

Date Distributed: 2016



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

# **NATIONAL BOARD SUBCOMMITTEE INSTALLATION**

## **MINUTES**

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Meeting of July 20th, 2016  
Columbus, OH

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

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

Chair, M. Richards, called the meeting to order at 8:00 a.m.

## **2. Introduction of Members and Visitors (Attachment Page 1)**

Introductions took place amongst all members and visitors and an attendance sheet was circulated for review and check off.

Mr. Gene Tompkins was in attendance as an alternate/backup for Mr. Geoffrey Halley.

With the attached roster a quorum was established. There was a motion to approve the roster as published with the noted alternate/backup. The motion was unanimously approved.

## **3. Announcements**

### **Weeks Activities / Events**

- A gift is being distributed for all committee members. See Brad.
- Tuesday – Thursday – Lunch provided.
- Wednesday Evening – Reception held at the National Board Pavilion – 5p.m.
- Thursday Morning – Breakfast provided – 7:00 a.m.
- Reminders announced – This is the last meeting to get items approved to be included in the 2017 Edition. Any item that is letter balloted will be considered for the 2019 Edition. It was also noted to continue to make use of breakout sessions.
- Presentations – WebEx training procedures will be presented in the SC meeting for disposition to public review comments and will be available on the cloud. Practice sessions will be held from 2-4 p.m. on September 22, 2016 and from 9-10 a.m. on September 23, 2016. Public Review Comment Resolution WebEx for the SC Installation will be held from 11 a.m.-1 p.m. on October 19, 2016. Approval of the final version to be published WebEx will be held December 7, 2016 at 1 p.m.

## **4. Adoption of the Agenda**

Task Group Member corrections as follows:

Remove on Action Items: NB12-0302 – K. Watson, NB14-0403 – K. Watson, NB15-0108 – P. Bourgeois

Add onto Action Items: NB15-0106 – R. Austin

New Action Items added as follows:

NB16-0806 (Scribner), NB16-0809c (Besserman), and NB16-1901 (Wadkinson)

There was a motion to adopt the Agenda as published with the additions/corrections. The motion was Unanimously approved.

## **5. Approval of the Minutes of January 13<sup>th</sup>, 2016 Meeting**

There was a motion to approve the Minutes of January 12, 2016 as published. The motion was unanimously approved.

## 6. Review of Rosters

### a. Membership Nominations

- Mr. Rex Smith would like to become a member of SG Installation. A vote will be taken. Any appointment is subject to the approval of the Chairman of the Board of Trustees. (Attachment Pages 2-6)
- Mr. Rex Smith would like to become a member of SC Installation. A vote will be taken. Any appointment is subject to the approval of the Chairman of the Board of Trustees. (Attachment Pages 2-6)

This is Mr. Smith's second meeting in attendance. This will be voted on, if in attendance, in the meeting to hold in January 2017.

There was a motion to approve the roster as published. The motion was unanimously approved.

### b. Membership Reappointments

- Mr. Eddie Wiggins is eligible for reappointment to SG Installation. A vote will be taken. Any appointment is subject to the approval of the Chairman of the Board of Trustees.

A majority vote was taken on the above and unanimously approved to reappoint accordingly.

## 7. Interpretations

There were no interpretations assigned to the Subcommittee on Installation

## 8. Action Items – Old Business

<b>Item Number: NB11-1901</b>	<b>NBIC Location: Part 1</b>	<b>No Attachment</b>
<b>General Description:</b> Add guidance for the safe installation of high pressure composite pressure vessels operating in close proximity to the public		
<b>Subgroup:</b> FRP		
<b>Task Group:</b> M. Richards (PM), S. Konopacki and D. Patten		
<b>Meeting Action:</b> M. Richards gave a progress report. Francis Brown spoke to the SC presenting an overview of the progress status.		

<b>Item Number: NB12-0302</b>	<b>NBIC Location: Part 1</b>	<b>No Attachment</b>
<b>General Description:</b> Add installation requirements for pressure vessels for human occupancy (PVHOs)		
<b>Subgroup:</b> Installation		
<b>Task Group:</b> B. Moore (PM), T. Creacy, <del>K. Watson</del> , T. Millette, M. Richards, <del>G. Scribner</del>		
<b>Meeting Action:</b> Remove K. Watson and G. Scribner from the TG. Nothing to report at this time.		

<b>Item Number: NB14-0403</b>	<b>NBIC Location: Part 1</b>	<b>No Attachment</b>
<b>General Description:</b> Identify terms from Part 1 that need to be added to the index		
<b>Subgroup:</b> Installation		
<b>Task Group:</b> B. Moore (PM), M. Richards, T. Creacy, <del>K. Watson</del> , M. Washington		
<b>Meeting Action:</b> Remove K. Watson from the TG. This is an ongoing item. A review of the index will be completed, as items are added, and will be communicated to Brad Besserman. As of present there is nothing to report.		

<b>Item Number: NB15-0106</b>	<b>NBIC Location: Part 1, 3.7.5.1</b>	<b>Attachment Pages 2-7</b>
<b>General Description:</b> Address Figure 3.7.5.1		
<b>Subgroup:</b> Installation		
<b>Task Group:</b> B. Moore (PM), T. Creacy, M. Washington, and <u>R. Austin</u>		
<b>Meeting Action:</b> Add R. Austin to the TG. In the SG meeting a working group met to discuss and prepare a proposal of editorial changes to figures 3.7.5.1 a, b, and c with regard to pressure controls (operating and high limit). The SG unanimously approved the proposal to the SC. The SC makes a motion to approve the proposal to the MC. The motion was unanimously approved.		

<b>Item Number: NB15-0108</b>	<b>NBIC Location: Part 1</b>	<b>No Attachment</b>
<b>General Description:</b> Add a supplement to address high temperature hot water boilers		
<b>Subgroup:</b> Installation		
<b>Task Group:</b> M. Wadkinson (PM) B. Moore, T. Creacy, D. Patten and <del>P. Bourgeois</del>		
<b>Meeting Action:</b> Remove P. Bourgeois from the TG. A breakout session was held amongst the SG. M. Wadkinson will reach out to the PRD group to put together a proposal to be presented in the January 2017 meeting to include a new paragraph be added to the Power Boilers Section for additional requirements for high temperature water boilers (feedwater, valves, PRD, expansion tank, safety valve discharge piping).		

<b>Item Number: NB15-2104</b>	<b>NBIC Location: Part 1, S3.6 d)</b>	<b>Attachment Pages 8-12</b>
<b>General Description:</b> General technical review of CO2 supplement in NBIC Part 1		
<b>Subgroup:</b> Installation		
<b>Task Group:</b> G. Scribner (PM), M. Richards, T. Creacy, J. Brockman, D. Patten		
<b>Meeting Action:</b> A breakout session was held amongst the SG. This item corresponds with Action Item NB16-0806. Mr. Scribner presented a proposal to figure S3.6.1-a, wording in S3.4, and Figure S3.5. The SG unanimously approved a revised proposal to the SC. The SC makes a motion to approve the revised proposal to the MC. The motion was unanimously approved.		

<b>Item Number: NB15-2202</b>	<b>NBIC Location: Part 1</b>	<b>No Attachment</b>
<p><b>General Description:</b> Add checklist for the safe installation of high pressure composite pressure vessels operating in close proximity to the public</p> <p><b>Subgroup:</b> FRP</p> <p><b>Task Group:</b> B. Moore (PM)</p> <p><b>Meeting Action:</b> M. Richards gave a progress report.</p>		

<b>Item Number: NB15-2209</b>	<b>NBIC Location: Part 1</b>	<b>No Attachment</b>
<p><b>General Description:</b> Develop guidance and requirements for installation of graphite pressure equipment</p> <p><b>Subgroup:</b> Graphite</p> <p><b>Task Group:</b> A. Stupica (PM)</p> <p><b>Meeting Action:</b> Francis Brown spoke to the SC presenting an overview of the progress status.</p>		

<b>Item Number: NB15-3301</b>	<b>NBIC Location: Part 1</b>	<b>Attachment Page 13</b>
<p><b>General Description:</b> Power boiler combustion air</p> <p><b>Subgroup:</b> Installation</p> <p><b>Task Group:</b> M. Wadkinson (PM), G. Halley, J. Brockman, T. Creacy, D. Patten</p> <p><b>Meeting Action:</b> M. Wadkinson presented a proposal to the SG. The SG unanimously approved a revised proposal to the SC. The SC makes a motion to approve the revised proposal to the MC. The motion was unanimously approved.</p>		

<b>Item Number: NB16-0101</b>	<b>NBIC Location: Part 1</b>	<b>No Attachment</b>
<p><b>General Description:</b> Result of NB13-1101, address carbon monoxide sensors in equipment rooms</p> <p><b>Subgroup:</b> Installation</p> <p><b>Task Group:</b> : <del>None assigned</del> <u>E. Wiggins (PM), D. Patten, G. Halley, S. Konopaki, T. Creacy, T. Millet, and G. Tompkins</u></p> <p><b>Meeting Action:</b> A TG was assigned to include E. Wiggins (PM), D. Patten, G. Halley, S. Konopaki, T. Creacy, T. Millet, and G. Tompkins. A breakout session was held amongst the SG. Mr. Trout lead discussions with regard to this topic and the rise in incidents. Mr. G. Halley, although not in attendance, did send his feedback to be shared with the SG of which M. Wadkinson commucated accordingly. The SG has agreed to do research, continue discussions and to possible generate a proposal of general wording ideas for a potential starting point.</p>		

<b>Item Number: NB16-0102</b>	<b>NBIC Location: Part 1</b>	<b>Attachment Pages 14-15</b>
<b>General Description:</b> Result of NB10-1201, address post installation pressure testing		
<b>Subgroup:</b> Installation		
<b>Task Group:</b> <del>None assigned.</del> <u>S. Konopacki (PM), E. Wiggins, P. Cole, R. Smith, M. Wadkinson, and D. Patten</u>		
<b>Meeting Action:</b> A TG was assigned to include S. Konopacki (PM), E. Wiggins, P. Cole, R. Smith, M. Wadkinson, and D. Patten. A working group met in the SG meeting to discuss and prepare a proposal. The SG unanimously approved the proposal to the SC. The SC makes a motion to approve the proposal to the MC. The motion was unanimously approved		

## 9. Action Items – New Business

<b>Item Number: NB16-0103</b>	<b>NBIC Location: Part 1</b>	<b>No Attachment</b>
<b>General Description:</b> Review footnote 1 in Part 1 for possible removal, review as a result of NB15-2303		
<b>Subgroup:</b> Installation		
<b>Task Group:</b> M. Washington (PM), T. Creacy		
<b>Meeting Action:</b> The SG reviewed a proposal submitted by Mr. Washington. After reviewing the proposal, it was determined that this is administrative/editorial in nature and will be forwarded to NB staff. The SG unanimously approved to close this item with no action required. The SC makes a motion to approve closing this item with no action required. The motion was unanimously approved.		

<b>Item Number: NB16-0801</b>	<b>NBIC Location: Part 1</b>	<b>Attachment Pages 16-17</b>
<b>General Description:</b> Is it standard operating procedure (per NBIC) to do hydrostatic pressure tests on installed ASME Section IV boilers at 150% of the rated pressure as part of the installation inspection?		
<b>Subgroup:</b> Installation		
<b>Task Group:</b> G. Scribner		
<b>Meeting Action:</b> A working group met to discuss and prepare a proposal. The SG reviewed, held discussions and revised the prepared proposal to close this action item to convert into an interpretation – IN16-0701 was assigned. There was a motion to approve IN16-0701 as revised to the SC. The SC makes a motion to approve the revised proposal of closing this action item to convert into an interpretation – IN16-0701 to the MC. The motion was unanimously approved.		

<b>Item Number: NB16-0804</b>	<b>NBIC Location: Part 1, 3.7.7.1</b>	<b>Attachment Page 18</b>
<b>General Description:</b> Update table with NPS/DN information, not in./mm		
<b>Subgroup:</b> Installation		
<b>Task Group:</b> G. Scribner		
<b>Meeting Action:</b> Mr. Scribner presented a proposal to Table 3.7.7.1. to switch over from in.(mm) to NPS (DN). The SG unanimously approved this proposal to the SC. The SC makes a motion to approve the proposal to the MC. The motion was unanimously approved.		

<b>Item Number: NB16-0805</b>	<b>NBIC Location: Part 1</b>	<b>No Attachment</b>
<b>General Description:</b> Update language about pipe material able to handle temperature requirements, in line with IMC		
<b>Subgroup:</b> Installation		
<b>Task Group:</b> G. Scribner, <a href="#">R. Smith, E. Wiggins, J. Brockman, M. Wadkinson and A. Renaldo</a>		
<b>Meeting Action:</b> Additional individuals were added to the TG to include R. Smith, E. Wiggins, J. Brockman, M. Wadkinson and A. Renaldo. A progress report was presented. A request is planned to be made to PRD to look at 2.9.6; 3.9.1.5; 4.5.6; S3.6; S5.7.6 suggesting that wording is added "All piping and fittings shall be rated for the pressure and temperature of the effluent and capable of performing its intended function."		

<b>Item Number: NB16-1201</b>	<b>NBIC Location: Part 1, Section 2 and 3</b>	<b>No Attachment</b>
<b>General Description:</b> Proper installation of CO monitors in equipment rooms		
<b>Subgroup:</b> Installation		
<b>Task Group:</b> M. Richards (PM), S. Konopacki and D. Patten		
<b>Meeting Action:</b> This item corresponds with action item NB16-0101. There was a motion to close this item with no action required. The motion was unanimously approved.		

<b>Item Number: NB16-1701</b>	<b>NBIC Location: Part 1</b>	<b>No Attachment</b>
<b>General Description:</b> High temp limit control clarification that the limit only needs to shut off fuel prior to max allowable temperature		
<b>Subgroup:</b> Installation		
<b>Task Group:</b> M. Wadkinson (PM)		
<b>Meeting Action:</b> This was addressed in the January 2016 meeting. There was a motion to close this item with no further action required. The motion was unanimously approved.		

<b>Item Number: NB16-1702</b>	<b>NBIC Location: Part 1, 3.8.1.5</b>	<b>Attachment Page 19</b>
<b>General Description:</b> Result of NB15-1302, update language regarding low water cutoffs to match NB15-1302		
<b>Subgroup:</b> Installation		
<b>Task Group:</b> M. Wadkinson (PM)		
<b>Meeting Action:</b> A proposal was presented. The SG unanimously approved the proposal to the SC. The SC makes a motion to approve the proposal to the MC. The motion was unanimously approved.		

**Items added**

<b>Item Number: NB16-0806</b>	<b>NBIC Location:</b>	<b>No Attachment</b>
<b>General Description:</b>		
<b>Subgroup:</b> Installation		
<b>Task Group:</b> G. Scribner (PM)		
<b>Meeting Action:</b> After reviewing, it was determined that this item is already handled under NB15-2104. There was a motion to close this item with no further action required. The motion was unanimously approved.		

<b>Item Number: NB16-0809c</b>	<b>NBIC Location:</b>	<b>Attachment Pages 20-22</b>
<b>General Description:</b>		
<b>Subgroup:</b> Installation		
<b>Task Group:</b> B. Besserman (PM)		
<b>Meeting Action:</b> A proposal was presented. The SG reviewed and held discussions on the prepared proposal. The TG revised the use of guidance verses guidelines. The SG unanimously approved revised proposal to the SC. The SC makes a motion to approve the proposal to the MC. The motion was unanimously approved.		

<b>Item Number: NB16-1901</b>	<b>NBIC Location:</b>	<b>No Attachment</b>
<b>General Description:</b>		
<b>Subgroup:</b> Installation		
<b>Task Group:</b> M. Wadkinson (PM)		
<b>Meeting Action:</b> After reviewing, it was determined that this item is already handled under NB16-1702. There was a motion to close this item with no further action required. The motion was unanimously approved.		



## 10. Future Meetings

January 9-12, 2017 – San Diego, California  
July 17-20, 2017 – Location TBD

## 11. Adjournment

Respectfully submitted,



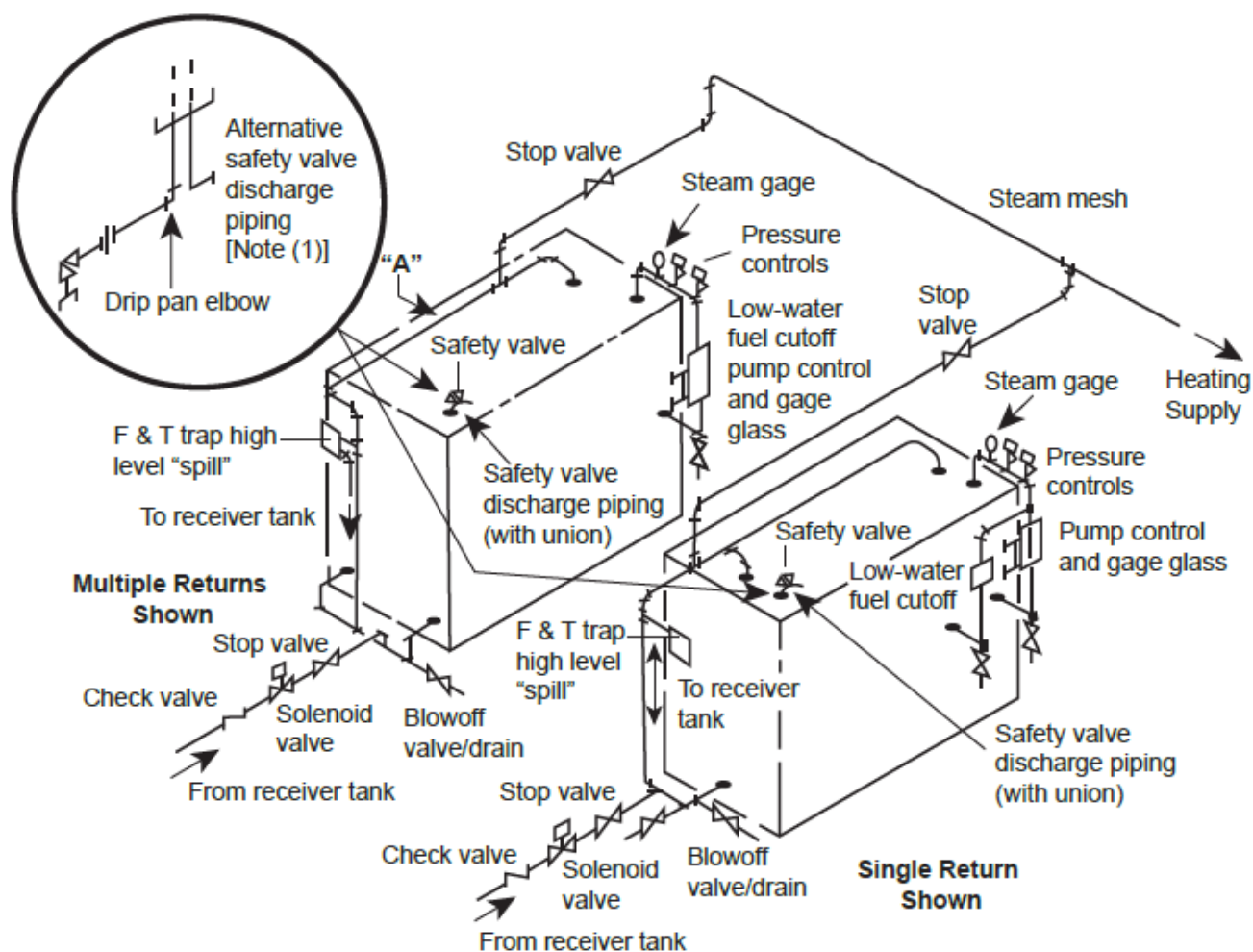
Brad Besserman  
NBIC Secretary

SC Installation Attendance Sheet - 7/20/16

Name	Company	Phone Number	Email	Signature	Attend Rec.?	Guest?
Mike Richards	Southern Company	(205) 992-7111	<a href="mailto:hmichaelrichards.pe@gmail.com">hmichaelrichards.pe@gmail.com</a>		✓	
Don Patten	Bay City Boiler	(510) 786-3711	<a href="mailto:dpatten@baycityboiler.com">dpatten@baycityboiler.com</a>		✓	
Jeanne Bock	National Board	(614) 431-3233	<a href="mailto:jbock@nationalboard.org">jbock@nationalboard.org</a>			
Geoffrey Halley	ABMA	(636) 394-3483	<a href="mailto:ghalleysj@aol.com">ghalleysj@aol.com</a>			
Stanley Konopacki	NRG Energy	(630) 771-7956	<a href="mailto:stanley.konopacki@nrgenergy.com">stanley.konopacki@nrgenergy.com</a> nrg.com		✓	
Brian Moore	Hartford Steam Boiler	(860) 722-5657	<a href="mailto:brian.moore@hsb.com">brian.moore@hsb.com</a>			
Paul Schuelke	Weil-McLain	(219) 879-6561	<a href="mailto:pschuelke@weil-mclain.com">pschuelke@weil-mclain.com</a>			
Melissa Wadkinson	Fulton Thermal	(315) 298-7112	<a href="mailto:melissa.wadkinson@fulton.com">melissa.wadkinson@fulton.com</a>		-	
Edward Wiggins	Liberty Mutual	(256) 357-2825	<a href="mailto:edward.wiggins@libertymutual.com">edward.wiggins@libertymutual.com</a>		-	
Joseph Milette	UAB	205-705-5531	<a href="mailto:jmilette@uab.edu">jmilette@uab.edu</a>		-	
Gene Tompkins	ABMA	920-289-0240	<a href="mailto:gtomp76600@hotmail.com">gtomp76600@hotmail.com</a>		✓	
Andy Scribner	WB				✓	
Todd Creacy	Zurich	817-403-4601	<a href="mailto:todd.creacy@zurichna.com">todd.creacy@zurichna.com</a>			
Randy Austin	ARIZONA		<a href="mailto:Randy.Austin@AZOSHA.GOV">Randy.Austin@AZOSHA.GOV</a>			
Donnie LeSage	State of Louisiana	225-268-5549	<a href="mailto:Donnie.Lesage@LA.Gov">Donnie.Lesage@LA.Gov</a>			
Rex Smith	AUTHORIZED INSPECTION ASSOCIATES	713-775-8708	<a href="mailto:R.Smith@AIAALLC.ORG">R.Smith@AIAALLC.ORG</a>			
Phillip Cole	FM GLOBAL	781-255-4784	<a href="mailto:PHILLIP.COLE@FMGLOBAL.COM">PHILLIP.COLE@FMGLOBAL.COM</a>			✓
Kimberly Atkins	FM Global	540-965-6521	<a href="mailto:KIMBERLY.ATKINS@FMGLOBAL.COM">KIMBERLY.ATKINS@FMGLOBAL.COM</a>		-	

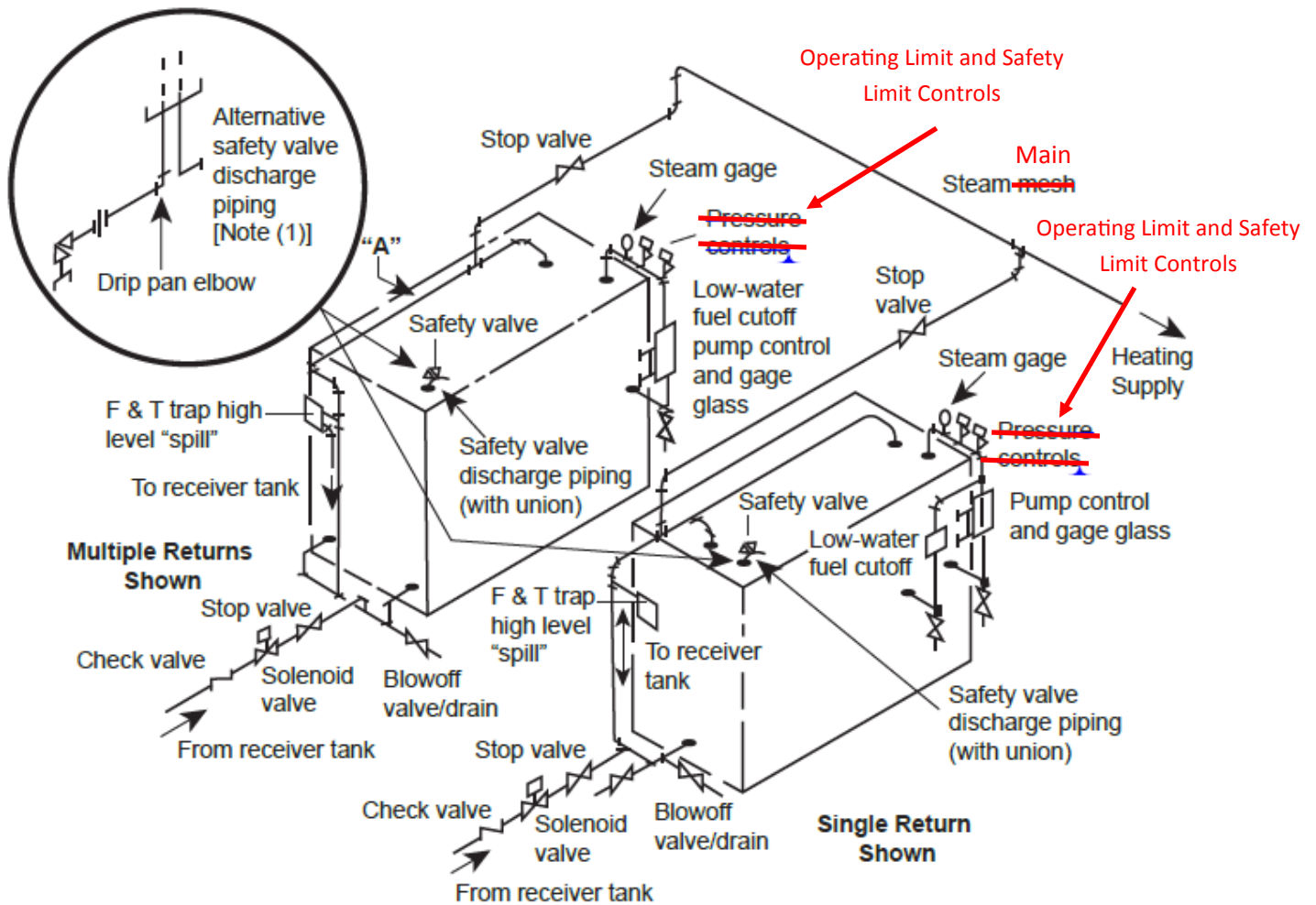
<b>Item Number:</b> NB15-0106	<b>NBIC Location:</b> Part 1, 3.7.5.1	<b>No Attachment</b>
<b>General Description:</b> Address Figure 3.7.5.1		
<b>Subgroup:</b> Installation		
<b>Task Group:</b> B. Moore (PM), T. Creacy, and M. Washington		
<b>History:</b>		
<p><u>July 2015</u> Mr. Richards gave a progress report and explained the purpose of the new item. Mr. Brian Moore has been assigned as progress report.</p> <p><u>January 2016</u> Mr. Paul Schuelke reported that Mr. Moore wasn't present, so no progress was made.</p>		

**FIGURE 3.7.5.1-a**  
**STEAM BOILERS IN BATTERY — PUMPED RETURN — ACCEPTABLE PIPING INSTALLATION**

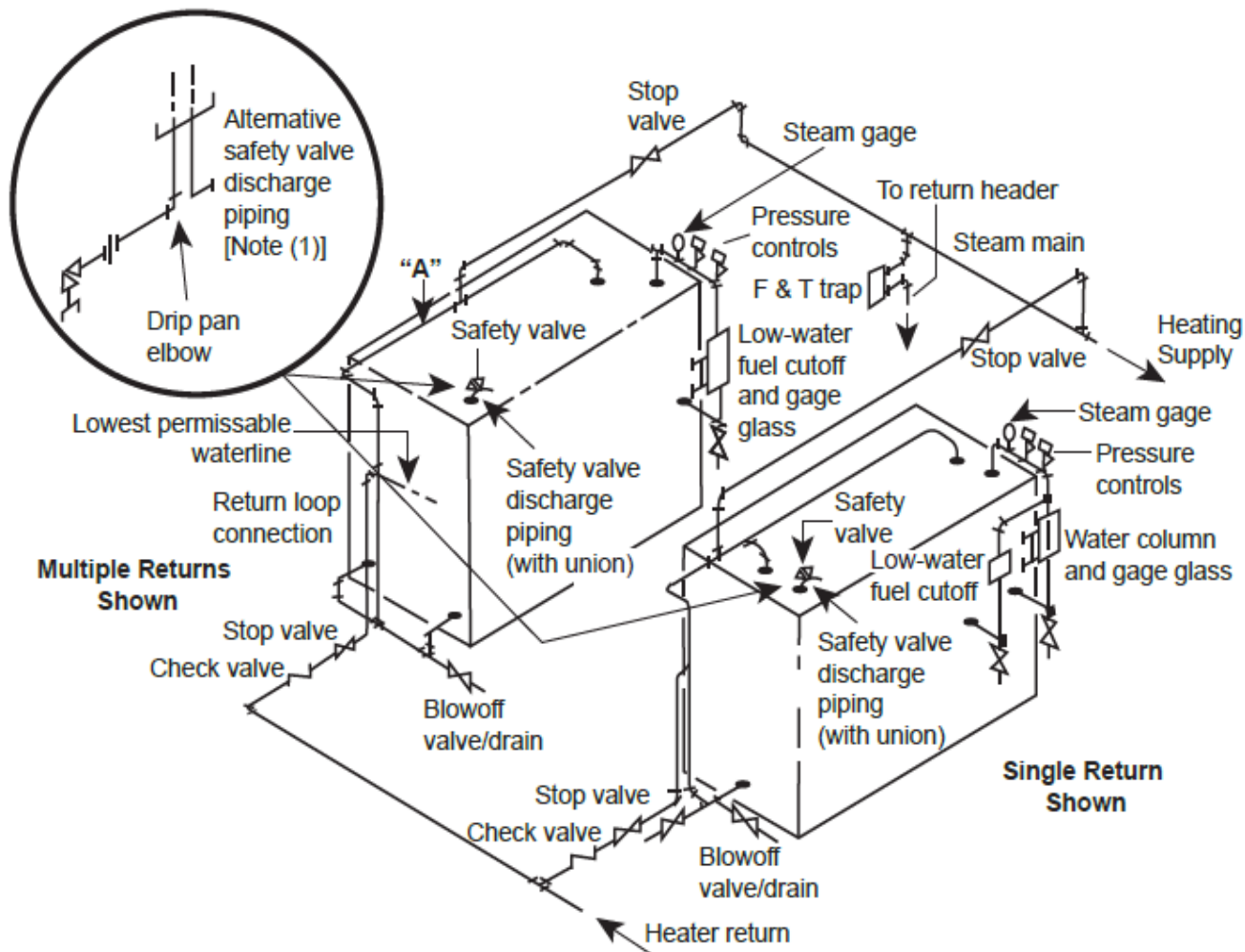


# Proposed Changes

**FIGURE 3.7.5.1-a**  
STEAM BOILERS IN BATTERY — PUMPED RETURN — ACCEPTABLE PIPING INSTALLATION

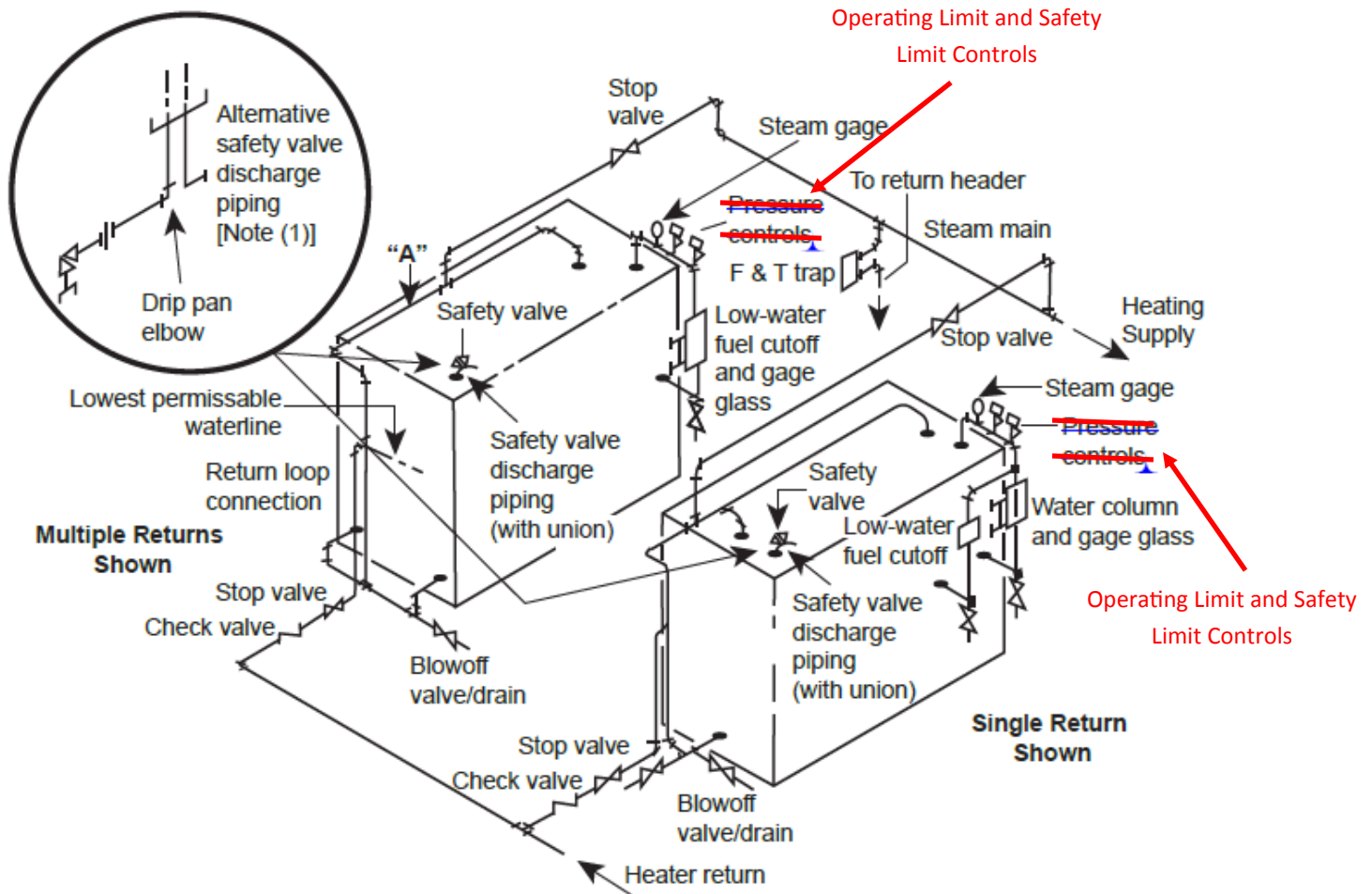


**FIGURE 3.7.5.1-b**  
**STEAM BOILERS IN BATTERY — GRAVITY RETURN — ACCEPTABLE PIPING INSTALLATION**



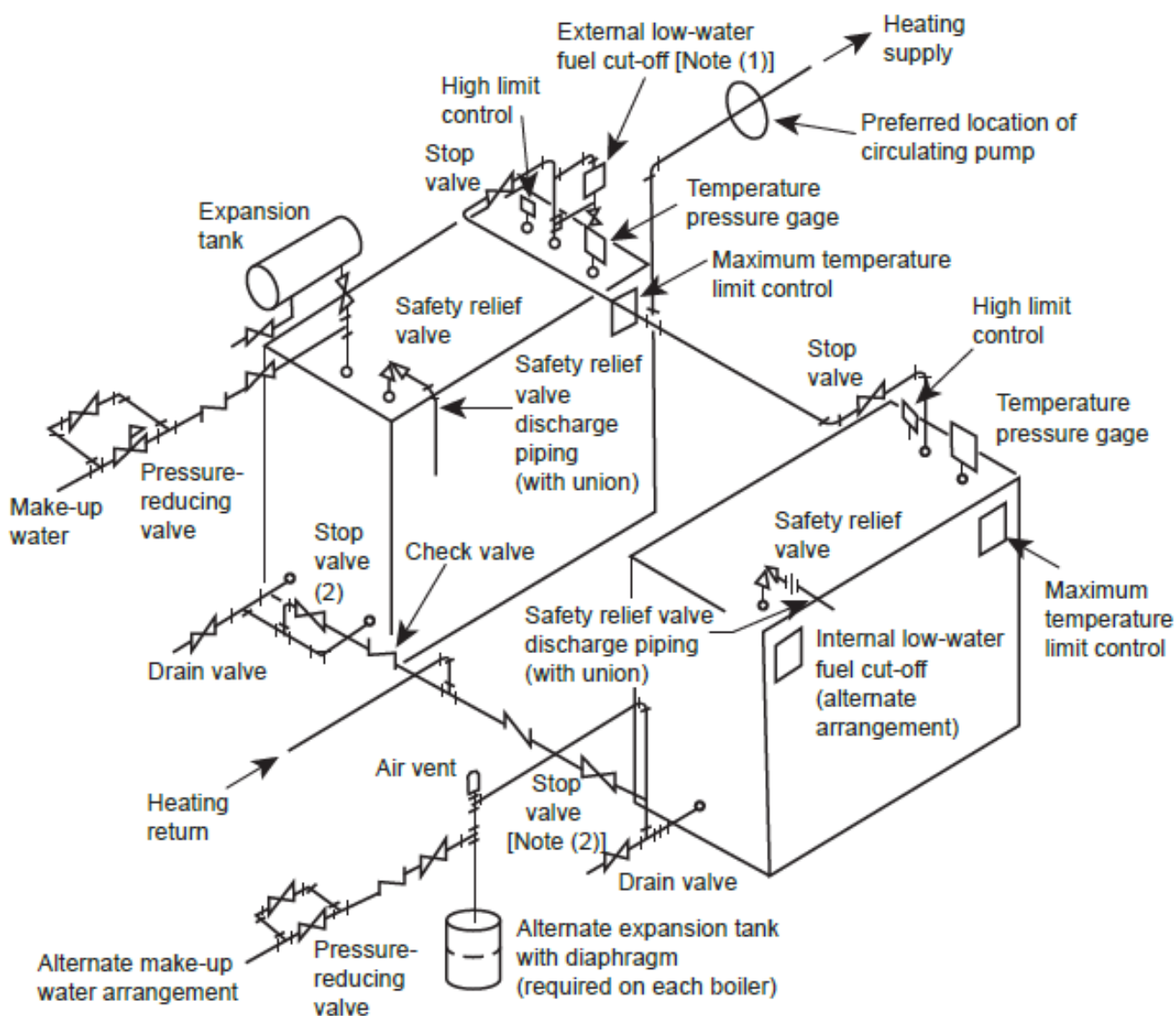
# Proposed Changes

**FIGURE 3.7.5.1-b**  
STEAM BOILERS IN BATTERY — GRAVITY RETURN — ACCEPTABLE PIPING INSTALLATION



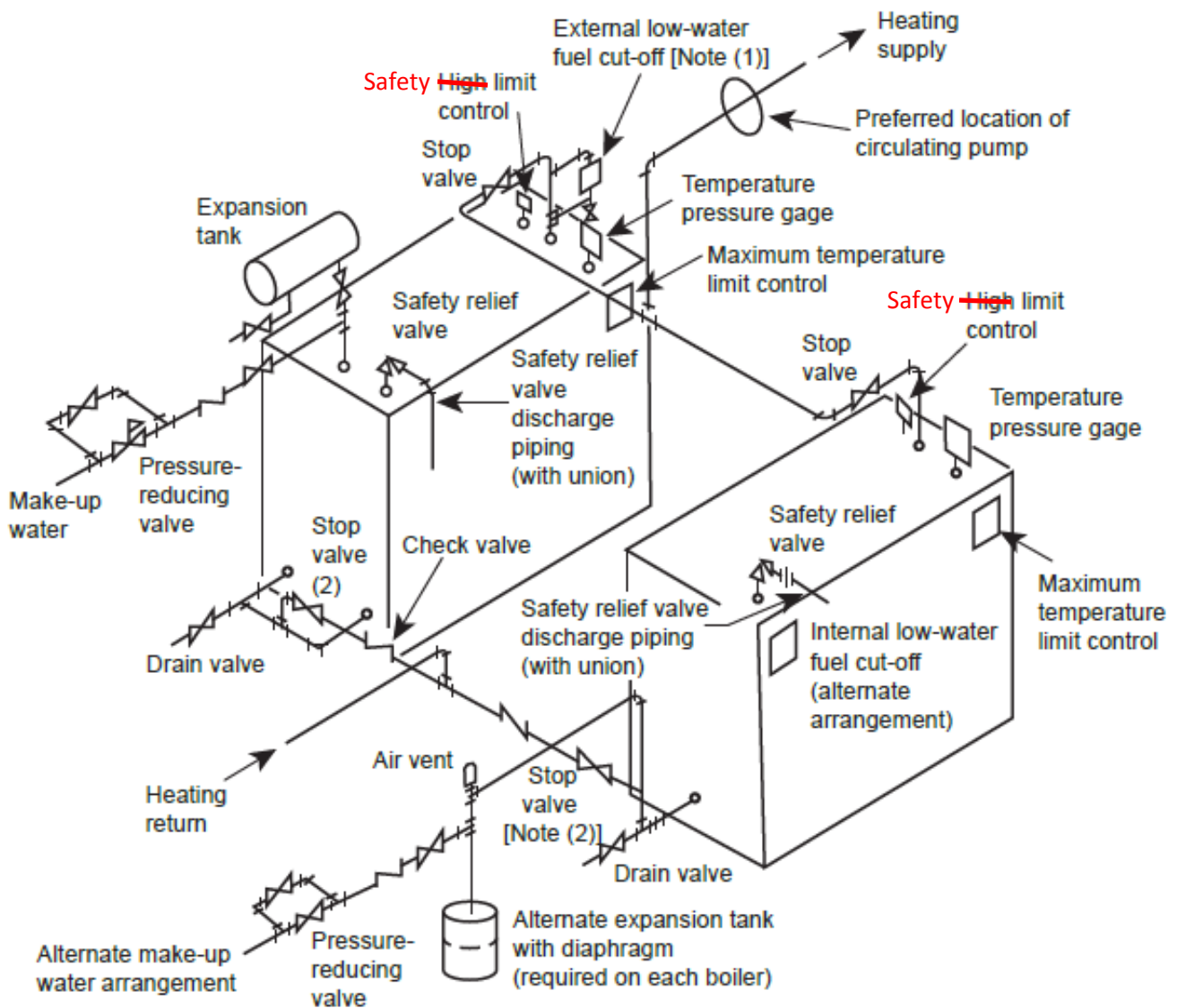
**FIGURE 3.7.5.1-c**

**HOT-WATER BOILERS IN BATTERY — ACCEPTABLE PIPING INSTALLATION**

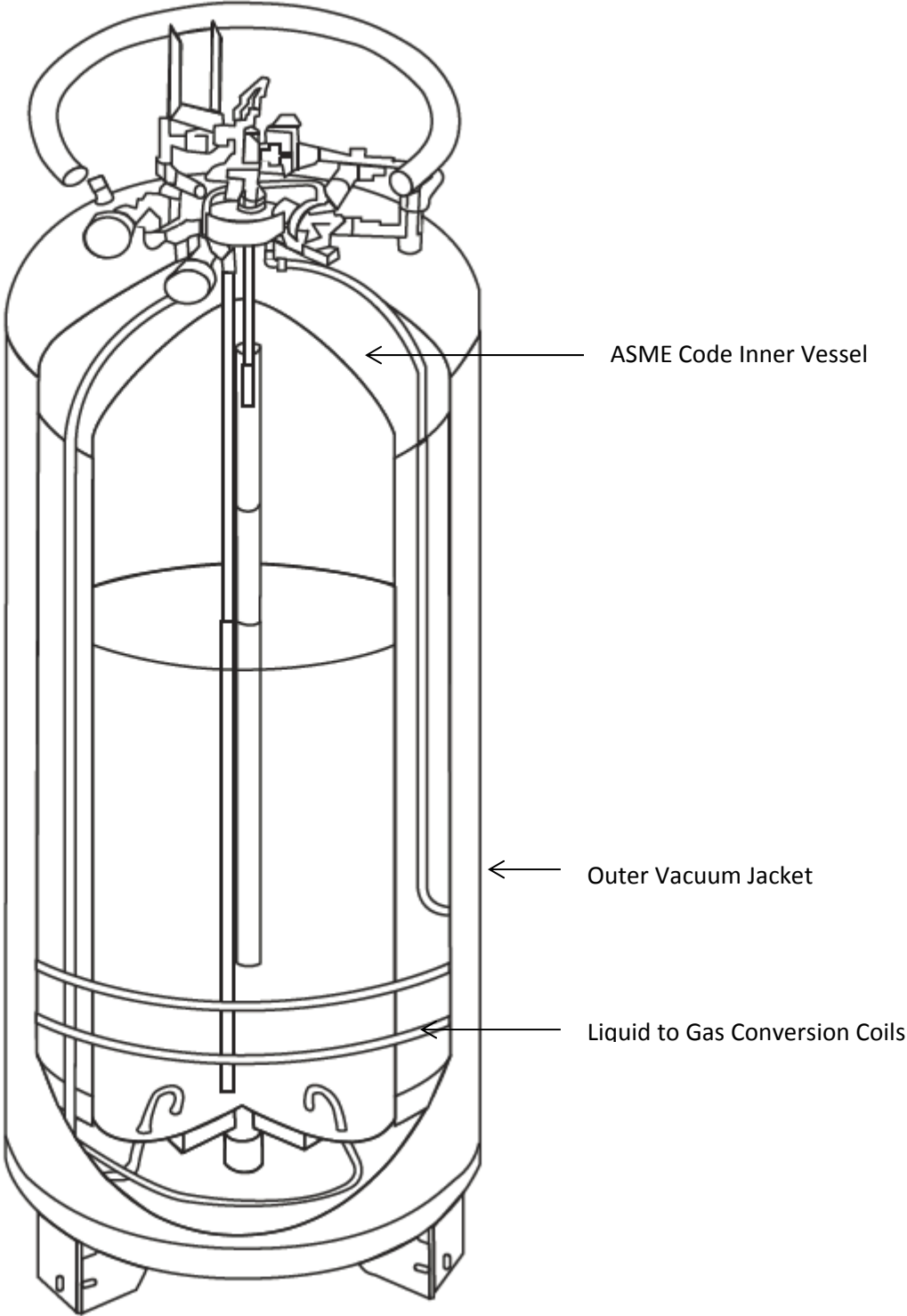


# Proposed Changes

**FIGURE 3.7.5.1-c**  
HOT-WATER BOILERS IN BATTERY — ACCEPTABLE PIPING INSTALLATION







### **S3.1 SCOPE**

This supplement provides requirements for the installation of Liquid Carbon Dioxide Storage Vessels (LCDSVs), fill boxes, fill lines, and pressure relief discharge/vent circuits used for carbonated beverage systems, swimming pool PH control systems, and other fill in place systems storing 1,000 lbs (454 kg) or less of liquid CO<sub>2</sub>.

### **S3.2 GENERAL REQUIREMENTS STORAGE TANK LOCATION**

LCDSVs should be installed in an unenclosed area whenever possible. LCDSVs that do not meet all criteria for an unenclosed area shall be considered an enclosed area installation. An unenclosed area:

- c) Shall be outdoors;
- d) Shall be above grade; and
- e) Shall not obstruct more than three sides of the perimeter with supports and walls. At least 25% of the perimeter area as calculated from the maximum height of the storage container shall be open to atmosphere and openings shall be in direct conveyance with ground level.

#### **S3.2.1 GENERAL REQUIREMENTS (ENCLOSED AND UNENCLOSED AREAS)**

- a) LCDSVs shall not be located within 10 feet (3,050 mm) of elevators, unprotected platform ledges, or other areas where falling would result in dropping distances exceeding half the container height.
- b) LCDSVs shall be installed with sufficient clearance for filling, operation, maintenance, inspection, and replacement.
- c) Orientation of nozzles and attachments shall be such that sufficient clearance between the nozzles, attachments, and the surrounding structures is maintained during the installation, the attachment of associated piping, and operation.
- d) LCDSVs shall not be installed on roofs.
- e) LCDSVs shall be safely supported. Vessel supports, foundations, and settings shall be in accordance with jurisdictional requirements, manufacturer recommendations and/or other industry standards as applicable. The weight of the vessel when full of liquid carbon dioxide shall be considered when designing vessel supports. Design of supports, foundations, and settings shall consider vibration (including seismic and wind loads where necessary), movement (including thermal movement), and loadings. Vessel foundations or floors in multistory buildings must be capable of supporting the full system weight and in accordance with building codes.
- f) LCDSVs shall not be installed within 36 in. (915 mm) of electrical panels.
- g) LCDSVs installed outdoors in areas in the vicinity of vehicular traffic shall be guarded to prevent accidental impact by vehicles. The guards or bollards shall be installed in accordance with local building codes or to a national recognized standard when no local building code exists.
- h) LCDSVs shall be equipped with isolation valves in accordance with paragraph NBIC Part 1, S3.6.

#### **S3.2.2 UNENCLOSED AREA LCDSV INSTALLATIONS**

If LCDSVs are installed outdoors and exposed to the elements, appropriate additional protection may be provided

as necessary based on the general weather conditions and temperatures that the tank may be exposed to. Some possible issues include:

- a) Exposure to high solar heating loads will increase the net evaporation rate and will decrease hold times in low CO<sub>2</sub> usage applications. The vessel may be covered or shade provided to help reduce the solar load and increase the time needed to reach the relief valve setting in low use applications.
- b) If supply line is not UV resistant then the supply line should be protected via conduit or appropriate covering.

### S3.2.3 ENCLOSED AREA LCDSV INSTALLATIONS

a) Permanent LCDSV installations with remote fill connections:

- 1) Shall be equipped with a gas detection system installed in accordance with NBIC Part 1, S3.4;
- 2) Shall have signage posted in accordance with NBIC Part 1, S3.5; and
- 3) Shall be equipped with fill boxes; fill lines and safety relief/vent valve circuits installed in accordance with NBIC Part 1, S3.6.

b) Portable LCDSV installations with no permanent remote fill connection: **Warning: LCDSVs shall not be filled indoors or in enclosed areas under any circumstances. Tanks must always be moved to the outside to an unenclosed, free airflow area for filling.**

- 1) Shall be equipped with a gas detection system installed in accordance with NBIC Part 1, S3.4;
- 2) Shall have signage posted in accordance with NBIC Part 1, S3.5;
- 3) Shall have a safety relief/vent valve circuit connected at all times except when the tank is being removed for filling. Connects may be fitted with quick disconnect fittings meeting the requirements of NBIC Part 1, S3.6; and
- 4) Shall be provided with a pathway that provides a smooth rolling surface to the outdoor, unenclosed fill area. There shall not be any stairs or other than minimal inclines in the pathway.

### S3.3 FILLBOX LOCATION / SAFETY RELIEF/VENT VALVE CIRCUIT TERMINATION

Fill boxes and/or vent valve terminations shall be installed above grade, outdoors in an unenclosed, free airflow area. The fill connection shall be located so not to impede means of egress or the operation of sidewalk cellar entrance doors, including during the delivery process and shall be:

- 1) At least 36 in. (915 mm) from any door or operable windows;
- 2) At least 36 in. (915 mm) above grade;
- 3) Shall not be located within 10 ft. (31 m) from side to side at the same level or below, from any air intakes; and
- 4) Shall not be located within 10 ft. (31 m) from stairwells that go below grade.

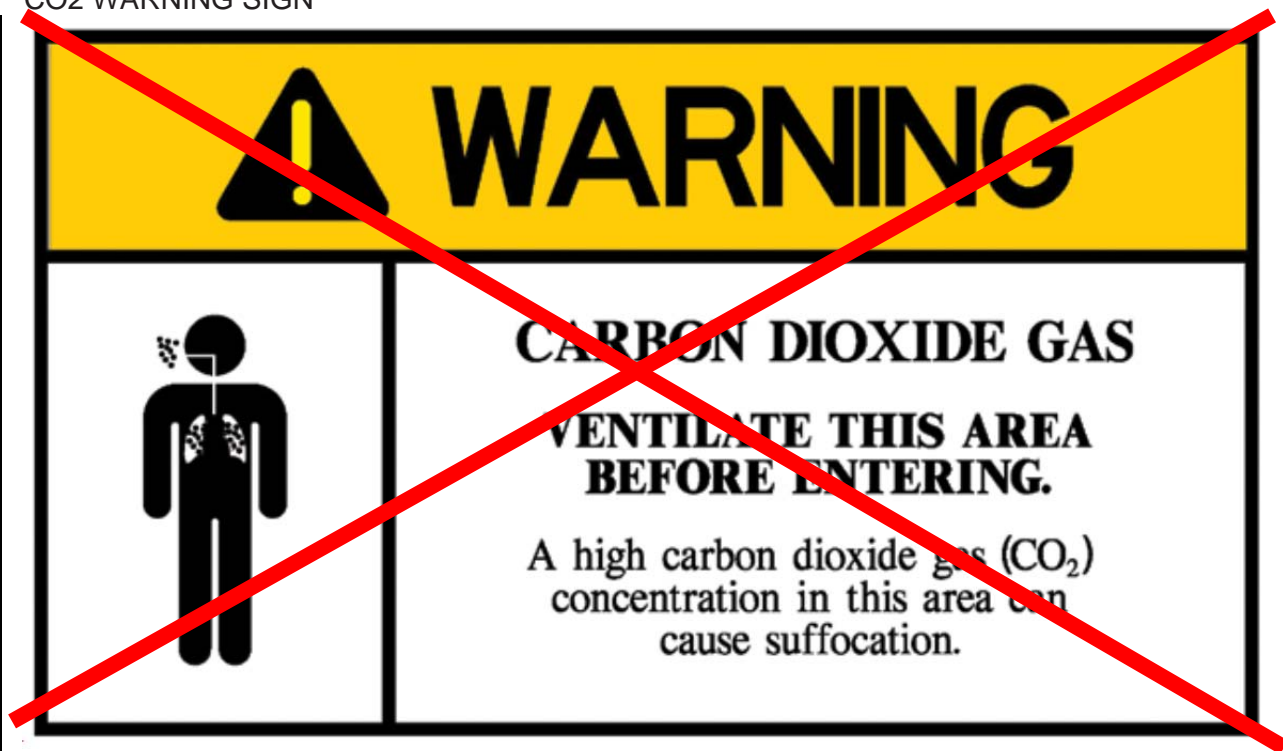
### S3.4 GAS DETECTION SYSTEMS

~~Rooms or areas where carbon dioxide storage vessel(s) are located indoors or in enclosed or below grade outdoor locations shall be provided with a gas detection and alarm system for general area monitoring that is capable of detecting and notifying building occupants of a CO<sub>2</sub> gas release. Alarms will be designed to activate a low level pre-alarm at 5,000 ppm concentration of CO<sub>2</sub> and a full high alarm at 30,000 ppm concentration of CO<sub>2</sub> which is the NIOSH & ACGIH 15 minute Short Term Exposure Limit for CO<sub>2</sub>. These systems are not designed for employee personal exposure monitoring. Gas detection systems shall be installed and tested in accordance with manufacturer's installation instructions and the following requirements:~~

- ~~a) Activation of the gas detection system shall activate an audible alarm within the room or area in which the carbon dioxide storage vessel is located.~~
- ~~b) Audible alarms shall also be placed at the entrance(s) to the room or area where the carbon dioxide storage vessel and/or fill box is located to notify anyone who might try to enter the area of a potential~~

A continuous gas detection system shall be provided in the room or area where container systems are filled and used, in areas where the heavier than air gas can congregate and in below grade outdoor locations. Carbon dioxide (CO<sub>2</sub>) sensors shall be provided within 12 inches (305mm) of the floor in the area where the gas is most likely to accumulate or leaks are most likely to occur. The system shall be designed to detect and notify at a low level alarm and high level alarm.

- a) The threshold for activation of the low level alarm shall not exceed a carbon dioxide concentration of 5,000 ppm (9,000 mg/m<sup>3</sup>) Time Weighted Average (TWA) over 8 hours. When carbon dioxide is detected at the low level alarm, the system shall activate a signal at a normally attended location within the building.
- b) The threshold for activation of the high level alarm shall not exceed a carbon dioxide concentration 30,000 ppm (54,000 mg/m<sup>3</sup>). When carbon dioxide is detected at the high level alarm, the system shall activate an audible and visual alarm at a location approved by the jurisdiction having authority.



~~Warning-Hazard identification signs shall be posted at the entrance to the building, room, enclosure, and / or the confined enclosed area where the LCDSV container is located. The warning sign shall be at least 8 in. (200 mm) wide and 6 in. (150 mm) high and indicate~~

~~**CAUTION- CARBON DIOXIDE GAS**  
Ventilate the area before entering.  
A high carbon dioxide (CO<sub>2</sub>) gas concentration  
In this area can cause asphyxiation.~~

~~The wording shall be concise and easy to read and the upper portion of the sign must be orange as shown in figure NBIC Part 1, S3.5. The size of the lettering must be as large as possible for the intended viewing distance and in accordance with jurisdictional requirements. When no jurisdictional requirements exist, the minimum letter height shall be in accordance with NEMA American National Standard for Environmental and Facility Safety Signs (ANSI Z535.2). The warning sign shall be as shown in Figure S3.5.~~

~~Additional instructional signage shall be posted outside of the area where the container is located and such signage shall contain at minimum the following information:~~

- ~~a) Carbon Dioxide Monitors for general area monitoring (not employee personal exposure monitoring) are provided in this area. These monitors are set to alarm at 5,000 ppm for the low level alarm and at 30,000 ppm for high level alarm.~~
- ~~b) Low Level Alarm (5,000 ppm) — Provide appropriate cross ventilation to the area. Personnel may enter area for short periods of time (not to exceed 15 minutes at a time) in order to identify and repair potential leaks.~~
- ~~c) High Level Alarm (30,000 ppm) — Personnel should evacuate the area and nobody should enter the affected area without proper self contained breathing apparatus until the area is adequately ventilated and the concentration of CO<sub>2</sub> is reduced below the high alarm limit.~~

### S3.6 VALVES, PIPING, TUBING, AND FITTINGS

a) **Materials** – Materials selected for valves, piping, tubing, hoses, and fittings used in the LCDSV system shall meet following requirements:

- 1) Components must be compatible for use with CO<sub>2</sub> in the phase (gas, or liquid in the applicable circuit) it encounters in the system.
- 2) Components shall be rated for the operational temperatures and pressures encountered in the applicable circuit of the system.
- 3) Shall be stainless steel, copper, brass, or plastic/polymer materials rated for CO<sub>2</sub>.
- 4) Only fittings and connections recommended by the manufacturer shall be used for all hoses, tubes, and piping.
- 5) All valves and fittings used on the LCDSV shall be rated for the maximum allowable working pressure stamped on the tank.
- 6) All piping, hoses, and tubing used in the LCDSV system shall be rated for the working pressure of the applicable circuit in the system and have a burst pressure rating of at least four times the maximum allowable working pressure of the piping, hose, or tubing.

b) **Relief Valves** – Each LCDSV shall have at least one ASME/NB stamped & certified relief valve with a pressure setting at or below the MAWP of the tank. The relief valve shall be suitable for the temperatures and flows experienced during relief valve operation. The minimum relief valve capacity shall be designated by the manufacturer. Additional relief valves that do not require ASME stamps may be added per recommendations in Compressed Gas Association pamphlet, CGA S-1.3 Pressure Relief Device Standards Part 3, Stationary Storage Containers for Compressed Gases. Discharge lines from the relief valves shall be sized in accordance with tables NBIC Part 1, S3.6-a and S3.6-b.

**Note:** Due to the design of the LCDSV, the discharge line may be smaller in diameter than the relief valve outlet size.

**Caution:** Companies and/or individuals filling or refilling LCDSVs shall be responsible for utilizing fill equipment that is acceptable to the manufacturer to prevent over pressurization of the vessel.

c) **Isolation Valves** – Each LCDSV shall have an isolation valve installed on the fill line and tank discharge, or gas supply line in accordance with the following requirements:

- 1) Isolation valves shall be located on the tank or at an accessible point as near to the storage tank as possible.
- 2) All valves shall be designed or marked to indicate clearly whether they are open or closed.
- 3) All valves shall be capable of being locked or tagged in the closed position for servicing.
- 4) Gas Supply and Liquid CO<sub>2</sub> Fill Valves shall be clearly marked for easy identification.

d) **Safety Relief/Vent Lines** – Safety relief/vent lines shall be as short and straight as possible with a continuous routing to an unenclosed area outside the building and installed in accordance with the manufacturer's instructions. The vent line(s) shall be a continuous run from the vessel pressure relief device vent piping to the outside vent line discharge fitting. Mechanical joints in metallic piping and tubing shall be visible and inspectable. Any splices in plastic or polymeric tubing shall be done within three feet of the vessel and must be visible and inspectable. These lines shall be free of physical defects such as cracking or kinking and all connections shall be securely fastened to the LCDSV and the fill box. All safety relief/vent lines shall be protected to prevent penetration by nail, projectile, or other foreign object when routed through a wall, floor, or ceiling. The minimum size and length of the lines shall be in accordance with NBIC Part 1, Tables S3.6-a and S3.6-b. Fittings or other connections may result in a localized reduction in diameter have been factored into the lengths given by the NBIC Part 1, Tables S3.6-a and S3.6-b.

**Note:** Due to the design of the LCDSV, the discharge line may be smaller in diameter than the relief valve outlet size but shall not be smaller than that shown in NBIC Part 1, Tables S3.6-a and S3.6-b.

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6-22-16

#### 1.6.6 VENTILATION AND COMBUSTION AIR

- a) The equipment room shall have an adequate air to permit clean, safe combustion, minimize soot formation, and maintain a minimum of 19.5% oxygen in the air of the equipment room and sufficient to maintain ambient temperatures as recommended by the boiler, heater, vessel manufacturer. The combustion and ventilation air should be supplied by either an unobstructed air opening or by power ventilation or fans.
- b) When combustion air is supplied to the boiler, heater, vessel by an independent duct, with or without the employment of power ventilators or fans, the duct shall be sized and installed in accordance with the manufacturer's recommendations. However, ventilation for the equipment room must still be considered.
- c) Unobstructed air openings shall be sized on the basis of the manufacturer's recommendations, or as specified by the National Fire Protection Association (NFPA) standards for oil and gas burning installations for the particular job conditions or 1 sq. in. (650 sq. mm) free area per 2000 Btu/hr (586 W) maximum fuel input of the combined burners located in the equipment room. The equipment room supply openings shall be kept clear at all times.
- d) Power ventilators or fans shall be sized on the basis of 0.2 cfm (0.0057 cu meters per minute) for each 1000 Btu/hr (293W) of maximum fuel input for the combined burners of all boilers and heaters located in the equipment room. Additional capacity may be required for other fuel burning equipment in the equipment room.
- e) When power ventilators or fans are used to supply combustion air, they shall be installed with interlock devices so that burners will not operate without an adequate number of ventilators/fans in operation.
- f) The size of openings specified in c) above may be reduced when special engineered air supply systems approved by the Jurisdiction are used.
- g) Care should be taken to ensure that steam, water and fluid lines are not routed across combustion air openings, where freezing may occur in cold climates.

## Action Item Request Form

**NB16-0102 8.2 CODE REVISIONS OR ADDITIONS**

Request for Code revisions or additions shall provide the following:

a) Proposed Revisions or Additions

For revisions, identify the rules of the Code that require revision and submit a copy of the appropriate rules as they appear in the Code, marked up with the proposed revision. For additions, provide the recommended wording referenced to the existing Code rules.

Existing Text:

**2.10.2 PRESSURE TEST**

Prior to initial operation, the completed boiler, including pressure piping, water columns, superheaters, economizers, stop valves, etc., shall be pressure tested in accordance with the original code of construction. Any pressure piping and fittings such as water columns, blowoff valves, feedwater regulators, superheaters, economizers, stop valves, etc., which are shipped connected to the boiler as a unit, shall be hydrostatically tested with the boiler and witnessed by an Inspector.

**2.10.4 SYSTEM TESTING**

Prior to final acceptance, an operational test shall be performed on the complete installation. The test data shall be recorded and the data made available to the jurisdictional authorities as evidence that the installation complies with the provisions of the governing code(s) of construction. This operational test may be used as the final acceptance of the unit.

**3.10.1 PRESSURE TEST**

Prior to initial operation, the completed boiler, individual module, or assembled module, shall be subjected to a pressure test in accordance with the requirements of the original code of construction.

**4.6 TESTING AND ACCEPTANCE**

a) The installer shall exercise care during installation to prevent loose weld material, welding rods, small tools, and miscellaneous scrap metal from getting into the vessel. The installer shall inspect the interior of the vessel and its appurtenances where possible prior to making the final closures for the presence of foreign debris.

b) The completed pressure vessel shall be pressure tested in the shop or in the field in accordance with the original code of construction. When required by the Jurisdiction, owner or user, the Inspector shall witness the pressure test of the completed installation, including piping to the pressure gage, pressure relief device, and, if present, level control devices.

**4.7.6 TESTING AND ACCEPTANCE**

Testing and acceptance shall be in accordance with NBIC Part 1, 4.6

## b) Statement of Need

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

NB10-1201 Covered reformatting multiple items. Pressure Testing was inconsistent between the three sections and really needs to be addressed

## c) Background Information

Provide background information to support the revision or addition, including any data or changes in technology that form the basis for the request that will allow the Committee to adequately evaluate the proposed revision or addition. Sketches, tables, figures, and graphs should be submitted as appropriate.

When applicable, identify any pertinent paragraph in the Code that would be affected by the revision or addition and identify paragraphs in the Code that reference the paragraphs that are to be revised or added.

N/A

**Proposed Wording:****1.?? TESTING AND ACCEPTANCE**

a) The installer shall exercise care during installation to prevent loose weld material, welding rods, small tools, and miscellaneous scrap metal from getting into the vessel. The installer shall inspect the interior of the vessel and its appurtenances where possible prior to making the final closures for the presence of foreign debris.

b) The completed boiler/pressure vessel shall be pressure tested in the shop or in the field in accordance with the original code of construction. Prior to final acceptance, an operational test shall be performed on any components who's pressure test is not documented under the items' Manufacture Data Report. This test should be at a pressure not to exceed the lowest pressure relief device setpoint. The test data shall be recorded and the data made available as required. This operational test may be used as the final acceptance of the unit.



<b>Item Number: NB16-0801</b>	<b>NBIC Location: Part 1</b>	<b>No Attachment</b>
<b>General Description:</b> Is it standard operating procedure (per NBIC) to do hydrostatic pressure tests on installed ASME Section IV boilers at 150% of the rated pressure as part of the installation inspection?		

Question:

If a pressure test has been performed and documented on the applicable Manufacturer's Data Report for a boiler, pressure vessel or piping, is an additional pressure test required prior to initial operation?

Reply:

NO

### Interpretation IN16-0701

#### Proposed Interpretation

<b>Inquiry:</b>	IN16-0701
<b>Source:</b>	NB16-0801
<b>Subject:</b>	Pressure Testing - Part 1
<b>Edition:</b>	2015 NBIC
<b>Question 1:</b>	Is it standard operating procedure (per NBIC) to do hydrostatic pressure tests on installed ASME Section IV boilers at 150% of the rated pressure as part of the installation inspection?
<b>Reply 1:</b>	
<b>Committee's Question:</b>	If a pressure test has been performed and documented on the applicable Manufacturer's Data Report for a boiler, pressure vessel or piping, is an additional pressure test required prior to initial operation?
<b>Committee's Reply:</b>	No
<b>Rationale:</b>	2.10.2 Power Boilers, 3.10.1 Heating Boilers, 4.6 Pressure Vessels, 5.4 Piping  It is not the intent of the code to mandate post construction testing at 150% of the rated pressure.
<b>SC Vote</b>	Passed – Unanimous
<b>NBIC Vote</b>	

### **2.10.2 PRESSURE TEST**

Prior to initial operation, the completed boiler, including pressure piping, water columns, superheaters, economizers, stop valves, etc., shall be pressure tested in accordance with the original code of construction. Any pressure piping and fittings such as water columns, blowoff valves, feedwater regulators, superheaters, economizers, stop valves, etc., which are shipped connected to the boiler as a unit, shall be hydrostatically tested with the boiler and witnessed by an Inspector.

### **3.10.1 PRESSURE TEST**

Prior to initial operation, the completed boiler, individual module, or assembled module, shall be subjected to a pressure test in accordance with the requirements of the original code of construction.

### **4.6 TESTING AND ACCEPTANCE**

a) The installer shall exercise care during installation to prevent loose weld material, welding rods, small tools, and miscellaneous scrap metal from getting into the vessel. The installer shall inspect the interior of the vessel and its appurtenances where possible prior to making the final closures for the presence of foreign debris.

b) The completed pressure vessel shall be pressure tested in the shop or in the field in accordance with the original code of construction. When required by the Jurisdiction, owner or user, the Inspector shall witness the pressure test of the completed installation, including piping to the pressure gage, pressure relief device, and, if present, level control devices.

### **5.4 EXAMINATION, INSPECTION, AND TESTING**

The owner shall ensure that all examinations, inspections, and tests required by the code of construction have been performed prior to operation.

- 1) Each steam boiler shall have a bottom blowoff connection fitted with a valve or cock connected to the lowest water space practicable with a minimum size as shown in NBIC Part 1, Table 3.7.7.1. The discharge piping shall be full size to the point of discharge.
- 2) Boilers having a capacity of 25 gallons (95 l) or less are exempt from the above requirements, except that they shall have a NPS 3/4 (DN 20) minimum drain valve.

b) Drains

- 1) Each steam or hot-water boiler shall have one or more drain connections, fitted with valves or cocks connecting to the lowest water containing spaces. All parts of the boiler must be capable of being drained (the boiler design will dictate the number and size of drains). The minimum size of the drain piping, valves, and cocks shall be NPS 3/4 (DN 20). The discharge piping shall be full size to the point of discharge.
- 2) When the blowoff connection is located at the lowest water containing space, a separate drain connection is not required.

c) Minimum Pressure Rating

The minimum pressure rating of valves and cocks used for blowoff or drain purposes shall be at least equal to the pressure stamped on the boiler but in no case less than 30 psig (200 kPa). The temperature rating of such valves and cocks shall not be less than 250°F (121°C).

**TABLE 3.7.7.1**  
**SIZE OF BOTTOM BLOWOFF PIPING, VALVE, AND COCKS**

Minimum Required Safety Valve Capacity, lbs. of steam/hr (kg steam/hr)	Blowoff Piping, Valve, and Cock Sizes, in. (mm)
Up to 500 (227)	<del>3/4 (19)</del> (20)
501 to 1,250 (over 227 to 567)	1 (25)
1,251 to 2,500 (227 to 1,134)	1-1/4 (32)
2,501 to 6,000 (1,134 to 2,722)	1-1/2 ( <del>38</del> ) (40)
6,001 and larger (2,722)	2 (50)

**Note:**

To determine the discharge capacity of the safety relief valves in terms of total energy absorbed, use 1 lb steam per hour per 1,000 Btu (1 kg steam per hour per 2,326 kJ).

**3.7.7.2 POTABLE WATER HEATERS**

Drain Valve

- a) Each water heater shall have a bottom drain pipe connection fitted with a valve or cock connected with the lowest water space practicable. The minimum size bottom valve shall be NPS 3/4 (DN 20).
- b) Any discharge piping connected to the bottom drain connection shall be full size to the point of discharge.

NB16-1702

**3.8.1.5 AUTOMATIC LOW-WATER FUEL CUTOFF AND/OR WATER FEEDING DEVICE**

a) Each automatically fired steam-or vapor-system boiler shall have an automatic low-water fuel cutoff. The low-water fuel cutoffs must be so located ~~as~~ to automatically cut off the fuel supply when the surface of the water falls to a level not lower than the lowest visible part of the water-gage glass. If a water feeding device is installed, it shall be so constructed that the water inlet valve cannot feed water into the boiler through the float chamber and so located as to supply requisite feedwater.

## NB16-0809C - 7-13-16 - Besserman

### 1.1 SCOPE

~~NBIC Part 1~~ This part provides requirements and guidelines guidance for the installation of power boilers, steam heating boilers, hot-water heating boilers, hot-water supply boilers, potable water heaters, pressure vessels and piping.

The proper installation of boilers, pressure vessels, piping, and other pressure-retaining items is essential for safe and satisfactory operation. The owner-user is responsible for ensuring that installations meet all the requirements of the Jurisdiction at the point of installation including licensing, registration, or certification of those performing installations. NBIC Part 1 identifies minimum safety requirements for installing pressure-retaining items when NBIC Part 1 is mandated by a Jurisdiction. Otherwise, the requirements specified in NBIC Part 1 provide information and guidance for installers, contractors, owners, inspectors, and Jurisdictions to ensure safe and satisfactory installation of specified pressure-retaining items. Jurisdictions may require other safety standards, including following manufacturer's recommendations. When a Jurisdiction establishes different requirements or where a conflict exists, the rules of the Jurisdiction prevail. Users of NBIC Part 1 are cautioned that other requirements may apply for a particular installation and NBIC Part 1 is not a substitute for sound engineering evaluations.

### 2.1 SCOPE

~~NBIC Part 1, Section 2~~ This section provides requirements and guidelines guidance for the installation of power boilers.

### 3.1 SCOPE

~~The scope of NBIC Part 1, Section 3~~ This section shall apply to provides requirements and guidelines guidance for the installation of steam heating boilers, hot-water heating boilers, hot-water supply boilers, and potable water heaters.

### 4.1 SCOPE

~~NBIC Part 1, Section 4~~ This section provides requirements and guidelines guidance for the installation of pressure vessels.

### 5.1 SCOPE

~~NBIC Part 1, Section 5~~ This section provides requirements and guidelines guidance for the installation of piping.

#### S1.1 SCOPE

~~a)~~ This supplement ~~describes~~ provides guidelines for the installation of a Yankee dryer. A Yankee dryer is a pressure vessel with the following characteristics:

a) A Yankee dryer is a rotating steam-pressurized cylindrical vessel commonly used in the paper industry, and is typically made of cast iron, finished to a high surface quality, and characterized by a center shaft connecting the heads.

b) Yankee dryers are primarily used in the production of tissue-type paper products. When used to produce machine-glazed (MG) paper, the dryer is termed an MG cylinder. A wet paper web is pressed onto the finished dryer surface using one or two pressure (pressing) rolls. Paper is dried through a combination of mechanical

dewatering by the pressure roll(s), thermal drying by the pressurized Yankee dryer, and a steam-heated or fuel-fired hood. After drying, the paper web is removed from the dryer.

c) A Yankee dryer is typically manufactured in a range of outside diameters from 8 to 23 ft. (2.4 to 7 m), widths from 8 to 28 ft. (2.4 to 8.5 m), pressurized and heated with steam up to 160 psi (1,100 kPa), and rotated at speeds up to 7,000 ft/min (2,135 m/min). Typical pressure roll loads against the Yankee dryer are up to 600 pounds per linear inch (105 kN/m). A thermal load results from the drying process due to difference in temperature between internal and external shell surfaces. The dryer has an internal system to remove steam and condensate. These vessels can weigh up to 220 tons (200 tonnes).

d) The typical Yankee dryer is an assembly of several large castings. The shell is normally a gray iron casting, in accordance with ASME designation SA-278. Shells internally may be smooth bore or ribbed. Heads, center shafts, and journals may be gray cast iron, ductile cast iron, or steel.

### S2.1 SCOPE

[This supplement provides requirements and guidelines for the installation of safety valves on the low-pressure side of steam pressure-reducing valves.](#)

a) The subject of protection of vessels in steam service connected to the low-pressure side of a steam-pressure-reducing valve is of considerable importance to proper operation of auxiliary equipment such as pressure cookers, hot-water heating systems, etc., operating at pressures below that which the primary boiler generating unit is operating.

b) To automatically reduce the primary boiler pressure for such processing equipment, pressure-reducing valves are used. The manufacturers of such equipment have data available listing the volume of flow through reducing valves manufactured by them, but such data are not compiled in a form that the results can be deduced readily. To protect the equipment operating on the low-pressure side of a pressure-reducing valve, safety valves of a relieving capacity sufficient to prevent an unsafe pressure rise in case of failure of the pressure-reducing valve, should be installed.

c) The pressure-reducing valve is a throttling device, the design of which is based on certain diaphragm pressures opposed by spring pressure which, in turn, controls the opening through the valve. If the spring, the diaphragm, or any part of the pressure-reducing valve fails, steam will flow directly through the valve and the low pressure equipment will be subjected to the boiler pressure. To protect the equipment operating on the low pressure side of the pressure-reducing valve, safety valve(s) should be installed on the low pressure side of the pressure-reducing valve, which will provide a relieving capacity sufficient to prevent the pressure from rising above the system design pressure.

d) In most cases pressure-reducing valves used for the reduction of steam pressures have the same pipe size on the inlet and outlet. In case of failure of a pressure-reducing valve, the safety valve on the low-pressure side must have a capacity to take care of the volume of steam determined by the high pressure side and the area of the pipe.

### S3.1 SCOPE

This supplement provides requirements [and guidelines](#) for the installation of Liquid Carbon Dioxide Storage Vessels (LCDSVs), fill boxes, fill lines, and pressure relief discharge/vent circuits used for carbonated beverage systems, swimming pool PH control systems, and other fill in place systems storing 1,000 lbs (454 kg) or less of liquid CO<sub>2</sub>.

#### **S4.1 SCOPE**

| This supplement provides requirements and guidelines for the installation of biomass (wood/solid fuel) fired boilers as defined in NBIC Part 1, Section 9.

#### **S5.1 SCOPE**

| This supplement provides requirements and describes guidelines for the installation of a thermal fluid heater. A thermal fluid heater system consists of the heater, expansion tank, circulating pump, safe catchment with the proper piping and controls to heat jacketed kettles, presses, reactors, ovens, exchangers, etc. The scope does not include thermal fluid vaporizers.