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

NATIONAL BOARD SUBGROUP FRP

MINUTES

Meeting of October 17th, 2016
Las Vegas, NV

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The National Board of Boiler & Pressure Vessel Inspectors
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1. Call to Order

Chair Bernie Shelley called the meeting to order at 1:17pm local time.

2. Introduction of Members and Visitors

All members and visitors in attendance introduced themselves. An attendance sheet was signed by all in attendance. (Attachment Page 1-2)

3. Announcements

Chair Bernie Shelley and Secretary Brad Besserman reviewed the items relating to FRP that were approved by the subgroup for the 2017 edition of the NBIC. Items NB15-2201 and NB16-0808 were approved by the subgroup, subcommittee and Main Committee, and will be included in the 2017 edition of the NBIC.

4. Adoption of the Agenda

Mr. Doug Eisberg requested that a new discussion topic be added to the agenda on inservice inspection of FRP vessels coated with putty. The agenda was approved as modified by a unanimous vote of the committee.

5. Approval of the Minutes of April 2016 Meeting

The minutes of the April 2016 meeting were approved by a unanimous vote of the committee.

6. Action Items

Item Number: NB11-1901	NBIC Location: Part 1	Attachment Pages 3-6
General Description: Add guidance for the safe installation of high pressure composite pressure vessels operating in close proximity to the public		
Subgroup: FRP		
Task Group: D. Keeler (PM)		
Meeting Action: Mr. Dale Keeler presented a modified proposal for this item. He expressed that the new proposal addressed comments from a previously disapproved ballot to SC Installation. The committee requested this item be sent to letter ballot prior to the next meeting.		

Item Number: NB15-2202	NBIC Location: Part 1	Attachment Pages 7-9
General Description: Add checklist for the safe installation of high pressure composite pressure vessels operating in close proximity to the public		
Subgroup: FRP		
Task Group: D. Keeler (PM)		
Meeting Action: Mr. Dale Keeler presented the draft for the installation checklist which had not been modified since the April 2016 meeting. The committee requested this item be sent to letter ballot prior to the next meeting.		

Item Number: NB16-1401	NBIC Location: Part 2, S10	No Attachment
General Description: Revise and update Supplement 10 on Inspection of CRPVs		
Subgroup: FRP		
Task Group: N. Newhouse (PM)		
Meeting Action: Mr. Norm Newhouse was not present at the meeting to give an update on this item. A proposal will be ready for the next meeting.		

Item Number: NB16-1402	NBIC Location: Part 3	No Attachment
General Description: Life extension for high pressure vessels above vessel life		
Subgroup: FRP		
Task Group: M. Gorman (PM);		
Meeting Action: Mr. Mike Gorman requested guidance on how to move forward on this item. He explained an outline for the proposal, which had been reviewed by the committee at the April 2016 meeting. The committee requested Mr. Gorman prepare a proposal for the next meeting based on his outline.		

Item Number: NB16-1403	NBIC Location: Part 3, S4	No Attachment
General Description: Add information on repair of high pressure vessels		
Subgroup: FRP		
Task Group:		
Meeting Action: Mr. Neel Sirosh was not present at this meeting or the previous three meetings, so Mr. Norm Newhouse was assigned as the new project manager. A proposal will be prepared for the next meeting of the subgroup.		

7. Additional Business

Mr. Doug Eisberg discussed a concern that in-service inspection of FRP vessels is impossible when putty has been added to the exterior of the vessel. After discussion, the committee requested that Mr. Shelley and Mr. Besserman send a formal letter to the secretary of the ASME Section X Committee for review of putty/paint requirements of FRP vessels, due to the complications they create with inservice inspection.

8. Future Meetings

April 24, 2017 – San Juan, Puerto Rico

October 2017 – Las Vegas, NV

9. Adjournment


Chair Mr. Bernie Shelley adjourned the meeting at 2:11pm local time.

Respectfully submitted,




Brad Besserman
NBIC Secretary


NBIC Subgroup FRP Meeting Attendance - 10/17/2016				
Name	Company	Phone Number	Email	Signature
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Brad Besserman	National Board	(614) 431-3236	bbesserman@nationalboard.org	
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Doug Eisberg	Avista Technologies	(760) 744-0536	deisberg@avistatech.com	
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Draft 16-09-1

NB11-1901

S3.0 Installation of High Pressure Composite Pressure Vessels

At the time of vessel installation, the current edition of all referenced documents shall apply.

S3.1 Scope

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

- a) Metallic vessel with a Fiber Reinforced Plastic (FRP) hoop wrap over the shell part of the vessel (both load sharing)
- b) Metallic vessel with a full FRP wrap (both load sharing)
- c) FRP vessel with a non load sharing metallic liner
- d) FRP vessel with a non load sharing non metallic liner

S3.2 Supports

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

S3.3 Clearances

The pressure vessel installation shall allow sufficient clearance for normal operation, maintenance, and inspection. Stacking of pressure vessels is permitted. The minimum clear space between pressure vessels shall be 1 ft. vertical and 2 ft. horizontal. Vessel nameplates shall be visible after installation for inspection.

The location of vessels containing flammable fluids shall comply with NFPA [2, Table 7.3.2.3.1.2(a)] *Minimum Distance From Outdoor (GH₂) Systems to Exposures (U.S.Units)*. The vessel owner shall document the vessel pressure and pipe diameters used as a basis for compliance with NFPA 2 location requirements.

S3.4 Piping Loads

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

S3.5 Mechanical Connections

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

S3.6 Pressure Indicating Devices

Each pressure vessel shall be equipped with a pressure gage mounted on the vessel. The dial range shall be from 0 psi to not less than 1.25 times the vessel MAWP. The pressure gage shall have an opening not to exceed 0.055in (1.4mm) (No. 54 drill size) at the inlet connection. In addition, vessel pressure shall be monitored by a suitable remote pressure indicating device with alarm having an indicating range of 0 psi to not less than 1.25 times the vessel MAWP.

S3.7 Pressure Relief Devices

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

- a) Pressure relief devices shall be suitable for the intended service.
- b) Pressure relief devices are to be manufactured in accordance with a national or international standard and certified for capacity (or resistance to flow for rupture disk devices) by the National Board.
- c) Dead weight or weighted lever pressure relief valves are prohibited.
- d) Pressure relief valves shall not be fitted with lifting devices.
- e) The pressure relief device shall be installed directly on the pressure vessel with no isolation valves between the vessel and the pressure relief device except:
 - 1) when these isolation valves are so constructed or positively controlled below the minimum required capacity, that closing the maximum number of valves at one time will not reduce the pressure relieving capacity, or
 - 2) upon specific acceptance of the jurisdiction, an isolation valve between vessel and its pressure relief device may be provided for vessel inspection and repair only. The isolation valve shall be arranged so it can be locked or sealed open.

- f) The discharge from pressure relief device(s) shall be directed upward so as to prevent any impingement of escaping fluid upon the vessel, adjacent vessels, adjacent structures, or personnel. The discharge must be to outdoors, not under any structure or roof that might permit formation of a "cloud". The pressure relief device(s) discharge piping shall be designed so that it cannot become plugged by animals, rain water, or other materials.
- g) The pressure relief device(s) shall be set at a pressure not exceeding the MAWP of the vessel.
- h) The pressure relief device(s) shall have sufficient capacity to ensure the pressure vessel does not exceed the MAWP of that specified in the original code of construction.
- i) The owner shall document the basis for selection of the pressure relief device(s) used, including capacity.
- j) The owner shall have such analysis available for review by the jurisdiction.
- k) Pressure relief devices and discharge piping shall be supported so that reaction forces are not transmitted to the vessel.
- l) Heat detection system: a heat activated system shall be provided so that vessel contents will be vented per f) (above), if any part of the vessel is exposed to a temperature higher than 185 °F.
- m) Positive methods shall be incorporated to prevent overfilling of the vessel.

S3.8 Assessment of Installation

- a) Isolation valve(s) shall be installed directly on each vessel, but not between the vessel and the pressure relief device except as noted in 3.7, e), above.
- b) Vessels shall **not** be buried.
- c) Vessels may be installed in a vault subject to a hazard analysis, verified by the Authorized Inspector, or the jurisdiction, to include as a minimum the following:
 - 1) Ventilation
 - 2) Inlet and outlet openings
 - 3) Access to vessels
 - 4) Clearances
 - 5) Intrusion of ground water
 - 6) Designed for cover loads
 - 7) Explosion control
 - 8) Ignition sources
 - 9) Noncombustible construction
 - 10) Remote monitoring for leaks, smoke, and fire
 - 11) Remote controlled isolation valves

12) Other safety requirements

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

e) Installation locations shall provide the following:

1) Guard posts shall be provided to protect the vessels from vehicular damage per NFPA [2:4.14.1]. Protection from wind, seismic events, and other miscellaneous impacts shall be provided.

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

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

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

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

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

7) Completed installations shall be validated by the local jurisdiction or an Authorized Inspection Agency as addressing all of the above and jurisdictional requirements prior to first use. This verification shall include an itemized check list identifying all applicable areas and date of the inspection by authorized personnel. This verification shall be posted in a conspicuous location near the vessel and on file with the local jurisdiction. Certificates shall be updated as required by mandated subsequent inspections.

8) Piping installation shall comply with ASME B31.12 *Hydrogen Piping and Pipelines* or NFPA [2:7.1.15]

[2:7.3.1.2.5].

10) The vessels shall be electrically bonded and grounded per NFPA [55:10.2.6].

S3.9 Ladders and runways

A minimum of two exits shall be provided for each walkway or enclosed space. The distance from any point on the walkway to the nearest exit shall not exceed 75 ft.

S3.10 Guide for Developing an Installation Assessment Checklist

The following checklist lists most, but not necessarily all, items that should be reviewed at the time of vessel installation.

NB15-2202**High Pressure Vessel Installation Checklist (draft 4)**

Preface: This checklist is a guide to be used in preparation of formal installation inspection documents in conjunction with regulatory authorities.

1. Construction Code Compliance
 - a. Manufacturers data plate (record all information)
 - b. ASME Code with appropriate designator for the type of Construction
 - c. Capacity (when indicated on nameplate in water volume)
 - d. Manufactured date, expiration date, or/service life
2. Condition of tank - paint, signs
 - a. Condition of all painted surfaces
 - b. Visible damage per inspection guidelines ~ (scratches, gouges, impact, etc.)
 - c. Flammable warning signs
 - d. No smoking, welding, or open flame signs
 - e. Exterior protective barrier condition
3. Foundations / Supports per the jurisdiction building code
 - a. fire protection
 - b. painted metallic parts
 - c. anchoring / securing of supports
 - d. is support frame condition acceptable
 - e. are tanks installed on a firm foundation
4. Tank Connections / Fittings
 - a. Connections equipped with required correctly rated valves, (shut off valves, relief device, excess flow valve)

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- a. Remote operated emergency shut off or isolation valves
 - b. protected from damage
 - c. leak free
6. Gauges
- a. Dedicated pressure gauge for each tank.
 - b. Gauges in good condition, display ~ 1.25 x operating pressure
 - c. remote and local indicating gauges function
7. Pressure Relief Device(s)
- a. information legible
 - b. isolation valve between PRD and tank
 - c. pressure relief device is properly certified (ASME/NB)
 - d. discharge unobstructed
 - e. properly capped/protected to prevent entry of foreign material or objects
 - f. weep holes to drain moisture
 - g. free of corrosion
 - h. routine inspection and test documents (date and results)
8. Fence / Security
- a. Area properly secured
 - b. Limited / restricted access provided
 - c. Camouflaged
 - d. Properly protected from errant vehicle damage
 - e. Protection from vandalism (rifle shot, etc)
9. location and spacing of tanks
- a. proper tank spacing to allow inspection

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- b. proper tank spacing to allow for maintenance or replacement
- c. stacking does not exceed allowable limits
- 10. presence of combustible materials
 - area is free from combustible materials
- 11. vault installed tanks
 - a. non combustible construction
 - b. at least two points of access (entrance and egress)
 - c. secured against unauthorized entry
 - d. adequate ventilation
 - e. fire suppression
 - f. adequate access for inspection, maintenance, and replacement
 - g. Confined space signs (vault installation)
- 12. Shading
 - shade to prevent solar heating