part of the test piece. A successful twist test, in conjunction with the completed procedural checklist, shall serve as a valid cement technician certification for a single repair operation.

The R Certificate Holder shall review the material certifications including verification that the shelf life of the cement has not been exceeded, and assure that the certified cement technician has completed the qualification demonstration, and has access to the procedure and checklist. The Inspector shall review and verify that the procedure and the other elements of the certified kit, as provided by the authorized G-designated ASME Certificate Holder, have been administered and completed prior to his acceptance. The R-certificate Holder shall note on Line 8 of the R-1 Form the installation of cemented graphite tube plugs in accordance with this section. The letter “G” shall not be applied to the vessel when performing this alternative repair. The R Certificate Holder shall identify and document the location of the plugged tubes on the R Form.

FIGURE S3.5.4

DEMONSTRATION PLUG JOINT TWIST TEST



Supplement 14
Life Extension of High Pressure Fiber Reinforced Plastic Pressure Vessels

S14.1 Scope

This document may be used to evaluate whether the service life of high pressure fiber reinforced plastic pressure vessels (FRP) can be extended for an additional lifetime. High pressure means vessels with a working pressure from 3,000 psi (20 MPa) to 15,000 psi (103 MPa). For vessels intended for cyclic service, fatigue testing of new vessels is carried out by the vessel manufacturer to be certain that the vessel will not fail in service and such testing is typically required by regulatory authorities. Fatigue design and testing is the starting point for consideration of life extension.

S14.2 General

a) The procedure for in-service testing of high pressure composite pressure vessels, **Supplement 10** herein, is incorporated by reference into this procedure for life extension of high pressure composite pressure vessels. Supplement 10 is based on acoustic emission (AE) testing, specifically modal AE (MAE) testing. The MAE inspection procedure employs detection and analysis techniques similar to those found in seismology and SONAR. Much as with earthquakes, transient acoustical impulses arise in a composite material due to the motion of sources such as the rupture of fibers. These transients propagate as waves through the material and, if properly measured and analyzed by the methods in Supplement 10, the captured waves reveal, for example, how many fibers have ruptured. Similar information about other sources is also determinable, such as the presence and size of delaminations. Delaminations can play a significant role in vessel fatigue life, particularly delaminations near the transition regions and in the heads. The rupture behavior can be used to determine the integrity of the vessel. However, the development of criteria for life extension (LE) requires an understanding of the vessel design and fatigue life.

b) Fatigue testing of out of life vessels is a crucial part of the life extension process. It is used to validate the mechanical behavior of the vessels and to develop the numerical values for the allowables in the MAE pass/fail criteria for the particular design, material and construction.

S 14.3 Life Extension Procedure

a) New vessel fatigue life testing data shall be obtained from the Manufacturer's Design Report (MDR) and the number of cycles in a lifetime shall be determined from the MDR. The type of vessel under consideration for life extension shall have been shown through testing to be capable of sustaining at least three lifetimes of cycles to developed fill pressure followed by a subsequent burst test at a pressure greater than minimum design burst pressure.

b) An evaluation of the service the vessel has seen should take into account any operational conditions that may have differed from those used in the design testing and analysis. Such conditions include for example exposure to more severe weather than expected, more cycles

per year, constant high temperature and humidity, chemical attack or any other of a number of conditions under which operations take place that were not specifically included in testing at manufacture. Any such conditions shall be listed on the attached form. If no such conditions exist, it shall be so noted on the form. The test program delineated herein shall be revised to reflect the modified conditions as documented by the user and submitted for approval to the proper authorities.

c) Data and records for all vessels considered for life extension shall be kept and made readily available to inspectors or examination personnel. This includes an operating log, number of operating cycles since the previous examination, total number of operating cycles, examinations, examination techniques and results, maximum operating pressure and any unexpected pressures, temperatures, temperature cycles, damage events or other significant events that were outside the intended operating parameters or conditions.

d) A life extension test program shall be carried out for each type of vessel under consideration. Type of vessel means the particular manufacturer, materials (fiber and resin), water volume and design. If the type of vessel passes all requirements, then that type shall be eligible for life extension testing. If such a vessel passes the life extension MAE test its lifetime can be extended for one additional lifetime in five-year increments. In order to maintain life extension a vessel must be requalified every five years using the MAE test.

S14.4 Life Extension Test Program

a) The type of vessel under consideration for LE shall be noted. Manufacturer, place of manufacture and manufacturing date shall be recorded. The vessel dimensions shall be recorded. The specific fiber, matrix and winding pattern shall be recorded. If the fiber, matrix and winding pattern are not available from the manufacturer, then a vessel of the type under consideration shall be used to verify the winding pattern (hoop and helical angles and number of plies) through destructive testing.

b) Ten out-of-life vessels of the particular type shall be tested in the manner described herein. MAE techniques shall be applied to every vessel tested. Analysis of the MAE data is described herein. Two strain gages, one in the 0-degree and one in the 90-degree direction, shall be applied to every vessel pressure tested under this program. The purpose of strain gage data is to compute the 0 and 90 modulus values and to confirm that the modulus values of the material do not vary during the fatigue cycling required herein. Strain data shall be recorded and analyzed as described later on.

c) The LE test program proceeds by Steps. If the Step 1 is not successful, then there is no need to proceed to Step 2, and so forth.

S14.5 Life Extension Test Program Steps

S14.5.1 Step 1

Three vessels shall be selected from the ten and pressurized to burst. The vessels shall be inspected for visible damage, i.e., cuts, scrapes, discolored areas, and the vessel appearance shall be documented with photographs. MAE testing shall be done in conjunction with this testing as specified in Supplement 10, except for transducer spacing, pressurization plan and accept/reject criteria values. The values in Supplement 10 are for requalification testing. The transducer spacing shall be determined by the distance at which the 400 kHz component of a suitable pulser source is detectable along the axis of the vessel (essentially across the hoop fibers) and in the perpendicular direction (essentially parallel to the hoop fibers). Detectable means that the resulting signal component has an amplitude with at least a signal to noise ratio of 1.4. Transducer frequency response calibration and energy scale shall be carried out as specified in SUPPLEMENT 10. The pressurization plan shall follow that in ASME Section X Mandatory Appendix 8, i.e., there shall be two pressure cycles to test pressure with holds at test pressure as prescribed therein, however, the time interval between the two cycles may be reduced to one minute. For the purposes of life extension, the fiber fracture energy and BEO (background energy oscillation) values shall be as specified below.

a) No BEO greater than 2 times the quiescent energy (see Supplement 10) shall be observed up to test pressure or during pressure holds.
b) No fiber break event energy shall be greater than $24 \times 10^3 \times U_{FB}$ (see Supplement 10) during the second pressurization cycle.
c) No single event shall have an energy greater than $24 \times 10^5 \times U_{FB}$ during the second pressurization cycle.

Note: The numerical values specified in b) and c) can be adjusted through documented testing and stress analysis methods in order to account for the particular design, material and construction.

d) At least two sensors shall remain on each vessel all the way to burst in order to establish the BEO pressure for this type of vessel.
e) Plots of stress versus strain shall show linear behavior up to 90% of burst pressure.
f) The burst pressures of all three vessels shall be greater than the minimum design burst pressure.
g) If the burst pressure of any one of the three vessels is not greater than the minimum design burst pressure, then these vessels shall not be eligible for life extension and there is no need to proceed with Step 2 below.

Note: It is possible that one or more of the vessels selected had damage not obvious to visual inspection. If during this burst testing phase the MAE test identifies a vessel as damaged, the substitution of three other randomly selected vessels is allowed.

S14.5.2 Step 2

If the vessels pass Step 1, fatigue testing shall be carried out on a minimum of three vessels of the same type being considered for life extension.

a) Prior to testing, the vessels shall be inspected for visible damage, i.e., cuts, scrapes, discolored areas, and the vessel appearance shall be documented with photographs.
b) Prior to fatigue testing, MAE testing as specified in Step 1 shall be done in conjunction with the fatigue testing, hereinafter called the MAE test or MAE testing, in order to determine the suitability of the vessels for fatigue testing, i.e., that they pass the MAE test.
c) Next, the vessels shall be subjected to fatigue cycles. Pressure shall be 100 psi +0, -50% to at least 1.05 x working pressure. Vessels shall survive one and one-half (1.5) additional lifetimes. If they survive then they shall be tested by an MAE test as was done prior to fatigue cycling.

d) Provided they pass the MAE test, they shall be burst tested. At least two sensors shall remain on each vessel all the way to burst in order to establish that the BEO (background energy oscillation) pressure for the fatigued vessels is consistent, i.e., is the same percentage of ultimate, with that of the vessels tested in Step 1.
e) Plots of stress versus strain shall show linear behavior up to 90% of burst pressure.
f) The burst pressures at the end of the fatigue testing shall be greater than or equal to the minimum design burst. If the burst pressure of any one of the three vessels is not greater than the minimum design burst pressure, then these vessels shall not be eligible for life extension.

S14.5.3 Step 3

If the vessels pass Step 2, impact testing shall be carried out on a minimum of three vessels of the same type being considered for life extension.

a) Prior to testing, the vessels shall be inspected for visible damage, i.e., cuts, scrapes, discolored areas, and the vessel appearance shall be documented with photographs. Prior to impact testing, MAE testing shall be done in order to determine the suitability of the vessels for impact testing, i.e., that they pass the MAE test.
b) Two vessels shall be subjected to an ISO 11119.2 drop test and then subjected to the MAE test. If they pass the MAE test, then one vessel shall be burst tested. At least two sensors shall remain on the vessel all the way to burst in order to establish that the BEO (background energy oscillation) pressure for the fatigued vessels is consistent, i.e., is the same percentage of ultimate, with that of the vessels tested in Step 1.
c) Plots of stress versus strain shall show linear behavior up to 90% of burst pressure.
d) If the burst pressure is not greater than the minimum design burst pressure, then these vessels shall not be eligible for life extension.
e) If the first vessel passes the burst test, the other dropped vessel shall be fatigue cycled and subsequently subjected to the MAE test and, if it passes, shall be burst tested under the same conditions as before. If the vessel fails during fatigue cycling, i.e., bursts or leaks, then these vessels shall not be eligible for life extension.
f) If the modulus changes by more than 10%, then these vessels shall not be eligible for life extension. The strain gages should be mounted in a location that is away from the impact zone.
g) The burst pressure at the end of the fatigue testing of the dropped vessel shall be greater than or equal to the minimum design burst. The vessels shall have MAE testing applied during burst testing as before and the BEO shall be consistent with the previously established percent of burst ±10%.

S14.5.4 Step 4

If the vessels pass Step 3, cut testing shall be carried out on a minimum of two vessels of the same type being considered for life extension.

a) Prior to testing, the vessels shall be inspected for visible damage, i.e., cuts, scrapes, discolored areas, and the vessel appearance shall be documented with photographs. Prior to cut testing, MAE testing shall be done in order to determine the suitability of the vessels for cut testing, i.e., that they pass the MAE test.

b) Two vessels shall be subjected to an ISO 11119.2 cut test and then subjected to the MAE test. If they pass, then one shall be burst tested under all the conditions and procedures delineated in Step 2. If the burst pressure is not greater than the minimum design burst pressure, then these vessels shall not be eligible for life extension.

c) If the cut vessel passes, then the other cut vessel shall be fatigue cycled as described in Step 2 and subsequently subjected to the MAE test and then burst tested with at least two MAE sensors remaining on and monitoring the vessel as before. If it does not survive fatigue cycling, then these vessels shall not be eligible for life extension.

d) The burst pressure at the end of the fatigue testing of the cut vessel shall be greater than or equal to the minimum burst pressure specified by ISO 11119.2.

If the vessel type passes Steps 1 to 4, then that type is eligible for life extension. An out of life vessel of the type subjected to the program above may have its life extended for one additional lifetime if it passes the MAE test. The vessel shall pass the MAE test at subsequent five-year intervals or at one-third of the lifetime, whichever is less, in order to continue in service. The vessel shall be labeled as having passed the NBIC life extension test.

NB16-1801 approved April 2018 by SGL

Materials -
NBIC S1.1.3.1-d); Maximum staybolt *tensile strength* shall be 7,500 psi? Errata. Should be tensile stress

Bolts and Studs;
NBIC Table S1.1.3.1; SA-307 A and B. Add SA-675 grade 60, 65, 70

Threaded Staybolts;
NBIC Table S1.1.3.1; SA-31 Gr. A, SA-675 ~~47 ksi to 65 ksi inclusive~~. Remove 47ksi to 65 ksi inclusive. Add grade 45, 50, and 55

Staybolt Sleeves and Caps;
NBIC Table S1.1.3.1; SA-105, SA-675, and SA-696. Add SA-216 WCA and SA-217 WC1

Threaded Staybolts –
NBIC S1.2.2 a); The thread pitch shall be either 11 or 12.
Current wording:
~~All threaded staybolts shall have either 11- or 12-thread pitch. Staybolt threads shall have a good close fit in sheets. Changing the staybolt thread pitch from 11 to 12 or the reverse shall be considered a repair.~~
Proposed wording:
All threaded staybolts shall have a pitch between 10 and 13 threads per inch inclusive, (2 mm to 2.5 mm). Staybolt threads shall have a good close fit in sheets. Changing the staybolt thread pitch from any pitch within the allowed range to another pitch within the allowed range shall be considered a repair.

NBIC S1.2.2 h)
Current wording:
~~Installation of larger diameter staybolts shall be considered a repair.~~
Proposed wording:
Installation of different diameter staybolts shall be considered a repair provided the stay stress does not exceed 7500 psi (52.5 MPa). Cautionary Note: Larger diameter staybolts will transfer stresses to other structures and will be subject to higher extreme fiber stresses.

NBIC S1.2.5 d)
Current wording:
~~Installation of different diameter staybolts shall be considered a repair.~~
Proposed wording:
Installation of different diameter staybolts shall be considered a repair provided the stay stress does not exceed 7500 psi (52.5 MPa). Cautionary Note: Larger diameter staybolts will transfer stresses to other structures and will be subject to higher extreme fiber stresses.

Arch tubes –
NBIC S1.2.9.3;
Current wording:
~~The minimum wall thickness of replacement arch tubes shall be as shown in Table S1.2.9.3.~~
Proposed wording:
The minimum wall thickness of replacement arch tubes shall be as determined by the following formulas.

(U.S. Customary Units)

$$t = \frac{PD}{16,000} + 0.125$$

(SI Units)

$$t = \frac{PD}{111} + 3.175$$

where

D = outside diameter of tube, in. (mm)

P = maximum allowable working pressure, psi (MPa)

t = thickness of tube wall, in. (mm)

Delete Table S1.2.9.3

Thermic Syphons –
NBIC S1.2.9.4 b);
Current wording:
~~All weld repairs to the unstayed sections of the syphon neck and body shall be radiographically examined.~~
Proposed wording:
Except for the attachment weld to the throat sheet, welds on the thermic syphon unit shall be full penetration, and the unit shall be stress relieved in accordance with ASME, Section I, PW-39. Volumetric examination is not required.

Water Gage Connection –
NBIC S1.2.13.1 a);
Current wording:
~~Water gage glasses shall be applied so that the lowest water reading in the water glass gage glass of a horizontal firetube boiler on level track shall be at least 3 inches above the highest point of the *tubes, flues, or crownsheet*".~~
Proposed wording:
NBIC S1.2.13.1 a); Water gage glasses shall be applied so that the lowest water reading in the water glass gage glass of a horizontal firetube boiler on level track shall be not less than 3 inches (75 mm) above the highest point of the crownsheet.

Item 18-41
Part 3, S4.18.2.1 2) d. 2. and 4.

1) …

2) Applying Test Patches to Verify Adequate Surface Preparation

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

b. The subsequent steps shall be followed:

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

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

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

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

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

6. A clean separation indicates a poor bond.

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

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

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

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

1. Hot water wash the equipment.

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

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

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

5. Allow this primer to cure.

Part 3, S4.18.2.2 2)

1) …

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

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

    a. Surface must be free of contaminants;

    b. Surface must be structurally sound;

    c. Surface must have adequate anchor pattern;

    d. Surface must be dry;

    e. Surface must be primed with recommended primer.

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

NB17-155

Approved by SGL April 2018

S1.2.14 Throttle Pipes, Dry Pipes, Superheater Headers & Front End Steam Pipes

1) Cracks in throttle pipes, dry pipes, superheater headers, and front end steam pipes made from steel may be repaired by welding. All welded repairs shall be done in accordance with NBIC Part 3.

2) Throttle castings, dry pipes, super heater headers, and front end steam pipes constructed of cast iron may be repaired by brazing. Brazing shall be done according to a procedure qualified to ASME Section IX, appropriate to the type of repair, and shall be acceptable to the Inspector and the jurisdiction if applicable. Cast iron shall not be fusion welded.

3) Weld build-up may be used for repair of steel components in accordance with NBIC Part 3.

4) Throttle pipes, dry pipes and superheater headers, should be supported by hangers, brackets or other structural methods as needed.

NB17-156

Approved by SGL April 2018

S1.1.2 REQUIREMENTS FOR WELDING AND BRAZING ACTIVITIES

a) Before performing any welding activities, consideration shall be given to ensure the weldability of locomotive boiler materials.

b) Special jurisdictional approval may be required prior to starting welding activity on locomotive boilers.

c) Performance of welded repairs on locomotive boilers shall meet the requirements of NBIC Part 3.

d) Performance of brazed repairs on locomotive boilers shall meet the requirements of ASME Section IX.

Action Item-Rivet Joint to One Piece Welded Joint
NB17-160

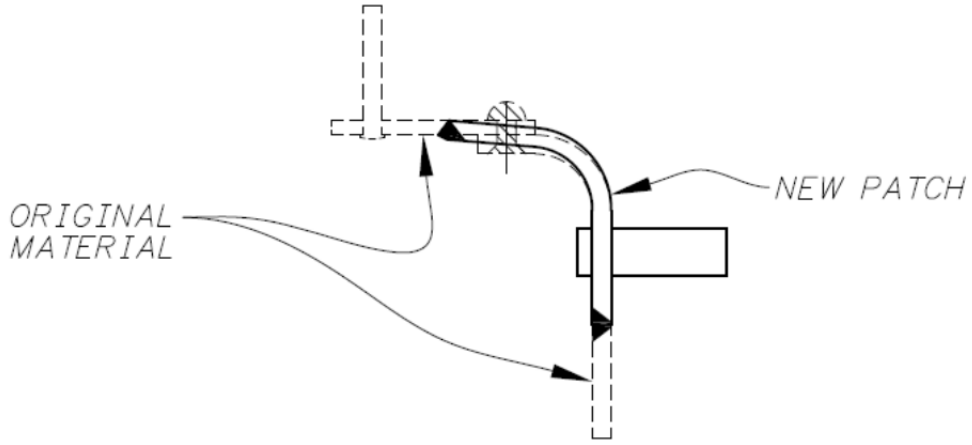
~~S1.2.11.5 REPAIR OF FIREBOX AND TUBESHEET KNUCKLES~~
S1.2.11.5 Repair of Firebox, Wrapper, and Tubesheet Knuckles

a) Welds within the points of tangency of a knuckle are permitted. Welds with angles of less than 45 degrees to the longitudinal axis of the knuckle shall be radiographically examined. (See NBIC Part 3, Figures S1.2.11.5-a through S1.2.11.5-g).
b) Any patch not supported by means other than the weld, such as rivets, staybolts, tubes, or other forms of construction, shall have all weld seams radiographically examined.
c) Patches shall be formed to proper shape and curvature.
d) Wasted sections of knuckles that have not wasted below 60% of the minimum required thickness may be repaired by weld buildup provided the strength of the structure will not be impaired. Where weld buildup is employed, the Inspector may require an appropriate method of NDE for the repair.
e) Wasted sections of knuckles that have wasted below 60% of the minimum required thickness shall be replaced.
f) Flanges shall be made so as to avoid stress intensifiers such as abrupt ridges and grooves.
g) Flanges shall be made smooth and free of ridges, valleys and grooves.
h) Flanges may be welded in accordance with this section and all applicable sections of this code.
i) For one-piece flange knuckle joint patches in portions of a riveted lap joint or in mud ring corners with a lap joint in the firebox, the knuckle patch shall be supported on at least one of the two planes adjacent to the flange, by means other than the weld. See Figure S1.2.11.5-c1. The weld shall be at least the full thickness of the new plate being installed. Volumetric examination is not required. This type of repair shall be considered a repair.

Cautionary note: Where a double-riveted lap joint is replaced with a seamless plate, stay pitch and stress must be considered since the doubling effect of the lap seam is being eliminated.

Add Figure S1.2.11.5-c1

Figure S1.2.11.5-c1



VIEW SHOWING NEW PATCH ALIGNMENT WITH ORIGINAL MATERIAL

17-179

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

5.1 SCOPE

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

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 this section. A Form R-4, *Report Supplement~~ary~~ Sheet*, 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 this section. A Form R-4, *Report Supplement~~ary~~ Sheet*, shall be used as needed to record additional data when the space provided on Form R-2 is not sufficient.

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

5.2.1 PREPARATION OF FORM R-1 ~~(REPAIRS)~~ REPORT OF REPAIR

a) Using the instructions found at NBIC Part 3, 5.12.4.1 preparation of Form R-1 shall be the responsibility of the "R" Certificate Holder performing the repair.

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

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

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

5.2.2 PREPARATION OF FORM R-2 ~~(ALTERATIONS)~~ REPORT OF ALTERATION

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

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

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

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

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

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

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

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

a) Using the instructions found at NBIC Part 3, 5.12.4.3 preparation of Form R-3 shall be the responsibility of the "R" Certificate Holder responsible for performing the work.

5.2.4 PREPARATION OF FORM R-4 REPORT SUPPLEMENT SHEET

a) Using the instructions found at NBIC Part 3, 5.12.4.4 preparation of Form R-4 shall be the responsibility of the "R" Certificate Holder responsible for performing the work.

SKIP 5.3 through 5.11

5.12 REPAIR AND ALTERATION FORMS AND INSTRUCTIONS FOR COMPLETING FORMS

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

5.12.1 FORM R-1, *REPORT OF REPAIR*, see Pg. 89 (***Page numbers will change)***

5.12.2 FORM R-2, *REPORT OF ALTERATION~~S~~*, see Pg. 91

5.12.3 FORM R-3, *REPORT OF PARTS FABRICATED BY WELDING*, see Pg. 93

5.12.4 FORM R-4, *REPORT SUPPLEMENT~~ARY~~ SHEET*, see Pg. 95

5.12.4.1 INSTRUCTIONS FOR COMPLETING NATIONAL BOARD FORM ~~"R" REPORTS~~ R-1

These instructions are to be used when completing the National Board Form ~~"R" Reports~~ R-1, Report of Repair. When computer generated, the format of the form shall replicate the type and relative location of the information depicted on the Form ~~"R" Reports~~ R-1 shown in NBIC Part 3, 5.12.1 ~~through 5.12.4~~. The

numbers below correspond to the “circled” numbers shown on the Form R-1 on **Page 89(??).** Note that a fillable version of the Form R-1 (NB-66, *Latest Revision*) is available on the National Board website.

DELETE NUMBERS 1 THROUGH 55 and INSERT 1 THROUGH 40 LISTED BELOW ALONG WITH 5.12.4.2, 5.12.4.3, and 5.12.4.4

1) Initials of the authorized representative of the “R” Certificate Holder.

2) Initials of the Inspector reviewing the “R” Certificate Holders work

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

21) Indicate test pressure applied.

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

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

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

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

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

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

28) Indicate National Board "R" Certificate or Authorization number.

29) Indicate month, day, and year that the "R" Certificate or Authorization expires.

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

31) Signature of "R" Certificate Holder authorized representative.

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

33) Type or print name of Inspector.

34) Indicate Inspector's Jurisdiction.

35) Indicate Inspector's employer.

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

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

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

39) Signature of Inspector.

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

5.12.4.2 INSTRUCTIONS FOR COMPLETING NATIONAL BOARD FORM R-2 REPORT

NOTE: THE FORM R-2 ON PAGE 91 DOES NOT HAVE THE "BUBBLED' NUMBERS. USE (INSERT) TEMPLATE FROM THE R-2 GUIDE FOR NUMBERING

These instructions are to be used when completing the National Board Form R-2, Report of Alteration. The numbers below correspond to the "circled" numbers depicted on Form R-2 in NBIC Part 3, 5.12.2. When computer generated, the format of the form shall replicate the type and relative location of the information depicted on the Form R-2 Report of Alteration shown on **Page 91(??)**. Note that a fillable version of the Form R-2 (NB-229, *Latest Revision*) is available on the National Board website.

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

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

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

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

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

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

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

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

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

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

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

12) When the pressure-retaining item is registered with the National Board, document the applicable

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

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

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

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

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

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

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

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

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

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

22) Indicate test pressure applied.

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

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

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

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

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

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

29) Indicate National Board “R” Certificate or Authorization number.

30) Indicate month, day, and year that the “R” Certificate or Authorization expires.

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

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

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

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

35) Indicate Inspector’s Jurisdiction.

36) Indicate Inspector’s employer.

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

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

39) Signature of the Inspector certifying the design review.

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

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

42) Indicate the National Board “R” Certificate or Authorization number.

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

44) Indicate the date the alteration was certified.

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

46) Signature of National Board “R” Certificate of Authorization authorized representative.

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

48) Indicate the Inspector’s Jurisdiction.

49) Indicate Inspector’s employer.

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

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

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

53) Signature of the Inspector certifying the construction inspection.

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

5.12.4.3 INSTRUCTIONS FOR COMPLETING NATIONAL BOARD FORM R-3 REPORT

This guide is to be used when completing the National Board Form R-3, Report of Parts Fabricated by Welding. The numbers below correspond to the "circled" numbers shown on the Form R-3 in NBIC Part 3, 5.12.3. When computer generated, the format of the form shall replicate the type and relative location of the information depicted on the Form R-3 Report of Parts Fabricated by Welding shown on **Page 93(??)**. Note that a fillable version of the Form R-3 (NB-230, Latest Revision) is available on the National Board website.

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

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

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

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

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

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

7) Document name of organization responsible for specifying the code design conditions, if known. If origin of design conditions are unknown, state "unknown."

8) Document name of organization responsible for performing the code design, if known. If code design organization is unknown, state "unknown."

9) Name, section, and division of the design code, if known. If the design is unknown, state "unknown."

10) Indicate code edition year used for fabrication.

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

12) Indicate the code paragraph reference for formula used to establish the MAWP, if known. If the code reference of the formula is unknown, state "unknown."

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

14) Indicate quantity of named parts.

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

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

17) Indicate drawing number for the named part.

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

19) Indicate test pressure, if applied.

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

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

22) Indicate the complete material specification number and grade.

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

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

25) Indicate minimum thickness after forming.

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

27) Indicate outside diameter.

28) Indicate minimum thickness of tubes.

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

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

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

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

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

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

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

36) Indicate the date the repair was certified.

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

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

39) Type or print name of Inspector.

40) Indicate Inspector's Jurisdiction.

41) Indicate Inspector's employer.

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

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

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

45) Signature of Inspector.

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

5.12.4.4 INSTRUCTIONS FOR COMPLETING NATIONAL BOARD FORM R-4 REPORT

This guide is to be used when completing the National Board Form R-4, Report Supplement Sheet. The numbers below correspond to the “circled” numbers shown on the Form R-4 in NBIC Part 3, 5.12.4. When computer generated, the format of the form shall replicate the type and relative location of the information depicted on the Form R-4, Report Supplement Sheet shown on **Page 95(??)**. Note that a fillable version of the Form R-4 (NB-231, Latest Revision) is available on the National Board website.

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

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

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

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

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

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

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

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

9) Indicate the date certified.

10) Signature of the repair organizations authorized representative.

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

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

13) Signature of the Inspector.

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

FORM R-1 REPORT OF REPAIR

in accordance with provisions of the *National Board Inspection Code*

1 (Authorized Rep. initials)

2 (Inspectors initials)

25 (Form "R" Registration no.)

26 (P.O. no., job no., etc.)

1. WORK PERFORMED BY: 5 (name of repair organization)

(address)

2. OWNER: 6 (name)

(address)

3. LOCATION OF INSTALLATION: 7 (name)

(address)

4. ITEM IDENTIFICATION: 8 (boiler, pressure vessel, or piping) NAME OF ORIGINAL MANUFACTURER: 9

5. IDENTIFYING NOS: 10 (mfg. serial no.) 11 (National Board no.) 12 (jurisdiction no.) 13 (other) 14 (year built)

6. NBIC EDITION/ADDENDA: 15 (edition) 15 (addenda)

Original Code of Construction for Item: 16 (name / section / division) 16 (edition / addenda)

Construction Code Used for Repair Performed: 17 (name / section / division) 17 (edition / addenda)

18

7. REPAIR TYPE: ☐ welded ☐ graphite pressure equipment ☐ FRP pressure equipment ☐ DOT

8. DESCRIPTION OF WORK: ☐ Form R-4, Report Supplementary Sheet is attached ☐ FFSA Form (NB-403) is attached
(use Form R-4, of neccessary))

19

20 (Liquid, Pneumatic, Vacuum, Leak) Pressure Test, if applied 21 psi MAWP 22 psi

9. REPLACEMENT PARTS: (Attached are Manufacturer's Partial Data Reports or Form R-3's properly completed for the following items of this report):
(name of part, item number, data report type or certificate of Compliance, mfg's. name and identifying stamp)

23

10. REMARKS:

24

25
(Form **"R"** Registration no.)

26
(P.O. no., job no., etc.)

CERTIFICATE OF COMPLIANCE

I, 27, certify that to the best of my knowledge and belief the statements made in this report are correct and that all material, construction, and workmanship on this Repair conforms to the *National Board Inspection Code*. National Board "**R**" *Certificate of Authorization* No. 28 Expiration date: 29

Repair Organization: 30

Signed: 31
(authorized representative)

Date: 32

CERTIFICATE OF INSPECTION

I, 33, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and certificate of competency, where required, issued by the Jurisdiction of 34 and employed by 35 of 36 have inspected the work described in this report on 37, 37 and state that to the best of my knowledge and belief, this work complies with the applicable requirements of the National Board Inspection Code. By signing this certificate, neither the undersigned nor my employer makes any warranty, expressed or implied, concerning the work described in this report. Furthermore, neither the undersigned nor my employer shall be liable in any manner for any personal injury, property damage, or loss of any kind arising from or connected with this inspection.

Commissions: 38
(National Board and Jurisdiction no. including endorsement)

Signed: 39
(inspector)

Date: 40

FORM R-2 REPORT OF ALTERATION

in accordance with provisions of the *National Board Inspection Code*

1 (Authorized Rep. initials)

2 (Inspectors initials)

25 (Form "R" Registration no.)

26 (P.O. no., job no., etc.)

1a. DESIGN PERFORMED BY: 5
(name of "R" organization responsible for design)

(address)

1b. CONSTRUCTION PERFORMED BY: 6
(name of "R" organization responsible for construction)

(address)

2. OWNER OF PRESSURE RETAINING ITEM: 6
(name)

(address)

3. LOCATION OF INSTALLATION: 7
(name)

(address)

4. ITEM IDENTIFICATION: 8
(boiler, pressure vessel, or piping)

NAME OF ORIGINAL MANUFACTURER: 9

5. IDENTIFYING NOS: 10 (mfg. serial no.) 11 (National Board no.) 12 (jurisdiction no.) 13 (other) 14 (year built)

6. NBIC EDITION/ADDENDA: 15 (edition) 15 (addenda)

Original Code of Construction for Item: 16 (name / section / division) 16 (edition / addenda)

Construction Code Used for Alteration Performed: 17 (name / section / division) 17 (edition / addenda)

7a. DESCRIPTION OF DESIGN SCOPE: ☐ Form R-4, Report Supplementary Sheet is attached

19

7b. DESCRIPTION OF CONSTRUCTION SCOPE: ☐ Form R-4, Report Supplementary Sheet is attached

20

20 Pressure Test, if applied 21 psi MAWP 22 psi

25
(Form "R" Registration no.)

26
(P.O. no., job no., etc.)

8. REPLACEMENT PARTS: (Attached are Manufacturer's Partial Data Reports or Form R-3's properly completed for the following items of this report):
(name of part, item number, data report type or Certificate of Compliance, mfg's. name and identifying stamp)

26

9. REMARKS:

27

DESIGN CERTIFICATION

I, 28, certify that to the best of my knowledge and belief the statements in this report are correct and that the Design Change described in this report conforms to the *National Board Inspection Code*. National Board "**R**" Certificate of Authorization No. 29 expires on 30

Date 31, 32 Signed 33
(name of design organization) (authorized representative)

CERTIFICATE OF DESIGN CHANGE REVIEW

I, 34, holding a valid Commission issued by The National Board of Boiler and Pressure Vessel Inspector and certificate of competency, where required, issued by the jurisdiction of 35 and employed by 36 of 37 have reviewed the design change as described in this report and state that to the best of my knowledge and belief such change complies with the applicable requirements of the *National Board Inspection Code*.

By signing this certificate, neither the undersigned nor my employer makes any warranty, expressed or implied, concerning the work described in this report. Furthermore, neither the undersigned nor my employer shall be liable in any manner for any personal injury, property damage or loss of any kind arising from or connected with this inspection.

Date 38 Signed 39 Commissions 40
(inspector) (National Board and jurisdiction no. including endorsement)

CONSTRUCTION CERTIFICATION

I, 41, certify that to the best of my knowledge and belief the statements in this report are correct and that all material, construction, and workmanship on this Alteration conforms to the National Board Inspection Code. National Board "**R**" Certificate of Authorization No. 42 expires on 43

Date 44, 45 Signed 46
(name of alteration organization) (authorized representative)

CERTIFICATE OF INSPECTION

I, 47, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and certificate of competency, where required, issued by the Jurisdiction of 48 and employed by 49 of 50 have inspected the work described in this report on 51, and state that to the best of my knowledge and belief, this work complies with the applicable requirements of the National Board Inspection Code. By signing this certificate, neither the undersigned nor my employer makes any warranty, expressed or implied, concerning the work described in this report. Furthermore, neither the undersigned nor my employer shall be liable in any manner for any personal injury, property damage, or loss of any kind arising from or connected with this inspection.

Date 52 Signed 53 54
(inspector) (National Board and jurisdiction no. including endorsement)

FORM R-3 REPORT OF PARTS FABRICATED BY WELDING

in accordance with provisions of the *National Board Inspection Code*

1 (Authorized Rep. initials)

2 (Inspectors initials)

3 (Form "**R-3**" Registration no.)

1. MANUFACTURED BY: 4 (name of "**R**" certificate holder) 26 (P.O. no., job no., etc.)

(address)

2. MANUFACTURED FOR: 6 (name)

(address)

3. DESIGN CONDITION SPECIFIED BY: 7 CODE DESIGN BY: 8

4. DESIGN CODE: 9 10 12

5. REPAIR/ALTERATION/MODIFICATION ACTIVITIES

Name of Part	Qty.	Line No.	Manufacturer's Identifying No.	Manufacturer's Drawing No.	MAWP	Shop Hydro PSI	Year Built
13	14	15	16	17	18	19	20

6. DESCRIPTION OF PARTS

	(a) Connections other than tubes			Heads or Ends			(b) Tubes		
Line No.	Size and Shape	Material Spec. No.	Thickness (in.)	Shape	Thickness (in.)	Material Spec. No.	Diameter (in.)	Thickness (in.)	Material Spec. No.
	21	22	23	24	25	26	27	28	29

7. REMARKS:

27

31
(Form **"R-3"** Registration no.)

26
(P.O. no., job no., etc.)

CERTIFICATE OF COMPLIANCE

I, 33, certify that to the best of my knowledge and belief the statements made in this report are correct and that all material, fabrication, construction, and workmanship of the described parts conforms to the *National Board Inspection Code* and the standards of construction cited.

National Board "**R**" *Certificate of Authorization* No. 34 expires on: 30

Date 32 37 Signed 38

(name of "R" Certificate holder) (Authorized Representative)

CERTIFICATE OF INSPECTION

I, 39, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and certificate of competency, where required, issued by the Jurisdiction of 47 and employed by 41 of 37 have inspected the part described in this report on 43 and state that to the best of my knowledge and belief the parts comply with the applicable requirements of the *National Board Inspection Code*.

By signing this certificate, neither the undersigned nor my employer makes any warranty, expressed or implied, concerning the work described in this report. Furthermore, neither the undersigned nor my employer shall be liable in any manner for any personal injury, property damage, or loss of any kind arising from or connected with this inspection.

Date 38 Signed 45 Commissions 46

(inspector) (National Board and jurisdiction No. including endorsement)

FORM R-4 REPORT SUPPLEMENT SHEET

in accordance with provisions of the *National Board Inspection Code*

1
(form "R" referenced)
26
(P.O. no., job no., etc.)

1. WORK PERFORMED BY: 6
(name)

(address)

2. OWNER: 7
(name)

(address)

3. LOCATION OF INSTALLATION: 5
(name)

(address)

REFERENCE LINE NO. CONTINUED FROM FORM R– 6

7	8

Date 9 Signed 10
(authorized representative)
Name 11
(Name of "R" certificate holder)

Date 12 Signed 13
(inspector)
Commissions 40
(National Board and jurisdiction no. including endorsement)

NBIC Subcommittee R&A Action Block

Subject Code Revision to Part 3, 2.5.3.6

File Number NB18-12 **Prop. on Pg.** 2

Proposed Revision Statement of Need The revision is to Welding Method 6 to allow for weld build-up limited to 100 square inches on only Grade 91 tube OD surfaces for local erosion or mechanical damage.

Project Manager John Siefert/G. Galanes

SubGroup Negatives **SG Meeting Date**

Background;
Welding Method 6 was successfully introduced into the NBIC, part 3 to permit butt weld repair with no PWHT. This action permits weld build-up of the Grade 91 tubes within the boiler setting and same limitations to repair erosion or mechanical damage without the need for complete tube replacement. To ensure adequate controls, the size of the repair are using a weld overlay is limited to 100 square inches.

NBIC Subcommittee R&A Action Block

Item 18-12

2.5.3.6 WELDING METHOD 6

This welding method provides requirements for welding only Grade 91 tube material within the steam boiler setting. When using this welding method, the following applies:

a) This method is limited to butt welds or weld build-up repairs limited to 100 square inches (64,500 square mm) or less in size in tubing NPS 5 (DN 125) or less in diameter and ½ in. (13 mm) or less in wall thickness for which the applicable rules of the original code of construction did not require notch toughness testing;

b) Application shall be limited to only boiler tube repairs at a location internal to the boiler setting;

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

1) The material shall be limited to P-No 15E, Group 1, Grade 91, creep strength enhanced ferritic steel (CSEF).

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

3) The welding procedure qualification test coupon shall be P-No 15 E, Group 1, Grade 91.

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

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

a. The minimum preheat for the GTAW process shall be 200°F (100°C). The minimum preheat for the SMAW process shall be 300°F (150°C). The preheat temperature shall be checked to ensure the minimum preheat temperature is maintained during welding and until welding is completed. The maximum interpass temperature shall be 550°F (290°C).

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

c. Regardless of the welding process (SMAW and/or GTAW), only the use of stringer beads shall be permitted.

d. The filler metal shall be limited to an austenitic, nickel-base filler metal having a designation F-No. 43 and limited to the following consumables: ERNiCr-3, ENiCrFe-3, ENiCrFe-

NBIC Subcommittee R&A Action Block

2, ASME B&PV Code Cases 2733 and 2734 (e.g. EPRI P87); or
e. A martensitic, iron-base filler metal having a designation F-No. 4 or F-No. 6 and limited to the following consumables: E8015-B8, E8018-B8 or ER80S-B8.
f. For weld build-up repairs due to wastage, the filler metal shall be limited to an austenitic, nickel-base filler metal having a designation F-No. 43. There is not a limit on the consumable for this repair application.

NBIC Subcommittee R&A Action Block

Subject Code Revision to Part 3, 2.5.3.6

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

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

Project Manager John Siefert/G. Galanes

SubGroup Negatives **SG Meeting Date**

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

NBIC Subcommittee R&A Action Block

NB Item 18-13
2.5.3.7 WELDING METHOD 7

This repair method provides requirements for dissimilar metal welding (DMW) of Grade 91 tube material to either austenitic or low alloy ferritic steel tubing within the steam boiler setting. When using this welding method, the following applies:

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

b) Application shall be limited to only boiler tube repairs at a location internal to the boiler setting;

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

For DMW of Grade 91 to austenitic steel steel tubing;

1) The materials shall be limited to P-No 15E, Group 1, Grade 91, creep strength enhanced ferritic steel (CSEF) joined to either P-No. 8, P-No. 42, P-No. 43, or P-No. 45, as permitted for welded construction by the applicable rules of the original code of construction.~~.~~

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

3) The welding procedure qualification test coupon shall be P-No 15 E, Group 1, Grade 91 joined to either P-No. 8, P-No. 42, P-No. 43, or P-No. 45 and as required for the repair application.

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

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

a). The minimum preheat for the GTAW process shall be 200°F (100°C). The minimum preheat for the SMAW process shall be 300°F (150°C). The preheat temperature shall be checked to ensure the minimum preheat temperature is maintained during welding and until welding is completed.

The maximum interpass temperature shall be 550°F (290°C).

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

c). Regardless of the welding process (SMAW or GTAW), only the use of stringer beads shall be permitted.

d). The filler metal shall be limited to an austenitic, nickel-base filler metal having a designation F-No. 43 and limited to the following consumables: ERNiCr-3 (e.g., Filler Metal 82), ENiCrFe-3 (e.g., INCONEL Welding Electrode 182), ENiCrFe-2 (e.g., INCO-WELD A), ASME B&PV Code Cases 2733 and 2734 (e.g. EPRI P87);
~~e. A martensitic, iron-base filler metal having a designation F-No. 4 or F-No. 6 and limited to the following consumables: E8015-B8, E8018-B8 or ER80S-B8.~~

For DMW of Grade 91 to low alloy (P-No 5A) steel tubing:

1) The materials shall be limited to P-No 15E, Group 1, Grade 91, creep strength enhanced ferritic steel (CSEF) joined to P-No. 5A steel.

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

3) The welding procedure qualification test coupon shall be P-No 15 E, Group 1, Grade 91 joined to P-No. 5A steels.

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

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

(a). The minimum preheat for the GTAW process shall be 200°F (100°C). The minimum preheat for the SMAW process shall be 300°F (150°C). The preheat temperature shall be checked to ensure the minimum

preheat temperature is maintained during welding and until welding is completed. The maximum interpass temperature shall be 550°F (290°C).

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

(c). Regardless of the welding process (SMAW or GTAW), only the use of stringer beads shall be permitted.

(d). The filler metal shall be limited to a martensitic, iron-base filler metal having a designation F-No. 4 or F-No. 6 and limited to the following consumables: E8015-B8, E8018-B8 or ER80S-B8.

S1.2.9.6 INSTALLATION OF BOILER FLUES

Maximum allowable working pressure and nominal wall thickness for flues shall be determined using TABLE S1.2.9.1 and TABLE S1.2.9.1M

Except as otherwise specified in this Part, flues shall be attached per the requirements of ASME Section I, PFT-12.2; however, flues shall not be attached by welding alone.

All flues smaller than 3 in. (75 mm) O.D. shall be expanded and beaded or expanded and welded on the firebox end. At least 1 in 10 distributed evenly on the front flue sheet shall be expanded and beaded or expanded and welded. All flues 3 in. (75 mm) O.D. and larger shall be expanded and beaded or expanded and welded at both ends. All adjacent flues smaller than 3 in. (75 mm) O.D. that are within the area occupied by the larger superheater flues shall be expanded and beaded or expanded and welded at both ends. At least 1 in 10 of the remaining flues smaller than 3 in.(75 mm) O.D. shall be beaded or welded on the front flue sheet, in addition to expanding. Where less than all flues are welded or beaded on the front flue sheet, those welded or beaded shall be distributed as evenly as practicable throughout the flue pack.

Flues shall be re-expanded upon completion of seal welding or beading, or both. The new reduced wall thickness of the enlarged flue end shall be reviewed to confirm that upon completion of the flue expansion process the new wall thickness will be sufficient for the MAWP.

When required by the original design, the ends of boiler flues shall be swaged to a smaller or larger diameter as required to fit the tube sheet holes. The swaging shall create smooth surfaces, smooth curves, and a uniform diameter reduction across the entire swaged length.

When flues are applied by expanding and seal welding, the seal weld shall protrude beyond the sheet a distance of 1/8 in. to 1/4 in. (3 mm to 6 mm) inclusive [see Figure S1.2.9.1-b] and the end of the flue shall not protrude past the weld. The end of the flue shall be ground or polished to eliminate any sharp edges.

Prior to welding, beading, or both; ensure that the flue is satisfactorily seated in the sheet. Seal welding may be done with water in the boiler, provided the water is heated to between 100°F and 120°F (38°C and 50°C).

Some acceptable types of attachments are shown in ASME Section I, Figure PFT-12.1, illustrations (a) through(g).

Ferrous or nonferrous ferrules may be used on either or both ends of flues. When seal welding over ferrous ferrules used in straight-expanded and seal-welded flues, the weld shall attach to the sheet and not just to the ferrule. Care shall be taken to avoid contamination of seal welds when nonferrous ferrules are used.

Cautionary Note:

Boiler flues shall be cut to or made to the correct length required for installation when the boiler and flues are at equal temperature. The use of heating or stretching the flue during installation to obtain the required length by thermal or mechanical expansion is prohibited.

NB18-7

Fillet Welded Staybolts

NBIC Part 3, S1.2.5.1;

The replacement of threaded staybolts with fillet welded staybolts is permissible. The work shall be done in accordance with the ASME BPVC, Section I, Part PL-30 and Figure PL-30.4.2-1. When replacing a threaded staybolt with a fillet welded staybolt, the existing threads in the sheets must be removed prior to installation. Cautionary Note: Larger minimum diameter staybolts will transfer stresses to other structures and will be subject to higher extreme fiber stresses.

Repairs to un-threaded fillet welded staybolts shall be performed in accordance with the original code of construction. If the original code of construction is not known, repairs shall be performed as follows in accordance with an appropriate code of construction that allows fillet welded staybolts:

a) The replacement of un-threaded fillet welded staybolts is permissible.

b) Existing un-threaded fillet welded staybolts that leak shall be repaired by re-welding after mechanically removing the entire weld. Only the leaking stays are to be re-welded.

c) Minor leakages (sweat pores) may be repaired by gently caulking the fillet weld. However, identifiable cracks shall be ~~repaired by~~removed before re-welding.

NB Item # 18-14, Update NBIC Part 3, Clause 2.3 and Table 2.3

Revise Clause 2.3 to recognize Re-affirmed, Amended and Revised SWPS confirming that suitability is as listed in Table 2.3

EXISTING TEXT

2.3 STANDARD WELDING PROCEDURE SPECIFICATIONS

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

b) The AWS reaffirms SWPSs in accordance with ANSI procedures. When reaffirmation occurs without revision to the SWPS, the letter "R" is added to the SWPS designation prior to the year. Such designation is considered to be identical with the previously published version and may be used pending incorporation herein, on the same basis as the version listed in NBIC Part 3, Table 2.3.

PROPOSED REVISION

2.3 STANDARD WELDING PROCEDURE SPECIFICATIONS

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

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

- Reaffirmed SWPSs: When reaffirmation occurs without revision to the SWPS, the letter "R" is added to the SWPS designation prior to the year.
- Amended SWPSs: Amendments are issued when essential for the prompt correction of an error that could be misleading. Amendments are incorporated into the existing text of the SWPS, which is reprinted and clearly marked as incorporating an amendment(s), and which is identified in the revised Foreword of the amended SWPS. •
- Revised SWPSs: When a revision to a published SWPS occurs, the publication date is added to the SWPS designation. The date of the superseded SWPS is also noted on the cover page. Previous versions of the superseded SWPS may be used at the option of the R Certificate holder."

NB Item # 18-14, Update NBIC Part 3, Clause 2.3 and Table 2.3

See the addition of 5 amended SWPS Highlighted in Red Type and 1 SWPS correction also Highlighted in Red; Type

Carbon Steel — (P1 Materials)

SMAW — Shielded Metal Arc Welding	
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel, (M-1/P-1, Group 1 or 2), 3/16 in. (5 mm) through 3/4 in. (19 mm), in the As-Welded Condition, With Backing.	B2.1.001-90 and B2.1-1-001: 90(R2006)
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, E7018, As-Welded or PWHT Condition.	B2.1-1-016-94 and B2.1-1-016-94R
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, E6010, As-Welded or PWHT Condition.	B2.1-1-017-94 and B2.1-1-017-94R
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, E6010 (Vertical Uphill) followed by E7018, As-Welded or PWHT Condition.	B2.1-1-022-94 and B2.1-1-022-94R
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, E6010 (Vertical Downhill) followed by E7018, As-Welded or PWHT Condition.	B2.1-1-026-94 and B2.1-1-026-94R
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 3/4 in. (19 mm) Thick, E6010 (Vertical **Uphill**) followed by E7018, (Vertical Uphill) As-Welded Condition, Primarily Pipe Applications.	B2.1-1-201-96, and B2.1-1-201-96(R2007)
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 3/4 in. (19 mm) thick, E6010 (Vertical Downhill) followed by E7018 (Vertical Uphill), As-Welded Condition, Primarily Pipe Applications.	B2.1-1-202-96(R2007)
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 3/4 in. (19 mm) Thick, E6010 (Vertical Uphill), As-Welded Condition, Primarily Pipe Applications.	B2.1-1-203-96 and B2.1-1-203-96(R2007)
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 3/4 in. (19 mm) Thick, E6010 (Vertical downhill root with balance vertical uphill), As-Welded Condition, Primarily Pipe Applications.	B2.1-1-204-96 and B2.1-1-204-96(R2007)
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, E6010 (Vertical Uphill) followed by E7018 (Vertical Uphill), As-Welded or PWHT Condition, Primarily Pipe Applications.	B2.1-1-205-96 and B2.1-1-205-96(R2007)
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 3/4 in. (19 mm) Thick, E6010 (Vertical Downhill) followed by E7018 (Vertical Uphill), As-Welded or PWHT Condition, Primarily Pipe Applications.	B2.1-1-206-96 and B2.1-1-206-96(R2007)
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 3/4 in. (19 mm) Thick, E7018, As-Welded or PWHT Condition, Primarily Pipe Applications.	B2.1-1-208-96
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through1 ½ in. (38 mm) Thick, E7018, As-Welded or PWHT Condition, Primarily Pipe Applications.	B2.1-1-208-96(R2007)
GTAW — Gas Tungsten Arc Welding	
Standard Welding Procedure Specification for Gas Tungsten Arc Welding of Carbon Steel, (M-1/P-1, Group 1 or 2), 3/16 in. (5 mm) through 7/8 in. (22 mm) Thick, in the As-Welded Condition, With or Without Backing.	B2.1-002-90, B2.1-002-90(R2006) and B2.1-1-002-90R
Standard Welding Procedure Specification for Gas Tungsten Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 3/4 in. (19 mm) Thick, ER70S-2, As-Welded or PWHT Condition, Primarily Pipe Application.	B2.1-1-207-96

Standard Welding Procedure Specification for Gas Tungsten Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 1 ½in. (38 mm) Thick, ER70S-2, As-Welded or PWHT Condition, Primarily Pipe Application.	B2.1-1-207-96 (R2007)
Standard Welding Procedure Specification for Gas Tungsten Arc Welding (Consumable Insert) of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 3/4 in. (19 mm) Thick, INMs1 and ER70S-2, As-Welded or PWHT Condition, Primarily Pipe Application.	B2.1-1-210-96
Standard Welding Procedure Specification for Gas Tungsten Arc Welding with Consumable Insert Root of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 1-1/2 in. (38 mm) Thick, INMs-1, ER70S-2, As-Welded or PWHT Condition, Primarily Pipe Applications.	B2.1-1-210:2001 R2012
FCAW — Flux Core Arc Welding	
Standard Welding Procedure Specification for Self-Shielded Flux Cored Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, E71T-8, As-Welded Condition.	B2.1-1-018-94 and B2.1-1.018-94R
Standard Welding Procedure Specification for CO2 Shielded Flux Cored Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, E70T-1 and E71T-1, As-Welded Condition.	**B2.1-1-019-94, B2.1-1-019-94R and B2.1-1-94 AMD1**
Standard Welding Procedure Specification for 75% Ar/25% CO2 Shielded Flux Cored Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 1-1/2 in. (38 mm) Thick, E70T-1M and E71T-1M, As-Welded or PWHT Condition.	**B2.1-1-020-94, B2.1-1-020-94R and B2.1-1-020 94-AMD1**
Standard Welding Procedure for Self-Shielded Flux Cored Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 1/2 in. (13 mm) Thick, E71T-11, As-Welded Condition.	B2.1-1-027:1995 and B2.1-1-027-1998
Standard Welding Procedure Specification (SWPS) for Argon Plus 25% Carbon Dioxide Shielded Flux Cored Arc Welding of Carbon Steel (M-1/P-1/S-1, Groups 1 and 2), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, E7XT-XM, As-Welded or PWHT Condition, Primarily Pipe Applications.	B2.1-1-234: 2006
GMAW – Gas Metal Arc Welding	
Standard Welding Procedure Specification for Argon Plus 25% Carbon Dioxide Shielded Gas Metal Arc Welding (Short Circuiting Transfer Mode) followed by Argon Plus 2% Oxygen Shielded Gas Metal Arc Welding (Spray Transfer Mode) of Carbon Steel (M-1/P-1/S-1, Groups 1 and 2), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, ER70S-3, Flat Position Only, As-Welded or PWHT Condition, Primarily Pipe Applications.	B2.1-1-233: 2006
Standard Welding Procedure Specification for Argon Plus 2% Oxygen Shielded Gas Metal Arc Welding (Spray Transfer Mode) of Carbon Steel (M-1/P-1/S-1, Groups 1 and 2), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, ER70S-3, Flat Position Only, As-Welded or PWHT Condition, Primarily Pipe Applications.	B2.1-1-235: 2006
GTAW/SMAW Combination of Welding Processes	
Standard Welding Procedure Specification for Gas Tungsten Arc Welding Followed by Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, ER70S-2 and E7018, As-Welded or PWHT Condition.	B2.1-1-021-94 and B2.1-1-021-94R
Standard Welding Procedure Specification for Gas Tungsten Arc Welding followed by Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Groups 1 or 2), 1/8 in. (3.2 mm) through 3/4 in. (19 mm) Thick, ER70S-2 and E7018, As-Welded or PWHT Condition, Primarily Pipe Applications.	B2.1-1-209-96
Standard Welding Procedure Specification for Gas Tungsten Arc Welding followed by Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Groups 1 or 2), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, ER70S-2 and E7018, As-Welded or PWHT Condition, Primarily Pipe Applications.	B2.1-1-209-96 (R2007)
Standard Welding Procedure Specification for Gas Tungsten Arc Welding (Consumable Insert) Followed by Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 3/4 in. (19 mm) Thick, INMs1 and E7018, As-	B2.1-1-211-96

Welded or PWHT Condition, Primarily Pipe Applications.	
Standard Welding Procedure Specification for Gas Tungsten Arc Welding with Consumable Insert Root Followed by Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, INMs-1, ER70S-2, and E7018 As-Welded or PWHT Condition, Primarily Pipe Applications.	B2.1-1-211:2001 R2012
GMAW/FCAW – Combination of Welding Processes	
Standard Welding Procedure Specification for Argon Plus 25% Carbon Dioxide Shielded Gas Metal Arc Welding (Short Circuiting Transfer Mode) Followed by Argon Plus 25% Carbon Dioxide Shielded Flux Cored Arc Welding of Carbon Steel (m-1/P-1/S-1, Groups 1 and 2), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, ER70S-3 and EXT-X, As-Welded or PWHT Condition, Primarily Pipe Applications.	B2.1-1-232:2006

Austenitic Stainless Steel — (M8/P8/S8 Materials)

SMAW — Shielded Metal Arc Welding	
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 in. (3.2 mm) through 1½ in. (38 mm) Thick, As-Welded Condition.	B2.1-8-023-94
Standard Welding Procedure Specification for Shielded Metal Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 in. (3.2 mm) through 1½ in. (38 mm) Thick, E3XX-XX, As-Welded Condition, Primarily Pipe Application.	B2.1-8-213-97 and B2.1-8-213-96(R2007)
GTAW — Gas Tungsten Arc Welding	
Standard Welding Procedure Specification for Gas Tungsten Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, As-Welded Condition.	B2.1-8-024-94
Standard Welding Procedure Specification for Gas Tungsten Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/16 in. (1.6 mm) through 1 ½ in. (38 mm) Thick, ER3XX, As-Welded Condition, Primarily Plate and Structural Applications.	B2.1-8-024:2001
Standard Welding Procedure Specification for Gas Tungsten Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/16 in. (1.6 mm) through 1 ½ in. (38 mm) Thick, ER3XX, As-Welded Condition, Primarily Pipe Applications.	B2.1-8-212-97
Standard Welding Procedure Specification for Gas Tungsten Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/16 in. (1.6 mm) through 1 ½ in. (38 mm) thick, ER3XX, As-Welded Condition, Primarily Pipe Applications.	B2.1-8-212:2001 R2012
Standard Welding Procedure Specification for Gas Tungsten Arc Welding With Consumable Insert Root of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, IN3XX and ER3XX As-Welded Condition, Primarily Pipe Applications.	B2.1-8-215:1998 B2.1-8-215:2001 R2012
Combination Processes GTAW/SMAW	
Standard Welding Procedure Specification for Gas Tungsten Arc Welding followed by Shielded Metal Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, As-Welded Condition.	B2.1-8-025-94
Standard Welding Procedure Specification for Gas Tungsten Arc Welding followed by Shielded Metal Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, ER3XX and E3XX-XX, As-Welded Condition, Primarily Plate and Structural Applications.	B2.1-8-025:2001
Standard Welding Procedure Specification for Gas Tungsten Arc Welding Followed by Shielded Metal Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, ER3XX and E3XX-XX, As-Welded Condition, Primarily Pipe Applications.	B2.1-8-214-97
Standard Welding Procedure Specification for Gas Tungsten Arc Welding Followed by Shielded Metal Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, ER3XX and E3XX-XX, As-Welded Condition, Primarily Pipe Applications.	B2.1-8-214:2001 R2012

Standard Welding Procedure Specification for Gas Tungsten Arc Welding With Consumable Insert Followed by Shielded Metal Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) thick, IN3XX, ER3XX, and E3XX-XX As-Welded Condition, Primarily Pipe Application.	B2.1-8-216-1998
Standard Welding Procedure Specification for Gas Tungsten Arc Welding with Consumable Insert Root followed by Shielded Metal Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, IN3XX, ER3XX, and E3XX-XX As-Welded Condition, Primarily Pipe Applications.	B2.1-8-216:2001 R2012

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

SMAW — Shielded Metal Arc Welding	
Standard Welding Procedure Specifications for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Groups 1 or 2) to Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, E309 (L)-15, -16, or -17, As-Welded Condition, Primarily Pipe Applications.	B2.1-1/8-228:2002 R2013
GTAW — Gas Tungsten Arc Welding	
Standard Welding Procedure Specification for Gas Tungsten Arc Welding of Carbon Steel (M-1/P-1/S-1, Groups 1 or 2) to Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/16 in. (1.6 mm) through 1 ½ in. (38 mm) Thick, ER309 (L), As-Welded Condition, Primarily Pipe Applications.	**B2.1-1/8-227:2002, 2002 AMD1 and R2013**
Standard Welding Procedure Specifications for Gas Tungsten Arc Welding with Consumable Insert Root of Carbon Steel (M-1/P-1/S-1, Groups 1 or 2) to Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/16 in. (1.6 mm) through 1½ in. (38 mm) Thick, IN309 and ER309(L), As-Welded Condition, Primarily Pipe Applications.	**B2.1-1/8-230:2002, 2002 AMD1 and R2013**
GTAW/SMAW Combination of Welding Processes	
Standard Welding Procedure Specifications for Gas Tungsten Arc Welding followed by Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1,Groups 1 or 2) to Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 in. (3.2 mm) through 1½ in. (38 mm) Thick, ER309(L) and E309(L)-15, -16, or -17, As-Welded Condition, Primarily Pipe Applications.	**B2.1-1/8-229:2002, 2002-AMD1 and R2013**
Standard Welding Procedure Specifications for Gas Tungsten Arc Welding with Consumable Insert Root followed by Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Groups 1 or 2) to Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/8 in. (3.2 mm) through 1½ in. (38 mm) Thick, IN3009, ER309, and E309-15, -16, or -17 or IN309, ER309(L) and ER309(L)-15, -16, or -17, As-Welded Condition, Primarily Pipe Applications.	B2.1-1/8-231:2002 R2015

Chromium Molybdenum Steel (M4/P4 and M5a/P5A Materials)

SMAW — Shielded Metal Arc Welding	
Standard Welding Procedure Specifications for Shielded Metal Arc Welding of Chromium-Molybdenum Steel (M-4/P-4, Group 1 or 2), E8018-B2, 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, As-Welded Condition, 1/8 in. (3.2 mm) through 1½ in. (38 mm) Thick, PWHT Condition, Primarily Pipe Applications.	B2.1-4-218:1999 R2009
Standard Welding Procedure Specifications for Shielded Metal Arc Welding of Chromium-Molybdenum Steel (M-5A/P-5A), E9018-B3, 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, As-Welded Condition, 1/8 in. (3.2 mm) through 1½ in. (38 mm) Thick, PWHT Condition, Primarily Pipe Applications.	B2.1-5A-223:1999 R2009
GTAW — Gas Tungsten Arc Welding	
Standard Welding Procedure Specifications for Gas Tungsten Arc Welding of Chromium-Molybdenum Steel (M-4/P-4, Group 1 or 2), ER80S-B2, 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, As-Welded Condition, 1/8 in. (3.2 mm) through 3/4 in. (19 mm) Thick, PWHT Condition, Primarily Pipe Applications.	B2.1-4-217:1999 R2009
Standard Welding Procedure Specifications for Gas Tungsten Arc Welding (Consumable Insert Root) of Chromium-Molybdenum Steel (M-4/P-4, Group 1 or 2), E8018-B2, 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, As-Welded Condition, 1/8 in. (3.2 mm) through 3/4 in. (19	B2.1-4-220:1999

mm) Thick, PWHT Condition, IN515 and ER80S-B2, Primarily Pipe Applications.	R2009
Standard Welding Procedure Specifications for Gas Tungsten Arc Welding of Chromium-Molybdenum Steel (M-5A/P-5A), ER90S-B3, 1/8 in. (3.2 mm) through 1½ in. (38 mm) Thick, As-Welded Condition, 1/8 in. (3.2 mm) through 3/4 in. (19 mm) Thick, PWHT Condition, Primarily Pipe Applications.	B2.1-5A-222:1999 R2009
Standard Welding Procedure Specifications for Gas Tungsten Arc Welding (Consumable Insert Root) of Chromium-Molybdenum Steel (M-5A/P-5A), 1/8 in. (3.2 mm) through 1-1/2 in. (38 mm) Thick, As-Welded Condition, 1/8 in. (3.2 mm) through 3/4 in. (19 mm) Thick, PWHT Condition, IN521 and ER90S-B3, Primarily Pipe Applications.	B2.1-5A-225:1999 R2009
Chromium-Molybdenum Steel Processes GTAW/SMAW	
Standard Welding Procedure Specifications for Gas Tungsten Arc Welding (Consumable Insert Root) followed by Shielded Metal Arc Welding of Chromium-Molybdenum Steel (M-4/P-4, Group 1 or 2), 1/8 in. (3.2 mm) through 1-1/2 in. (38 mm) Thick, As-Welded Condition, 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, PWHT Condition, IN515, ER80S-B2, and E8018-B2, Primarily Pipe Applications.	B2.1-4-221:1999 R2009
Standard Welding Procedure Specifications for Gas Tungsten Arc Welded followed by Shielded Metal Arc Welding of Chromium-Molybdenum Steel (M-5A/P-5A), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, As-Welded Condition, 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, PWHT Condition, ER90S-B3 and E9018-B3, Primarily Pipe Applications.	B2.1-5A-224:1999 R2009
Standard Welding Procedure Specifications for Gas Tungsten Arc Welding (Consumable Insert Root) followed by Shielded Metal Arc Welding of Chromium-Molybdenum Steel (M-5A/P-5A), 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, As-Welded Condition, 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, PWHT Condition, IN521, ER90S-B3, and E9018-B3, Primarily Pipe Applications.	B2.1-5A-226:1999 R2009
Standard Welding Procedure Specifications (SWPS) for Gas Tungsten Arc Welded followed by Shielded Metal Arc Welding of Chromium-Molybdenum Steel (M-4A/P-4, Group 1 or 2), 1/8 in. (3.2 mm) through 1/2 in. (13 mm) Thick, As-Welded Condition, 1/8 in. (3.2 mm) through 1 ½ in. (38 mm) Thick, PWHT Condition, ER80S-B2 and E9018-B2, Primarily Pipe Applications.	B2.1-4-219:199 R2009

PART 3, SECTION 1
REPAIRS AND ALTERATIONS — GENERAL AND ADMINISTRATIVE REQUIREMENTS

1.1 SCOPE

a) This part provides requirements and guidelines that apply when performing repairs and alterations to pressure-retaining items.

b) The National Board administers three specific accreditation programs:

1) “R” — Repairs and Alterations to Pressure-Retaining Items
2) “NR” — Repair and Replacement Activities for Nuclear Items
3) “VR” — Repairs to Pressure Relief Valves
4) “T/O” – In-service testing only of Pressure Relief Valves

c) This part describes some of the administrative requirements for the accreditation of repair organizations. Additional administrative requirements can be found in:

1) NB-415, Accreditation of “R” Repair Organizations
2) NB-417, Accreditation of “NR” Repair Organizations
3) NB-514, Accreditation of “VR” Repair Organizations
4) NB-528, Accreditation of “T/O” Test Only Organizations

d) Requirements for repairs to pressure relief valves can be found in NBIC Part 4.

REQUEST FOR CODE REVISION

The following are proposed revisions to Part 3 Section 2 and the Glossary. The proposal expands Section 2 to include rules for brazing and fusing and definitions for brazing, fusing and welding in the Glossary.

EXPLANATION

In a recent request for revision to the rules relating to locomotive boilers, it was proposed to allow brazing on certain boiler parts. While considering the proposal, it was noted that the NBIC does not yet provide rules for brazing. While developing this proposal for revision, it was decided to expand Part 3 Section 2 to include fusing as well as brazing.

CURRENT	PROPOSED
PART 3, SECTION 2 REPAIRS AND ALTERATIONS — WELDING AND HEAT TREATMENT	**PART 3, SECTION 2 REPAIRS AND ALTERATIONS — WELDING, BRAZING, FUSING AND HEAT TREATMENT**
2.1 SCOPE This section provides requirements and guidelines for welding and heat treating when performing welded repairs and alterations to pressure-retaining items. Careful consideration shall be given to pressure-retaining items that have been fabricated of either creep strength enhanced ferritic materials or ferritic materials enhanced by heat treatment. The tensile and creep strength properties of these materials can be degraded by not following specific welding and heat treatment requirements. The user is cautioned to seek technical guidance for welding and heat treating requirements in accordance with the original code of construction.	**2.1 SCOPE** a) This section provides requirements and guidelines for welding, brazing, fusing and heat treating when performing ~~welded~~ repairs and alterations to pressure-retaining items. b) Careful consideration shall be given to pressure-retaining items that have been fabricated of either creep strength enhanced ferritic steel materials or ferritic steel materials enhanced by heat treatment. The tensile and creep strength properties of these materials can be degraded by not following specific welding procedure specification and heat treatment requirements. The user is cautioned to seek technical guidance for welding and heat treating requirements for these materials in accordance with the original code of construction.
2.2 WELDING Welding shall be performed in accordance with the requirements of the original code of construction used for the pressure-retaining item whenever possible.	**2.2 WELDING, BRAZING AND FUSING** Welding, brazing and fusing shall be performed in accordance with the requirements of the original code of construction used for the pressure-retaining item whenever possible.
2.2.1 WELDING PROCEDURE SPECIFICATIONS Welding shall be performed in accordance with Welding Procedure Specifications (WPS) qualified in accordance with the original code of construction or the construction standard or code selected. When this is not possible or practicable, the WPS may be qualified in accordance with	**2.2.1 ~~WELDING~~ PROCEDURE SPECIFICATIONS** A procedure specification is a written document providing direction to the person applying the material joining process. Welding, brazing and fusing shall be performed in accordance with ~~Welding Procedure Specifications (WPS)~~ procedure specifications for welding (WPS),

ASME Section IX.	brazing (BPS), and fusing (FPS) qualified in accordance with the original code of construction or the construction standard or code selected. When this is not possible or practicable, the ~~WPS~~ procedure specification may be qualified in accordance with ASME Section IX.
2.2.2 STANDARD WELDING PROCEDURE SPECIFICATIONS An "R" Certificate Holder may use one or more applicable Standard Welding Procedure Specifications (SWPS) shown in NBIC Part 3, Table 2.3 without supporting Procedure Qualification Records (PQRs) since SWPS are pre-qualified.	No change to this paragraph.
2.2.3 PERFORMANCE QUALIFICATION Welders and 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, the construction standard, code selected or ASME Section IX. Use of a Standard Welding Procedure Specification shown in NBIC Part 3, 2.3 is permitted for performance qualification testing.	**2.2.3 PERFORMANCE QUALIFICATION** ~~Welders and welding operators shall be qualified for the welding processes that are used~~. The "R" Certificate Holder shall qualify the performance of personnel for each process they will use for repairs and alterations of pressure retaining items. Such qualification shall be in accordance with the requirements of the original code of construction, the construction standard, code selected, or ASME Section IX. Use of a Standard Welding Procedure Specification shown in NBIC Part 3, 2.3 is permitted for performance qualification testing.
2.2.4 WELDING RECORDS The "R" Certificate Holder shall maintain a record of the results obtained in Welding Procedure Qualifications, except for those qualifications for which the provisions of NBIC Part 3, 2.2.2 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.	**2.2.4 ~~WELDING~~ QUALIFICATION RECORDS** The "R" Certificate Holder shall maintain a record of the results obtained in ~~Welding Procedure Qualifications,~~ procedure specification qualification (except for those qualifications for which the provisions of NBIC Part 3, 2.2.2 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.
2.2.5 WELDER'S 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 welded joints are 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 welded joints made by the individual, or the "R" Certificate Holder may	**2.2.5 ~~WELDER'S~~ QUALIFIED PERSONNEL IDENTIFICATION** The "R" Certificate Holder shall establish a system for the assignment of a unique identification mark to each ~~welder/welding operator~~ person qualified in accordance with the requirements of the NBIC. The "R" Certificate Holder shall also establish a written procedure whereby ~~welded~~ production joints are identified and traceable to the person ~~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. a) The ~~welder's or welding operator's~~ person's

keep a documented record of welded joints and the welders or welding operators used in making the joints.	identification mark may be stamped (low stress stamp, if used) adjacent to ~~welded~~ production joints made by the individual, or, b) the "R" Certificate Holder may keep a documented record of ~~welded~~ production joints and the ~~welders or welding operators~~ persons used in making the joints.
2.2.6 WELDER'S CONTINUITY The performance qualification of a welder or welding operator shall be affected when one of the following conditions occur: a) 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; or b) When there is specific reason to question a welder's 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.	**2.2.6 ~~WELDER'S~~ CONTINUITY OF QUALIFIED PERSONNEL** The performance qualification of a ~~welder or welding operator~~ qualified person shall be affected when one of the following conditions occur: a) When the ~~welder or welding operator~~ person has not ~~welded using~~ used a specific process during a period of six months or more, their qualifications for that process shall expire; or b) When there is specific reason to question ~~a welder's~~ the person's ability to make ~~welds~~ joints that meet the specification, the qualification which supports the ~~welding~~ process that is being performed shall be revoked. All other qualifications not questioned remain in effect.
2.2.6.1 WELDER'S CONTINUITY RECORDS a) The "R" Certificate Holder shall maintain a welding continuity record and shall make the record available to the Inspector. b) The method of recording welding continuity and the record retention period shall be described in the "R" Certificate Holder's Quality System Manual. c) When there is specific reason to question a welder's 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.	**2.2.6.1 ~~WELDER'S~~ PROCESS CONTINUITY RECORDS** a) The "R" Certificate Holder shall maintain ~~a welding~~ process continuity records and shall make the records available to the Inspector. b) The method of recording ~~welding~~ process continuity and the record retention period shall be described in the "R" Certificate Holder's Quality System Manual. c) When there is specific reason to question a ~~welder's~~ person's ability to make ~~welds~~ joints that meet the specification, the qualification which supports the ~~welding~~ process that is being performed shall be revoked. All other qualifications not questioned remain in effect.
2.3 STANDARD WELDING PROCEDURE SPECIFICATIONS	No change to this paragraph
2.4 AWS REFERENCE STANDARDS	No change to this paragraph.
2.5 HEAT TREATMENT	**2.5 HEAT TREATMENT**
2.5.1 PREHEATING a) Preheating may be employed during welding to assist in completion of the welded joint. 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. The Welding Procedure Specification for the material being welded shall specify the preheat temperature requirements. b) See minimum temperatures for preheating given in NBIC Part 3, Table 2.5.1 as a general	**2.5.1 PREHEATING** a) Preheating may be employed during ~~welding~~ use of a process to assist in completion of the ~~welded~~ joint. 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. The ~~Welding Procedure Specification~~ procedure specification for the material being ~~welded~~ joined shall specify the preheat temperature requirements. b) See minimum temperatures for preheating

guide. It is cautioned that the preheating temperatures listed do not necessarily ensure satisfactory completion of the welded joint. Requirements for individual materials within the P-Number listing may have preheating requirements more or less restrictive than this general guide. When reference is made in this section to materials by the ASME designation, P-Number and Group Number, the suggestions of this section apply to the applicable materials of the original code of construction, either ASME or other, which conform by chemical composition and mechanical properties to ASME materials having the ASME P-Number and Group Number designations.	given in NBIC Part 3, Table 2.5.1 as a general guide. It is cautioned that the preheating temperatures listed may not be the same as those of the original code of construction and do not necessarily ensure satisfactory completion of the ~~welded~~ joint. Requirements for individual materials within the P-Number listing may have preheating requirements more or less restrictive than this general guide. When reference is made in this section to materials by the ASME designation, P-Number and Group Number, the suggestions of this section apply to the applicable materials of the original code of construction, either ASME or other, which conform by chemical composition and mechanical properties to ASME materials having the ASME P-Number and Group Number designations.
TABLE 2.5.1 MINIMUM TEMPERATURES FOR PREHEATI	No change to this Table.
2.5.2 POSTWELD HEAT TREATMENT (PWHT) a) Postweld heat treatment shall be performed as required by the original code of construction, the construction standard or code selected in accordance with a written procedure. The procedure shall contain the parameters for postweld heat treatment.	No change to this paragraph.
No additional changes for the remainder of Part 3 Section 2.	
PART 3, SECTION 9 REPAIRS AND ALTERATIONS—GLOSSARY OF TERMS **9.1 DEFINITIONS**	**PART 3, SECTION 9 REPAIRS AND ALTERATIONS—GLOSSARY OF TERMS** **9.1 DEFINITIONS**
	Add the following:
	Brazing – see Welding
	Fusing – see Welding
	Welding (Brazing, Fusing) – a group of processes which produce a localize coalescence of metal or nonmetal materials.

Repair Form Guides on Web – Hellman – 3-23-18

CODE REVISION AND ADDITION

Proposed Revisions or Additions

Proposing revision to Part 3, 5.12 by removing:

- the general instructions for completing all "R" Report forms in paragraph 5.12.4.1,
- the instructions for completing "NR" Report forms in paragraph 5.12.5.1, and
- the instructions for completing "NVR" Report forms in paragraph 5.12.6.1

Proposing revision to Part 3, by adding a new paragraph (5.13 – Instructions for Completing National Board Form "R", "NR", and "NVR" Reports) that would make reference to the National Board website for the latest revision and current instructions on completing each specific form.

Blank "R", "NR", and "NVR" forms can be left in place as "example forms", but the balloon numbers identifying each field within the forms are to be deleted.

The proposed text revision can be seen in the attached document: 2017NBICPart3 – R and NR Forms and Guides – Web Reference – Hellman – 3-23-18 (ATTACHMENT 1).

Statement of Need

Currently, instructions for completing all National Board "R" Reports are under a single paragraph (5.12.4.1). Due to revisions of specific forms, these general instructions no longer coincide with all intended report forms (R-1, R-2, R-3, and R-4).

Proposed addition of paragraph 5.13 will reference the National Board website for the instructions specific to each Report of Repair, as well as the instructions for "NR" and "NVR" forms. This will help ensure that the most current revision of all Report forms are used and completed correctly.

Background Information

A screen shot of the NBIC website with the specific instructions for reference is attached (ATTACHMENT 2).

A copy of the "GUIDE FOR COMPETING NATIONAL BAORD FORM R-2, REPORT OF ALTERATION" is attached as an example of the instructions available on the website (ATTACHMENT 3).

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

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

5.11 REMOVAL OF ORIGINAL STAMPING OR NAMEPLATE

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

5.12 REPAIR AND ALTERATION FORMS AND INSTRUCTIONS FOR COMPLETING FORMS

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

5.12.1 FORM R-1, *REPORT OF REPAIR*, see Pg. ~~89~~

5.12.2 FORM R-2, *REPORT OF ALTERATIONS*, see Pg. ~~91~~

5.12.3 FORM R-3, *REPORT OF PARTS FABRICATED BY WELDING*, see Pg. ~~93~~

5.12.4 FORM R-4, *REPORT SUPPLEMENTARY SHEET*, see Pg. ~~95~~

~~5.12.4.1 INSTRUCTIONS FOR COMPLETING NATIONAL BOARD FORM "R" REPORTS~~

~~These instructions are to be used when completing the National Board Form "R" Reports. When computer generated, the format of the form shall replicate the type and relative location of the information depicted on the Form "R" Reports shown in NBIC Part 3, 5.12.1 through 5.12.4.~~

~~1) The name and address of the "R" Certificate Holder performing the work as it appears on the "*Certificate of Authorization*". On a Form R-2, the organization that performed the design work will complete line 1a) and the organization completing the construction activities will complete line 1b).~~

~~2) When registering a Form "R" Report with the National Board, this line is solely designated for a unique sequential number assigned by the "R" Certificate Holder. When the "R" Form is not to be registered, indicate so by "N/A". As described in NBIC Part 3,5.6, a log shall be maintained identifying sequentially, any Form "R" registered with the National Board. For re-rating only, the Design Organization registers the Form R-2. Where physical work is also performed, the Construction Organization registers the Form R-2.~~

~~3) Name and address of the owner of the pressure-retaining item.~~

~~4) Name and address of plant or facility where the pressure-retaining item is installed.~~

~~5) Description of the pressure-retaining item, such as boiler or pressure vessel, or piping. Include the applicable unit identification.~~

~~6) Name of the original manufacturer of the pressure-retaining item. If the original manufacturer is unknown, indicate by, "unknown."~~

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

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

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

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

11) Indicate the name, section, division, edition, and addenda of the original code of construction for the pressure-retaining item. Also indicate the name, section, division, edition, and addenda of the construction code used for the work being performed. If code cases are used, they shall be identified in the "Remarks" section.

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

13) Indicate test pressure applied.

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

15) Indicate any additional information pertaining to the work involved (e.g., routine repairs, code cases). For Form R-3, the part manufacturer is to indicate the extent he has performed any or all of the design function. If only a portion of the design, state which portion.

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

17) Indicate National Board "R" Certificate or Authorization number.

18) Indicate month, day, and year that the "R" certificate expires.

19) Enter date certified.

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

21) Signature of authorized representative.

22) Type or print name of Inspector.

23) Indicate Inspector's Jurisdiction.

24) Indicate Inspector's employer.

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

26) Indicate month, day, and year of inspection by Inspector. In case of routine repairs this shall be the month, day, and year the Inspector reviews the completed routine repair package.

27) Signature of Inspector.

28) National Board commission number of Inspector, and when required by the Jurisdiction, the applicable State or Provincial numbers.

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

30) Document name of organization responsible for specifying the code design conditions, if known. If origin of design conditions are unknown, state "unknown."

31) Document name of organization responsible for performing the code design, if known. If code design organization is unknown, state "unknown."

32) Name, section, and division of the design code, if known. If the design is unknown, state "unknown"

33) Indicate code edition year used for fabrication.

34) Indicate code addenda date used for fabrication.

35) Indicate the code paragraph reference for formula used to establish the MAWP, if known. If the code reference of the formula is unknown, state "unknown."

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

37) Indicate quantity of named parts.

38) Match line number references for identification of parts and description of parts.

39) Indicate manufacturer's serial number for the named part.

40) Indicate drawing number for the named part.

41) Indicate maximum allowable working pressure for the part, if known.

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

43) Indicate the complete material specification number and grade.

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

45) Indicate shape as fat, dished, ellipsoidal, or hemispherical.

46) Indicate minimum thickness after forming.

47) Indicate outside diameter.

48) Indicate minimum thickness of tubes.

49) Complete information identical to that shown on the Form "R" to which this sheet is supplementary.

50) Indicate the Form "R" type. Example: Form R-1, Form R-2, Form R-3.

51) Indicate the reference line number from the Form R to which this sheet is supplementary.

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

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

54) Indicate the maximum allowable working pressure of the pressure-retaining item.

55) Indicate the type of repair, e.g., welded, graphite pressure equipment, or fiber-reinforced plastic pressure equipment.

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

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

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

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

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

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

2) Indicate NR Form Registration Number.

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

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

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

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

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

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

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

10) Organization having responsibility for design when there is a change from the original design specification.

11) Identify code edition/addenda used for design, when applicable.

12) Check the type of test conducted (e.g., hydrostatic, pneumatic, system leakage, exempt, or other) and indicate the pressure applied when applicable.

13) Indicate the number of components where work was performed. Each component shall be indicated on page 2 of the form NR-1.

14) Provide a detailed summary describing the scope of work completed. Information to be considered should include type of work (welding, brazing, fusing), location, steps taken for removal or acceptance

of defects, examinations, testing, heat treat, and other special processes or methods utilized. If Necessary, attach additional data, sketch, drawing, Form R-4, etc. In the remarks section state if additional data is attached.

15) Indicate any additional information pertaining to the work, including manufacturer's data reports.

16) Number in sequence beginning with No. 1 to identify each component work was performed. This number may be used to correspond with the detailed description of work performed.

17) Identify the type of item. i.e. piping, pump, valve, etc.

18) Identify the manufacturer's name of component.

19) Identify the manufacturer's serial no. or other assigned number for traceability.

20) Identify the National Board registration number, if previously assigned.

21) Identify the code class criteria, as assigned for each component.

22) Identify the code section used to perform work.

23) Identify Code section year and/or addenda used to perform work.

24) Identify any code cases used for work performed.

25) Identify any revisions to be made to the design specifications or if any design reconciliations were performed.

26) Type or print name of authorized representative from the certificate holder.

27) Name of the organization that performed the identified work, using the full name as shown on the *Certificate of Authorization,* or an abbreviation acceptable to the National Board.

28) Indicate code section as applicable to the repair/replacement activity and/or re-rating activity performed.

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

30) Indicate month, day, and year the certificate expires.

31) Signature of authorized representative from the NR certificate holder.

32) Indicate month, day and year of signature by the Authorized Representative

33) Title of authorized representative as defined in the Quality Program.

34) Type or print name of Authorized Nuclear Inspector.

35) Indicate the Jurisdiction where the activity is performed, when required.

36) Indicate Authorized Nuclear Inspector's employer.

37) Indicate month, day, and year of inspection by the Authorized Nuclear Inspector.

38) Signature of Authorized Nuclear Inspector.

39) Indicate month, day, and year of signature by the Authorized Nuclear Inspector.

40) National Board Commission number and required endorsements.

5.12.6 FORM NVR-1, *NUCLEAR PRESSURE RELIEF DEVICES,* SEE PG. 99

~~5.12.6.1 GUIDE FOR COMPLETING NATIONAL BOARD FORM NVR-1 REPORT OF REPAIR/REPLACEMENT ACTIVITIES FOR NUCLEAR PRESSURE RELIEF DEVICES~~

~~This guide is to be used when completing the National Board Form NVR-1, Report of Repair/Replacement Activities for Nuclear Pressure Relief Devices. When computer generated, the format of the form shall replicate the type and relative location of the information depicted on the Form NVR-1, Report of Repair/Replacement Activities for Nuclear Pressure Relief Devices.~~

~~Title Block: Check type of activity, repair/replacement, as applicable~~.

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

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

~~2) Indicate NVR Form Registration Number.~~

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

~~4) Name and address of the organization for which the work was performed.~~

~~5) Name and address of the owner nuclear facility.~~

~~6) Name and address of the nuclear facility and, if applicable, identification of the unit.~~

~~7) Identify the edition, addenda, and as applicable, code cases of the code used for the inservice inspection activity.~~

~~8) Identify the edition, addenda, and as applicable, code cases of the code used for the repair/replacement activity.~~

~~9) Identify the NBIC edition used for the repair/replacement activity~~

~~10) Identify the organization responsible for design or design reconciliation, if applicable.~~

~~11) Indicate the set pressure of the valve.~~

~~12) Indicate the blowdown, if applicable, as a percentage of set pressure.~~

~~13) Indicate the location of testing.~~

~~14) Indicate medium (steam, air, etc.) used for the adjustment of the set pressure and, if applicable, blowdown.~~

~~15) Provide a detailed summary describing the scope of work completed. Information to be considered should include type of work (welding, brazing, fusing), location, steps taken for removal or acceptance of defects, examinations, testing, heat treat, and other special processes or methods utilized. If Necessary, attach additional data, sketch, drawing, Form R-4, etc. If additional data is attached, so state in the remarks section.~~

~~16) Indicate any additional information pertaining to the work, such as, additional documentation that is attached to this form to further support item 15.~~

~~17) Manufacturer's name of the affected item.~~

18) Describe the type of pressure relief device (e.g., safety valve, safety relief valve, pressure relief valve).

19) Manufacturer's serial number of the affected item.

20) National Board number, if applicable, of the affected item.

21) Indicate the service as steam, liquid, air/gas, etc.

22) Indicate the pressure relief device by inlet size, in inches.

23) Indicate the year the affected item was manufactured.

24) Indicate the name, section and division of the original construction code for the affected item.

25) Indicate the code class for the affected item as applicable, i.e. Class 1, 2 or 3.

26) Indicate the construction code edition for the affected item.

27) Indicate the construction code addenda, as applicable, for the affected item.

28) Indicate any applicable code cases used for manufacturing of the affected item.

29) Name of the replacement part.

30) Identifying number of the replacement part.

31) Number/quantity of each replacement part used.

32) Indicate the Serial number or other traceability used by the manufacturer of the replacement part.

33) Type or print name of authorized representative from the certificate holder.

34) Indicate code as applicable to the repair/replacement activity performed.

35) Indicate National Board *Certificate of Authorization* number, if applicable for the "VR" Stamp.

36) Indicate month, day, and year the certificate expires, if applicable for the "VR" Stamp.

37) Indicate National Board *Certificate of Authorization* number, if applicable for the "NR" Stamp.

38) Indicate month, day, and year the certificate expires, if applicable for the "NR" Stamp.

39) Signature of authorized representative from the certificate holder defined in item 27 above.

40) Indicate month, day, and year of signature by the authorized representative.

41) Title of authorized representative as defined in the Quality Program.

42) Type or print name of Authorized Nuclear Inspector.

43) Indicate the Jurisdiction where the activity is performed, when required.

44) Indicate Authorized Nuclear Inspector's employer.

45) Indicate address of Authorized Nuclear Inspector's employer (city and state or province).

46) Indicate month, day, and year of inspection by the Authorized Nuclear Inspector.

47) Signature of Authorized Nuclear Inspector defined in item 42 above.

48) Indicate month, day, and year of signature by the Authorized Nuclear Inspector.

49) National Board Commission number and required endorsements.

5.13 INSTRUCTIONS FOR COMPLETING NATIONAL BOARD FORM “R”, “NR”, and “NVR” REPORTS

The current National Board Form "R", “NR”, and “NVR” Reports, and the instructions for completing them, can be found on the National Board website: https://www.nationalboard.org. . When computer generated, the format of the form shall replicate the type and relative location of the information depicted on the example Form "R", “NR”, and “NVR” Reports shown in NBIC Part 3, 5.12.1 through 5.12.6.

THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS

NB-66, Rev. 14, (12/07/16)

FORM R-1 REPORT OF REPAIR

in accordance with provisions of the *National Board Inspection Code*

~~1~~ (Authorized Rep. initials)

~~2~~ (Inspectors initials)

~~3~~ (Form **"R"** Registration no.)

~~4~~ (P.O. no., job no., etc.)

1. WORK PERFORMED BY: ~~5~~ (name of repair organization)

(address)

2. OWNER: ~~6~~ (name)

(address)

3. LOCATION OF INSTALLATION: ~~7~~ (name)

(address)

4. ITEM IDENTIFICATION: ~~8~~ (boiler, pressure vessel, or piping) NAME OF ORIGINAL MANUFACTURER: ~~9~~

5. IDENTIFYING NOS: ~~10~~ (mfg. serial no.) ~~11~~ (National Board no.) ~~12~~ (jurisdiction no.) ~~13~~ (other) ~~14~~ (year built)

6. NBIC EDITION/ADDENDA: ~~15~~ (edition) (addenda)

Original Code of Construction for Item: ~~16~~ (name / section / division) (edition / addenda)

Construction Code Used for Repair Performed: ~~17~~ (name / section / division) (edition / addenda)

7. REPAIR TYPE: ~~18~~ ☐ welded ☐ graphite pressure equipment ☐ FRP pressure equipment ☐ DOT

8. DESCRIPTION OF WORK: (use Form R-4, if necessary) ☐ Form R-4, Report Supplementary Sheet is attached ☐ FFSA Form (NB-403) is attached

~~19~~

~~20~~ (Liquid, Pneumatic, Vacuum, Leak) Pressure Test, if applied ~~21~~ psi MAWP ~~22~~ psi

9. REPLACEMENT PARTS: (Attached are Manufacturer's Partial Data Reports or Form R-3's properly completed for the following items of this report):

(name of part, item number, data report type or certificate of Compliance, mfg's. name and identifying stamp)

~~23~~

10. REMARKS: ~~24~~

SECTION 5

THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS

NB-66, Rev. 14, (12/07/16)

3 (Form "R" Registration no.)

4 (P.O. no., job no., etc.)

CERTIFICATE OF COMPLIANCE

I, 25 _____, certify that to the best of my knowledge and belief the statements made in this report are correct and that all material, construction, and workmanship on this Repair conforms to the *National Board Inspection Code*. National Board "**R**" *Certificate of Authorization* No. 26 _____ expires on 27 _____, _____

Date 28 _____, 29 _____ Signed 30 _____

(name of repair organization) (authorized representative)

CERTIFICATE OF INSPECTION

I, 31 _____, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and certificate of competency, where required, issued by the Jurisdiction of 32 _____ and employed by 33 _____ of 34 _____ have inspected the work described in this report on 35 _____, _____ and state that to the best of my knowledge and belief, this work complies with the applicable requirements of the National Board Inspection Code. By signing this certificate, neither the undersigned nor my employer makes any warranty, expressed or implied, concerning the work described in this report. Furthermore, neither the undersigned nor my employer shall be liable in any manner for any personal injury, property damage, or loss of any kind arising from or connected with this inspection.

Date 36 _____ Signed 37 _____ 38 _____

(inspector) (National Board and Jurisdiction no. including endorsement)

THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS

NB-229, Rev. 8, (12/07/16)

FORM R-2 REPORT OF ALTERATION

in accordance with provisions of the *National Board Inspection Code*

(Authorized Rep. initials)

(Inspectors initials)

(Form **"R"** Registration no.)

(P.O. no., job no., etc.)

1a. DESIGN PERFORMED BY: _____
(name of "**R**" organization responsible for design)

(address)

1b. CONSTRUCTION PERFORMED BY: _____
(name of "**R**" organization responsible for construction)

(address)

2. OWNER OF PRESSURE RETAINING ITEM: _____
(name)

(address)

3. LOCATION OF INSTALLATION: _____
(name)

(address)

4. ITEM IDENTIFICATION: _____ NAME OF ORIGINAL MANUFACTURER: _____
(boiler, pressure vessel, or piping)

5. IDENTIFYING NOS: _____ _____ _____ _____ _____
(mfg. serial no.) (National Board no.) (jurisdiction no.) (other) (year built)

6. NBIC EDITION/ADDENDA: _____ _____
(edition) (addenda)

Original Code of Construction for Item: _____ _____
(name / section / division) (edition / addenda)

Construction Code Used for Alteration Performed: _____ _____
(name / section / division) (edition / addenda)

7a. DESCRIPTION OF DESIGN SCOPE: ☐ Form R-4, Report Supplementary Sheet is attached

7b. DESCRIPTION OF CONSTRUCTION SCOPE: ☐ Form R-4, Report Supplementary Sheet is attached

_____ Pressure Test, if applied _____ psi MAWP _____ psi

(Form **"R"** Registration no.)

(P.O. no., job no., etc.)

8. REPLACEMENT PARTS: (Attached are Manufacturer's Partial Data Reports or Form R-3's properly completed for the following items of this report):

(name of part, item number, data report type or Certificate of Compliance, mfg's. name and identifying stamp)

9. REMARKS:

DESIGN CERTIFICATION

I,_____, certify that to the best of my knowledge and belief the statements in this report are correct and that the Design Change described in this report conforms to the *National Board Inspection Code*. National Board "**R**" Certificate of Authorization No. _____ expires on _____

Date_____, _____ Signed _____
(name of design organization) (authorized representative)

CERTIFICATE OF DESIGN CHANGE REVIEW

I,_____, holding a valid Commission issued by The National Board of Boiler and Pressure Vessel Inspector and certificate of competency, where required, issued by the jurisdiction of_____ and employed by _____ of _____ have reviewed the design change as described in this report and state that to the best of my knowledge and belief such change complies with the applicable requirements of the *National Board Inspection Code*.

By signing this certificate, neither the undersigned nor my employer makes any warranty, expressed or implied, concerning the work described in this report. Furthermore, neither the undersigned nor my employer shall be liable in any manner for any personal injury, property damage or loss of any kind arising from or connected with this inspection.

Date_____ Signed_____ Commissions _____
(inspector) (National Board and jurisdiction no. including endorsement)

CONSTRUCTION CERTIFICATION

I,_____, certify that to the best of my knowledge and belief the statements in this report are correct and that all material, construction, and workmanship on this Alteration conforms to the National Board Inspection Code. National Board "**R**" Certificate of Authorization No._____ expires on _____

Date_____, _____ Signed _____
(name of alteration organization) (authorized representative)

CERTIFICATE OF INSPECTION

I,_____, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and certificate of competency, where required, issued by the Jurisdiction of_____ and employed by _____ of _____ have inspected the work described in this report on_____, _____ and state that to the best of my knowledge and belief, this work complies with the applicable requirements of the National Board Inspection Code. By signing this certificate, neither the undersigned nor my employer makes any warranty, expressed or implied, concerning the work described in this report. Furthermore, neither the undersigned nor my employer shall be liable in any manner for any personal injury, property damage, or loss of any kind arising from or connected with this inspection.

Date_____ Signed _____ _____
(inspector) (National Board and jurisdiction no. including endorsement)

THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS

NB-230, Rev. 4 (12/08/16)

FORM R-3 REPORT OF PARTS FABRICATED BY WELDING

in accordance with provisions of the *National Board Inspection Code*

(1) (Authorized Rep. initials)

(2) (Inspectors initials)

(3) (Form **"R-3"** Registration no.)

1. MANUFACTURED BY: (4) (name of "**NR**" certificate holder) (5) (P.O. no., job no., etc.)

(address)

2. MANUFACTURED FOR: (6) (name)

(address)

3. DESIGN CONDITION SPECIFIED BY: (7) CODE DESIGN BY: (8)

4. DESIGN CODE: (9) (10) (11) (12)

5. REPAIR/ALTERATION/MODIFICATION ACTIVITIES

Name of Part	Qty.	Line No.	Manufacturer's Identifying No.	Manufacturer's Drawing No.	MAWP	Shop Hydro PSI	Year Built
(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)

6. DESCRIPTION OF PARTS

	(a) Connections other than tubes			Heads or Ends			(b) Tubes		
Line No.	Size and Shape	Material Spec. No.	Thickness (in.)	Shape	Thickness (in.)	Material Spec. No.	Diameter (in.)	Thickness (in.)	Material Spec. No.
(15)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)

7. REMARKS: (30)

THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS

NB-230, Rev. 4 (12/08/16)

3
(Form **"R-3"** Registration no.)

5
(P.O. no., job no., etc.)

CERTIFICATE OF COMPLIANCE

I, 31 _____, certify that to the best of my knowledge and belief the statements made in this report are correct and that all material, fabrication, construction, and workmanship of the described parts conforms to the *National Board Inspection Code* and the standards of construction cited.

National Board "**R**" *Certificate of Authorization* No. 32 ___ expires on: _____ 33 , ___

Date 34 , _____ 35 _____ Signed 36 _____

(name of "R" Certificate holder) (Authorized Representative)

CERTIFICATE OF INSPECTION

I, 37 _____, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and certificate of competency, where required, issued by the Jurisdiction of 38 _____ and employed by 39 _____ of 40 _____ have inspected the part described in this report on 41 _____, _____ and state that to the best of my knowledge and belief the parts comply with the applicable requirements of the *National Board Inspection Code*.

By signing this certificate, neither the undersigned nor my employer makes any warranty, expressed or implied, concerning the work described in this report. Furthermore, neither the undersigned nor my employer shall be liable in any manner for any personal injury, property damage, or loss of any kind arising from or connected with this inspection.

Date 42 _____, _____ Signed 43 _____ Commissions 44 _____

(inspector) (National Board and jurisdiction No. including endorsement)

THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS

NB-231, Rev. 3, (12/08/16)

FORM R-4 REPORT SUPPLEMENT SHEET

in accordance with provisions of the *National Board Inspection Code*

1 (form "R" referenced)

2 (P.O. no., job no., etc.)

1. WORK PERFORMED BY: 3 (name)

(address)

2. OWNER: 4 (name)

(address)

3. LOCATION OF INSTALLATION: 5 (name)

(address)

REFERENCE LINE NO. CONTINUED FROM FORM R– 6

7	8

Date 9 , Signed 10 (authorized representative) Name 11 (Name of "R" certificate holder)

Date 12 , Signed 13 (inspector) Commissions 14 (National Board and jurisdiction no. including endorsement)

THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS

NB-81, Rev. 8, (03/30/17)

FORM NR-1, REPORT OF REPAIR/REPLACEMENT ACTIVITIES FOR NUCLEAR FACILITIES

CATEGORY OF ACTIVITY: 1 ☐ 2 ☐ 3 ☐

☐ REPAIR/REPLACEMENT ☐ RE-RATING

~~2~~ (NR Form Registration No.)

~~3~~ (R/R Plan No., Job No., etc.)

1. WORK PERFORMED BY: ~~1~~
(name of "NR" certificate holder)

(address)

2. OWNER: ~~4~~
(name)

(address)

3. NAME, ADDRESS, AND IDENTIFICATION OF NUCLEAR FACILITY:

~~5~~
(name)

(address)

(unit identification)

4. SYSTEM/COMPONENT: ~~6~~ ORIGINAL DESIGN SPECIFICATION NO./REV.: ~~7~~

5. CONSTRUCTION CODE, SECTION & EDITION/ADDENDA AND APPLICABLE CODE CASES USED FOR THE SYSTEM OR COMPONENT:
~~8~~

6. NBIC EDITION USED FOR PERFORMING REPAIRS/REPLACEMENT OR RE-RATING ACTIVITY: ~~9~~

7. DESIGN RESPONSIBILITY: ~~10~~ CODE ED/AD: ~~11~~

8. TESTS CONDUCTED: ☐ Hydrostatic ☐ Pneumatic ☐ System Leakage ☐ Pressure _____ psi (MPa)
~~12~~ ☐ Exempt ☐ Other _____

9. NUMBER OF COMPONENTS REPAIRED/REPLACED AND/OR RE-RATED (refer to page 2): ~~13~~

10. DESCRIPTION OF WORK (use of properly identified additional sheet[s] or sketch[es] is acceptable):
~~14~~

11. REMARKS: ~~15~~

THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS

NB-81, Rev. 8, (03/30/17)

2 (NR Form Registration No.)

3 (R/R Plan No., Job No., etc.)

WORK PERFORMED BY:

1

(Name of "**NR**" certificate holder)

(Address of "**NR**" certificate holder)

COMPONENT IDENTIFICATION

No.	Type of Item	Mfg. Name	Serial No.	Nat'l Bd No.	Code Class	Code Section	Year/ Addenda	Code Case	Revised Design Specification No./Rev. or Design Reconciliation No./Rev.
16	17	18	19	20	21	22	23	24	25

ATTACHMENT 1 - Page 18 of 22

(**NR** Form Registration No.)

(R/R Plan No., Job No., etc.)

CERTIFICATE OF COMPLIANCE

I, 26 _____, employed by 27 _____

certify that to the best of my knowledge and belief the statements made in this report are correct and the repair/replacement activities or re-rating described above conform to 28 _____ and the *National Board Inspection Code* "**NR**" rules.

National Board *Certificate of Authorization* No. 29 _____ Expiration date: 30 _____

Signed: 31 _____ Date: 32 _____

Title: 33 _____
(authorized representative)

CERTIFICATE OF INSPECTION

I, 34 _____, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and certificate of competency, where required, issued by the Jurisdiction of 35 _____ and employed by 36 _____ have inspected the repair/replacement and/or re-rating activities described in this report on 37 _____ and state that to the best of my knowledge and belief, these activities have been completed in accordance with the Code specified and the *National Board Inspection Code* "**NR**" rules.

By signing this certificate, neither the undersigned nor my employer makes any warranty, expressed or implied, concerning the work described in this report. Furthermore, neither the undersigned nor my employer shall be liable in any manner for any personal injury, property damage, or loss of any kind arising from or connected with this inspection.

Signed: 38 _____ Date: 39 _____ Commissions 40 _____
(inspector) (National Board and endorsement)

THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS

NB-160, Rev. 8, (03/30/17)

FORM NVR-1, REPORT OF REPAIR/REPLACEMENT ACTIVITIES FOR NUCLEAR PRESSURE RELIEF DEVICES

2 (**NVR** Form Registration No.)

3 (R/R Plan No., Job No., etc.)

CATEGORY OF ACTIVITY: 1 ☐ 2 ☐ 3 ☐

☐ REPAIR/REPLACEMENT ☐ RE-RATING

1. WORK PERFORMED BY: 1 (name of "**NVR**" authorized organization)

(address)

2. WORK PERFORMED FOR: 4 (name)

(address)

3. OWNER: 5 (name)

(address)

4. NAME, ADDRESS, AND IDENTIFICATION OF NUCLEAR FACILITY: 6 (name)

(address)/ (unit identification)

5. CODE APPLICABLE FOR INSERVICE INSPECTION: 7 (edition) (addenda) (code case(s))

6. CODE USED FOR REPAIR/REPLACEMENT ACTIVITY: 8 (edition) (addenda) (code case(s))

7. NBIC USED FOR REPAIR/REPLACEMENT ACTIVITY: 9 (edition)

8. DESIGN RESPONSIBILITY: 10

9. **REPAIRED PRESSURE RELIEF DEVICE: SEE PAGE 2**

10. OPENING PRESSURE: 11 BLOWDOWN (if applicable): 12

11. SET PRESSURE AND BLOWDOWN ADJUSTMENT MADE AT: 13 USING: 14

12. DESCRIPTION OF WORK: (include name and identifying number of replacement parts):

15

12. REMARKS: 16

SECTION 5

The National Board of Boiler and Pressure Vessel Inspectors

NB-160, Rev. 8, (03/30/17)

(2)
(**NR** Form Registration No.)

(3)
(R/R Plan No., Job No., etc.)

WORK PERFORMED BY:

(1)
(Name of "**NR**" certificate holder)

(Address of "**NR**" certificate holder)

PRESSURE RELIEF DEVICE

Name of Mfg.	Type	Mfg. Serial No.	Nat'l Bd No.	Service	Size	Year Built
(17)	(18)	(19)	(20)	(21)	(22)	(23)

CONSTRUCTION CODE

Section	Class	Edition	Addenda	Code Case(s)
(24)	(25)	(26)	(27)	(28)

NAME AND IDENTIFYING NUMBER OF REPLACEMENT PARTS

No.	Part Name	Part Number	Quantity	Serial Number/Traceability No.
1.	(29)	(30)	(31)	(32)
2.				
3.				
4.				
5.				
6.				
7.				

ATTACHMENT 1 - Page 21 of 22

(form "**NVR**" registration no.)

(R/R Plan No., Job No., etc.)

CERTIFICATE OF COMPLIANCE

I, (33) _____, certify that to the best of my knowledge and belief the statements made in this report are correct and the repair/replacement of the pressure relief devices described above conform to (34) _____ and the *National Board Inspection Code* "**VR**" & "**NR**" rules.

National Board *Certificate of Authorization* No. (35) _____ to use the "**VR**" stamp expires (36) _____

National Board *Certificate of Authorization* No. (37) _____ to use the "**NR**" stamp expires (38) _____

Date (39) _____ Signed (40) _____ (41) _____

(authorized representative) (title)

CERTIFICATE OF INSPECTION

I, (42) _____, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and certificate of competency, where required, issued by the Jurisdiction of (43) _____ and employed by (44) _____ of (45) _____ have inspected the repair/replacement described in this report on (46) _____ and state that to the best of my knowledge and belief, this repair/replacement has been completed in accordance with the Code specified and the *National Board Inspection Code* "**VR**" & "**NR**" rules.

By signing this certificate, neither the undersigned nor my employer makes any warranty, expressed or implied, concerning the repair/replacement described in this report. Furthermore, neither the undersigned nor my employer shall be liable in any manner for any personal injury, property damage, or loss of any kind arising from or connected with this inspection.

Signed (47) _____ Date (48) _____ (49) _____

(inspector) (National Board and endorsement)

SECTION 5

ATTACHMENT 2

Online Ordering

- ASME BPV Manufacturers' Data Reports - Ordering Information
- NBIC Report Forms

National Board Inspection Code Report Forms

The National Board recommends the Electronic Data Transfer (EDT) system for the completion and registration of data report forms. It is an interactive document management system that both simplifies and expedites the process of registering data reports, conveniently accomplished through the Internet. The entire process is completed electronically with just a few clicks of a button. The NBIC R-1 and R-2 forms are available through EDT.

The following forms are available in .PDF format for downloading. Forms marked with an asterick (*) are .PDF fillable.

2017 R-1 Form* NB-66, *Report of Repair* Available Through EDT 2017 Sample Form R-1 with Guide for Completion 2015 R-1 Form* 2015 Sample Form R-1 with Guide for Completion	**2017 R-3 Form*** NB-230, *Report of Parts Fabricated by Welding* 2017 Sample Form R-3 with Guide for Completion 2015 R-3 Form* 2015 Sample Form R-3 with Guide for Completion
2017 R-2 Form* NB-229, *Report of Alteration* Available Through EDT 2017 Sample Form R-2 with Guide for Completion 2015 R-2 Form* 2015 Sample Form R-2 with Guide for Completion	**2017 R-4 Form*** NB-231, *Report Supplementary Sheet* 2017 Sample Form R-4 with Guide for Completion 2015 R-4 Form* 2015 Sample Form R-4 with Guide for Completion

Linked document is ATTACHEMENT 3

NR-1 Form* NB-81, *Report of Repair/Replacement Activities for Nuclear Facilities* Sample Form NR-1 with Guide for Completion	**NVR-1 Form*** NB-160, *Report of Repair/Replacement Activities for Nuclear Pressure Relief Devices* Sample Form NVR-1 with Guide for Completion

GUIDE FOR COMPLETING NATIONAL BOARD FORM R-2, REPORT OF ALTERATION

This guide is to be used when completing the National Board Form R-2, Report of Alteration. When computer generated, the format of the form shall replicate the type and relative location of the information depicted on the Form R-2, Report of Alteration.

When additional space is needed, a Form R-4 shall be used and attached. Information determined to be of a proprietary nature need not be included, but shall be stated on the form.

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

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

3) When registering a Form "R" Report with the National Board, this line is solely designated for a unique sequential number assigned by the "R" Certificate Holder. When the "R" Form is not to be registered, indicate so by "N/A". As described in NBIC Part 3, Paragraph 5.6, a log shall be maintained identifying unique and sequentially numbered Form "R" reports that are registered with the National Board. For re-rating only, the Design Organization registers the Form R-2.

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

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

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

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

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

9) Description of the pressure-retaining item, such as boiler, pressure vessel, or piping.

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

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

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

13) Record the Jurisdiction Number, if available.

14) Document any other unique number assigned to the pressure retaining item such as a unique number assigned by the owner or user. If unknown, state "unknown."

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

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

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

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

19) Provide a detailed summary of the scope of design that was performed.

20) The information to be considered when describing the scope of work should include such items as, the nature of the alteration (i.e. welding, bonding, cementing), the specific location of the work performed to the pressure-retaining item, the steps taken to remove a defect or as allowed by NBIC Part 3, Paragraph 3.4.8 to remain in place, and the method of alteration described as listed in the examples of NBIC Part 3, Section 3 or applicable supplement.

21) Indicate the type of Pressure test performed (Liquid, Pneumatic, Vacuum)

22) Indicate test pressure applied.

23) Indicate the maximum allowable working pressure of the part. (As altered)

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

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

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

27) Indicate National Board "R" Certificate or Authorization number.

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

29) Indicate the date the alteration was certified.

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

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

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

33) Indicate the Inspector's Jurisdiction.

34) Indicate the Inspector's employer; also indicate the address of the Inspector's employer (city and state or province).

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

36) Signature of the Inspector certifying the design review.

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

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

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

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

41) Indicate the date the alteration was certified.

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

43) Signature of National Board "R" Certificate of Authorization authorized representative

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

45) Indicate the Inspector's Jurisdiction.

46) Indicate the Inspector's employer; also indicate the address of the Inspector's employer (city and state or province).

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

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

49) Signature of the Inspector certifying the construction inspection.

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

FORM R-2 REPORT OF ALTERATION

in accordance with provisions of the *National Board Inspection Code*

(1) (Authorized Rep. initials)

(2) (Inspectors initials)

(3) (Form "**R**" Registration no.)

1a. DESIGN PERFORMED BY: (5) (name of "**R**" organization responsible for design)

(P.O. no., job no., etc.)

(address)

1b. CONSTRUCTION PERFORMED BY: (6) (name of "**R**" organization responsible for construction)

(address)

2. OWNER OF PRESSURE RETAINING ITEM: (7) (name)

(address)

3. LOCATION OF INSTALLATION: (8) (name)

(address)

4. ITEM IDENTIFICATION: (9) (boiler, pressure vessel, or piping) NAME OF ORIGINAL MANUFACTURER: (10)

5. IDENTIFYING NOS: (11) (mfg. serial no.) (12) (National Board no.) (13) (jurisdiction no.) (14) (other) (15) (year built)

6. NBIC EDITION/ADDENDA: (16) (edition) (addenda) (11)

Original Code of Construction for Item: (17) (name / section / division) (edition / addenda)

Construction Code Used for Alteration Performed: (18) (name / section / division) (edition / addenda)

7a. DESCRIPTION OF DESIGN SCOPE: ☐ Form R-4, Report Supplementary Sheet is attached

(19)

7b. DESCRIPTION OF CONSTRUCTION SCOPE: ☐ Form R-4, Report Supplementary Sheet is attached

(20)

(21) Pressure Test, if applied (22) psi MAWP (23) psi

(3) _____
(Form "R" Registration no.)

(4) _____
(P.O. no., job no., etc.)

8. REPLACEMENT PARTS: (Attached are Manufacturer's Partial Data Reports or Form R-3's properly completed for the following items of this report):

_____
(name of part, item number, data report type or Certificate of Compliance, mfg's. name and identifying stamp)

(24) _____

_____

_____

9. REMARKS: (25) _____

_____

_____

Design Certification

I, (26) _____, certify that to the best of my knowledge and belief the statements in this report are correct and that the Design Change described in this report conforms to the *National Board Inspection Code*. National Board "**R**" Certificate of Authorization No. (27) _____ expires on (28) _____

Date (29) _____, (30) _____ Signed (31) _____
(name of design organization) (authorized representative)

certificate of design change review

I, (32) _____, holding a valid Commission issued by The National Board of Boiler and Pressure Vessel Inspector and certificate of competency, where required, issued by the jurisdiction of (33) _____ and employed by (34) _____ of _____

have reviewed the design change as described in this report and state that to the best of my knowledge and belief such change complies with the applicable requirements of the *National Board Inspection Code*.

By signing this certificate, neither the undersigned nor my employer makes any warranty, expressed or implied, concerning the work described in this report. Furthermore, neither the undersigned nor my employer shall be liable in any manner for any personal injury, property damage or loss of any kind arising from or connected with this inspection.

Date (35) _____ Signed (36) _____ Commissions (37) _____
(inspector) (National Board and jurisdiction no. including endorsement)

CONSTRUCTION CERTIFICATION

I, (38) _____, certify that to the best of my knowledge and belief the statements in this report are correct and that all material, construction, and workmanship on this Alteration conforms to the National Board Inspection Code. National Board "**R**" Certificate of Authorization No. (39) _____ expires on (40) _____

Date (41) _____, (42) _____ Signed (43) _____
(name of alteration organization) (authorized representative)

CERTIFICATE OF INSPECTION

I, (44) _____, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and certificate of competency, where required, issued by the Jurisdiction of (45) _____ and employed by (44) _____ of (44) _____

have inspected the work described in this report on (46) _____, (47) _____ and state that to the best of my knowledge and belief, this work complies with the applicable requirements of the National Board Inspection Code. By signing this certificate, neither the undersigned nor my employer makes any warranty, expressed or implied, concerning the work described in this report. Furthermore, neither the undersigned nor my employer shall be liable in any manner for any personal injury, property damage, or loss of any kind arising from or connected with this inspection.

Date (48) _____ Signed (49) _____ (50) _____
(inspector) (National Board and jurisdiction no. including endorsement)

New Item: 18-50

Statement of Need, The NBIC Part 3 only allows the use of VT for routine repairs, (see NBIC Part 3, 4.4.1 e)). Section S2.10 does refer you to this paragraph, however says VT "as necessary to ensure satisfactory welded repairs have been accomplished.

For clarity I recommend the following change to NBIC Part 3, S2.11 a)

a) The Inspector may require nondestructive examination such as ~~(~~RT, PT, MT, and UT~~, and VT)~~ as necessary to ensure satisfactory welded repairs have been accomplished.

We have found that in many cases people will read the paragraph and not go read all referenced sections, thus causing unacceptable NDE to be performed.

Request for NBIC Part 3, Revision to definition of "Jurisdiction"

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Purpose	Revise the definition of "Jurisdiction" in the NBIC.
Scope:	Revision to the glossary of Parts 1-4 of the NBIC to have the definition of "Jurisdiction" revised.
Background:	The first sentence in the current definition does not include non-members jurisdictions. The second sentence refers to jurisdictional involvement in reviews, and is not relevant to the definition of "jurisdiction".
Proposed Revision:	See below:

CURRENT DEFINITION	PROPOSED DEFINITION
Jurisdiction — The National Board member Jurisdiction where the organization is located. Alternatively, where the Jurisdiction elects not to perform the review or where there is no Jurisdiction or where the Jurisdiction is the organization's Authorized Inspection Agency, The National Board of Boiler and Pressure Vessel Inspectors will represent the Jurisdiction. At the Jurisdiction's discretion, the Jurisdiction may choose to be a member of the review team if the Jurisdiction chooses not to be the team leader.	**Jurisdiction** — A governmental entity with the power, right, or authority to interpret and enforce law, rules, or ordinances pertaining to boilers, pressure vessels, or other pressure-retaining items where the pressure retaining item is installed. It includes National Board member jurisdictions defined as "jurisdictional authorities". Where there is no National Board Member Jurisdiction, the National Board shall act on behalf of the Jurisdiction.