Date Distributed:

THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS

SUBGROUP ON PRESSURE VESSELS AND PIPING

Minutes

Meeting of July 17, 2012
Columbus, Ohio

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

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

1. **Call to Order – 1:00 p.m.**

   Chairman, Mr. Gary Scribner called the meeting to order at 12:35 p.m.

2. **Announcements**

   - Lunch will be served each day at 12:00 - 2nd floor - Training and Conference Center.
   - A trip to the Clippers game will take place Wednesday evening (7/18/2012), with buses leaving the Crowne Plaza at 5:30 p.m. It was noted that attendees should plan to meet at the hotel at 5:00 p.m.
   - A continental breakfast will be served Thursday morning (7/19/2012) - 2nd floor - Training and Conference Center.
   - The Executive Committee meeting was re-scheduled from Monday (7/16/2012) to Tuesday (7/17/2012 – 5:00 p.m.)

3. **Adoption of the Agenda**

   There was a motion to adopt the agenda as published. The motion was unanimously approved.

4. **Approval of Minutes of January 17, 2012**

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

5. **Review of the Roster**
   (Attachments 1, pages 5 – 6)

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

6. Action Items
(Attachments 2 – 4, pages 7 – 25)

NB10-0201 ***Part 1 S3, SG Pressure Vessels and Piping-*** Expand the section on installation of thermal fluid heaters. This action item is a result of splitting NB09-0601into two parts. A task group of D. Patten, G. Halley, M. Wadkinson and P. Bourgeois has been assigned.
(No Attachment)

July 2012
Mr. Patten and Ms. Wadkinson presented a progress report. This continues to be a work in progress. Mr. Patten will put together an update and send to Mr. Scribner who will in-turn get this out to the group and if need be for letter ballot.

NB10-1201 ***Part 1 SC Installation-*** Request for a format change to NBIC Part 1 Code Rules. A task group of G. Scribner, S. Torkildson, S. Konopacki and D. Patten has been assigned.
(No Attachment)

July 2012
Mr. Scribner presented a progress report.

NB11-2001 ***Part 1, 2.9.4 SG Pressure Vessels and Piping-*** Address the safe venting of isolatable economizers where the outlet is below the inlet of other communicable chambers (Headers, drums, etc.)
(Attachments 2, pages 7 – 16)

Secretary note: A letter ballot was given for this action item and the item's Chair, Don Patten, decided this item needed revision and requested that the ballot be closed for more work.

July 2012
Mr. Patten presented the negative feedback he had received. The group revisited with Mr. Pillow on his reasoning behind his negative vote. After taking into consideration Mr. Pillow's opinion and others the group unanimously agreed to make a motion to reaffirm. The motion was unanimously approved.

NB12-0302 ***Part 1, SG V&P*** Define installation requirements for (PVHO) hyperbaric chambers) This action item is a result of splitting NB09-0601into two parts. A task group of G. Scribner (Chair) and M. Richards has been assigned.
(No Attachment)

July 2012
Mr. Scribner presented a progress report. Concentration will be aimed in defining types and then identifying installation requirements.

NB12-0304 ***Part 1, SG Pressure Vessels and Piping*** - Installation requirements for carbonated beverage systems.
(Attachments 3, pages 17 – 22)

July 2012
Mr. Scribner presented a progress report with a proposal. Mr. Scribner presented a proposed System Description and Figures. There was a motion to approve this proposal with the intent of placing the System Description at the beginning of the Supplement and the figures at the end. Mr. Moore brought up concerns with regard to the figures. He will submit his question/concern to Mr. Scribner. There was a motion to approve both items as modified, move to the SC and send out as letter ballots at the MC. The motion was approved with 1 negative.

7. New Business
(Attachments 4, pages 23 – 26)

New Action Item NB13-0101: As a result of action item NB12-0304, new action item NB13-0101 was assigned to propose a functional description of these systems.

8. Future Meetings

July 17-20, 2012, Columbus, Ohio
January 14-18, 2013, Mobile, Alabama

9. Adjournment

The meeting adjourned at 3:10 pm

Respectfully Submitted,

Jeanne Bock
Secretary

Attendance List PV and Piping Subgroup

Meeting Date: July 17, 2012

Harold Tyndall Zurich Services Corporation Risk Engineering 770 Corbett Street Winterville, NC 28590 Ph: 252-215-1144 Fax: E-mail: **Harold.tyndall@zurichna.com**	Attended: Yes ☒ No ☐ HGT *Initial*	**Jeanne Bock** National Board 1055 Crupper Ave. Columbus, OH 43229 Ph: 614-888-8320 F: 614-847-1828 E: jbock@nationalboard.org	Attended: Yes ☐ No ☐ *Initial*
Geoffrey Halley ABMA 1315 Ridge Road Wildwood, MO 63021 Ph: 636-394-3483 Fax: 636-527-2839 Email: ghalleysji@aol.com	Attended: Yes ☒ No ☐ *Initial*	**Raymond Snyder** 150 Costa Loop Auburndale, FL 33823 Ph:865-965-4417 Fax: 865-967-0185 E-mail: Raymond.snyder@ariseinc.com	Attended: Yes ☒ No ☐ *Initial*
H. Michael Richards Southern Company 42 Inverness Center Pkwy. Birmingham, AL 35242 Ph: 205-992-7111 Fax: 205-992-0361 E-mail: hmrichar@southernco.com	Attended: Yes ☒ No ☐ *Initial*	**Gary Scribner** Missouri Division of Fire Safety P.O. Box 844 Jefferson City, MO 65102 Ph: 573-751-8708 Fax: 573-526-5971 E-mail: gary.scribner@dfs.mo.gov	Attended: Yes ☐ No ☐ *Initial*
Paul Bourgeois Traveler's ~~11441 Sarasota Lane~~ 6812 5TH ST Northport, AL ~~35475~~ 35476 Ph:205-339-6314 Fax: 888-803-1522 Email: pcbourge@travelers.com	Attended: Yes ☒ No ☐ *Initial*	**Stanley Konopacki** Midwest Generation 235 Remington Blvd. Suite A Bolingbrook, IL 60440 Ph: 847-599-2243 Fax: 847-599-2256 Email: SKonopacki@MWGen.com	Attended: Yes ☒ No ☐ SCK *Initial*

Attendance List PV and Piping Subgroup

Meeting Date: July 17, 2012

Donald Patten R.F. MacDonald Co. 25920 Eden Landing Road Hayward, CA 94545 P: 510-670-7422 F: 510-784-1004 Email: don.patten@rfmacdonald.com	Attended: Yes ☑ No ☐ D.P. *Initial*	Vews Newton UneCIS Insurance Company 3380 Chastain Meadows Pkwy Kennesaw, Ga 30144 770-429- 679-457-1310 Vews.Newton@unecis.com
Name: Melissa Wadkinson (visitor) Company: Fulton Address: PO Box 257 972 Centerville Rd City/State/Zip: Pulaski NY 13142 Ph: 315 298 7112 Ext. Fax: 315 298 6390 E-mail: melissa.wadkinson@fulton.com	Name: CRAIG HOPKINS Company: SEATTLE BOILER WORKS INC Address: 500 S. MYRTLE ST City/State/Zip: SEATTLE, WA 98108 Ph: 206 762-0237 Ext. Fax: 206 762-3516 E-mail: chopkins@seattleboiler.com	
Name: Brian W. Moore Company: HSB Address: one state street P.O. Box 5024 City/State/Zip: Hartford, CT 06102-5024 Ph: 860-722-5657 Ext. Fax: 860-722-5530 E-mail: brian_moore@hsb.com	Name: Paul Schuelke Company: Weil-McLain Address: 500 Blaine St City/State/Zip: Michigan City IN Ph: 219 879-6561 Ext. 407 Fax: 219-877-0535 E-mail: pschuelke@weil-mclain.com	
Name: TRENT MILLER Company: VICTORY ENERGY OPERATIONS Address: 16701 E 126TH ST NORTH COLLINSVILLE OK 74021 City/State/Zip: Ph: 402-261-8142 Ext. Fax: 918-274-0059 E-mail: tmiller@victoryenergy.com	Name: Amy S. KOVALAN Company: McDonald's Corp Address: 2915 Jorie Blvd City/State/Zip: Oak Brook, IL 60523 Ph: 630-623.8274 Ext. Fax: E-mail: amy.kovalan@us.mcd.com	

Fw: LB NB11-2001
Robin Hough to: Jeanne Bock 07/24/2012 03:59 PM

From: Robin Hough/NationalBoard
To: Jeanne Bock/NationalBoard@NationalBoard

Robin Hough
NBIC Committee Coordinator
The National Board of Boiler and Pressure Vessel Inspectors
1055 Crupper Avenue
Columbus, OH 43229
614-888-8320 x 228
614-431-3236 Direct Line
----- Forwarded by Robin Hough/NationalBoard on 07/24/2012 03:59 PM -----

From: Robin Hough/NationalBoard
To: bryan.schulte@nrgenergy.com, chopkins@seattleboiler.com, david.parrish@fmglobal.com, canonicod@epbfi.com., DCook@dir.ca.gov, fhart@furmanite.com, Gary.Scribner@dfs.dps.mo.gov, ggalanes@MWGen.com, HMICHAELRICHARDS.PE@GMAIL.COM, Paul Welch <Paul.Welch@dol.state.ga.us>, banthony@dlt.state.ri.us, jim.riley@conocophillips.com, "Pate, Ralph" <Ralph.Pate@labor.alabama.gov>, jpillow@commonarc.com, jsekely@comcast.net, jwrichar@aol.com, pcbourge@travelers.com, paul.edwards@shawgrp.com, raymond.snyder@ariseinc.com, breetz@state.nd.us, Robert_Wielgoszinski@hsbct.com, RLPulliam@babcock.com, stanleys@dot.gov, Terry Parks/NationalBoard@NationalBoard, mike.webb@xcelenergy.com, Lmac@gLabap.com
Cc: Don.Patten@RFMacDonald.com
Date: 04/16/2012 10:47 AM
Subject: LB NB11-2001

Gentlemen:

The subject letter ballot has now closed. The ballot has passed but due to the concerns of the negative voters the project chair, Don Patten, has decided to withdraw the ballot and take it back to the subcommittee for more work. This item will appear on the agendas for the July meeting.

Thank you,

Robin Hough
NBIC Committee Coordinator
The National Board of Boiler and Pressure Vessel Inspectors
1055 Crupper Avenue
Columbus, OH 43229
614-888-8320 x 228
614-431-3236 Direct Line

COMMITTEE CORRESPONDENCE

COMMITTEE: NBIC

TO: NBIC Committee

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

FROM: Robin Hough
NBIC Secretary

SUBJECT: Letter Ballot NB11-2001 MC

DATE: March 30, 2012

Committee Members,

Letter ballot NB11-2001 MC has now closed. The ballot was approved. The voting results are:

20	Approved
1	Disapproved
1	Abstained
1	Not Voting
3	Not Returned

Per the NBIC Procedures 7.3.2:

"NBIC Committee or subcommittee members shall be apprised of any unresolved comments and given two (2) weeks from notification to reconsider their original vote."

The ballot will remain open until April 13, 2012 for your reconsideration.

:rmh

Ballot Votes NB11-2001 MC

Name	Email	Votes	Vote Date
Paul Edwards	paul.edwards@shawgrp.com	Abstention	03/26/12
Benjamin Anthony	banthony@dlt.state.ri.us	Approve	03/20/12
Bob Reetz	breetz@nd.gov	Approve	03/06/12
Bryan Schulte	bryan.schulte@nrgenergy.com	Approve	03/21/12
Dave Parrish	david.parrish@fmglobal.com	Approve	03/01/12
Domenic canonico	canonicod@epbfi.com	Approve	02/29/12
Don Cook	dcook@hq.dir.ca.gov	Approve	03/01/12
Frank Hart	fhart@furmanite.com	Approve	02/29/12
Gary Scribner	Gary.Scribner@dfs.dps.mo.gov	Approve	03/05/12
George Galanes, PE	ggalanes@mwgen.com	Approve	03/02/12
Jim Riley	jim.riley@conocophillips.com	Approve	03/02/12
Jim Sekely	jsekely@comcast.net	Approve	02/29/12
John Richardson	jwrichar@aol.com	Approve	03/07/12
Lawrence McManamon	lmac@glabap.com	Approve	03/02/12
Michael Richards	hmrichar@southernco.com	Approve	03/02/12
Michael Webb	mike.webb@xcelenergy.com	Approve	03/01/12
Paul Bourgeois	pcbourge@travelers.com	Approve	03/06/12
Paul Welch	paul.welch@dol.state.ga.us	Approve	03/20/12
Raymond Snyder	raymond.snyder@ariseinc.com	Approve	03/01/12
Ronald Pulliam	rlpulliam@babcock.com	Approve	03/04/12
Stanley Staniszewski	stanley.staniszewski@dot.gov	Approve	03/21/12
James Pillow	jpillow@commonarc.com	Disapprove	03/21/12
Craig Hopkins	chopkins@seattleboiler.com	Not Voted	N/A
Ralph Pate	ralph.pate@labor.alabama.gov	Not Voted	N/A
Robert Wielgoszinski	Robert_Wielgoszinski@hsbct.com	Not Voted	N/A
Terry Parks	tparks@nationalboard.org	Not Voting	02/29/12

Ballot Comments NB11-2001 MC

Ballot Comments

Name	Document	Comment	Date Created
Donald Patten	NB11-2001	I looked at ASME 2007 edition Addenda 2009 and found nothing stipulating the location of a relief valve for isolable economizers. Please see a copy of the attached from said edition. If anyone can point me in the direction of where I can find this information I would greatly appreciate it.	03/27/2012
Donald Patten	NB11-2001	I responded with a copy of the attached from ASME. I could not find any stipulation for isolable economizers relief valve location. I had asked Mr. Pillows to please provide this information so I could review.	03/27/2012
Donald Patten	NB11-2001	I look at ASME Section 1 2007 Addenda 2009. I could not find any stipulation of relief valve location. See attached copy of PG 67.2.6. If you could point me to the section that designates or stipulates installation location of a relief valve for an isolable economizer I would greatly appreciate it.	03/27/2012
Paul Edwards		I would like to see a response to Mr. Pillow's concern.	03/26/2012
James Pillow		Jpillow 3/21/12 I disapprove because the proposal is an attempt to re-write ASME Section I rules that already address mounting of pressure relief valves. Section I does not allow the mounting of the valves "as recommended by the Manufacturer". Keep in mind that Part 1 of the NBIC does not overrule the Section I rules.	03/21/2012
Donald Patten		Mr. Richardson, I queried Mr. Olson at Victory Energy and below is his comments: Locating the PSV at the outlet without specifying an outlet location does not support an idea that the outlet of an isolated economizer is the strategic location for the PSV. The commenter is correct that, when the economizer is isolated, rarified fluid will immediately begin to collect at the upper areas. Due to the fact that the PSV can be set very close to operating pressures, the time element may not always come into affect. Anyway we look at it, allowing or the PSV location to be determined by the Designer is most beneficial. Regards, David Olson	03/21/2012
John Richardson		I approve this ballot with some hesitation. During normal operation the cooler, more dense fluid if. water or wet steam would be entering the top of the exchanger. The valve is apparently sized for steam but is the slower discharge rate advisable ?? When isolation occurs a sudden transient would follow in which the more rarified fluid would collect at the top. Is it possible that the original requirement to place the PRV at or near the outlet was due to the time element?? How rapid is the pressure rise in the heat	03/07/2012

	exchanger?? How long does the heat input continue?? I trust Victory Energy has looked at all the credible scenarios. Perhaps I will have a chance to look at this a bit closer before the ballot closes.	
George Galanes, PE	This is more of an editorial comment, but I believe it would be better stated below; The safety valve shall be installed in a location either recommended by the manufacturer, or if no recommendation is provided shall be located as close as practical to the economizer outlet.	03/02/2012

Ballot Comments NB11-2001

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Name	Document	Comment	Date Created
Robin Hough		This commnet comes from Donald Patten: I was unaware of any conflicts with ASME. When we as the subcommitte voted we all voted for the submitted change. Now that there is a conflict. I agree that this should be sent back to us and I will submit to the ASME on this subject. 04/13/2012	04/13/2012
Robin Hough		I was unaware of any conflicts with ASME. When we as the subcommitte voted we all voted for the submitted change. Now that there is a conflict. I agree that this should be sent back to us and I will submit to the ASME on this subject. 04/13/2012	04/13/2012
Donald Patten		I was unaware of any conflicts with ASME. When we as the subcommitte voted we all voted for the submitted change. Now that there is a conflict. I agree that this should be sent back to us and I will submit to the ASME on this subject.	04/13/2012
Robert Wielgoszinski		I vote negative on this in support of the other negative ballotors. First, was this item discussed at the Part 1 Installation subcommittee meeting? If so, what was the result of the deliberation? Was there a vote taken? What was the result of that vote? Secondly, this proposal conflicts with the intent of the ASME Code Section I and inclusion in the NBIC would usurp the completion of ASME Code requirements. If this valve alignment is something that is allowed or common in other international boiler standards, then perhaps the	04/11/2012

		proposal should be revised accordingly.	
Michael Webb		To Jim Pillow's comment: Seemingly the original code of construction may be circumvented. As indicated by the statement of need, there is no intent to deviate from the requirements of ASME Section 1 or Section VIII, Div.I as applicable; but the proposed language as stated does not align the manufacturer to the original code of construction. In my opinion, Mr. Pillow's comment needs to be addressed and the language refined to reflect an alignment to the original code of construction. M. Webb	04/11/2012
George Galanes, PE		GWG 4/11/12; I am changing my vote from approve to disapprove. After further re-consideration and no follow-up response to Mr. Pillow's original comment regarding Section I rules by the PM, I believe the proposed change is unnecessary because the NBIC is not a construction code. There is no need to reference the Manufacturer's recommendation in locating a PRD. The original wording is acceptable and does not conflict with Section I.	04/11/2012
Bob Reetz		I would like to change my vote from approve to disapprove after viewing Mr. James Pillow's comments. We should not be addressing this issue as it is the jurisdiction of Section I and should be handled there. Part I of the NBIC cannot be used to overrule Section I. The request should be handled by Section I. Section I, Figure PG 58.3.1(b), shows the location of a safety valve for an isolable economizer to be the outlet and not the inlet. I am not sure if Donald Patten has viewed this section.	04/02/2012
Donald Patten	NB11-2001	I looked at ASME 2007 edition Addenda 2009 and foiund nothing stipulating the location of a releif valve for isolable economizers. Please see acopy of the attached from said edition. If anyone can point me in the direction of wher I can find this information I would greatly appreciate it.	03/27/2012
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Don Patten Comment

Copy from ASME Section 1 – 2007 Edition Addenda 2009

PG-67.2.6 Any economizer that may be shut off from the boiler, thereby permitting the economizer to become a fired pressure vessel, shall have one or more pressure relief valves with a total discharge capacity, in lb /hr (kg/hr), calculated from the maximum expected heat absorption in Btu/hr (W), as determined by the Manufacturer, divided by 1,000 (646). This absorption shall be stated in the stamping (PG-106.4). For overpressure conditions where the fluid relieved is water, the discharge capacity of the pressure relief valve, or valves shall be sufficient to prevent the pressure from exceeding the limits of PG-67.2.

NB 11-2001 ***Part 1, 2.9.4 SG Pressure Vessels and Piping*** - Address the safe venting isolatable economizers where the outlet is below the inlet of other communicable chambers (Headers, drums, etc.)

Current Language:

2.9.4 ECONOMIZERS

An economizer that may not be isolated from a boiler does not require a safety relief valve. Economizers that may be isolated from a boiler or other heat transfer device, allowing the economizer to become a fired pressure vessel, shall have a minimum of one safety relief valve. Discharge capacity, rated in lbs/hr (kg/hr), of the safety relief valve or valves shall be calculated from the maximum expected heat absorption rate in Btu/hr (Joules/hr) of the economizer, and will be determined from manufacturer data, divided by 1000. The safety relief valve shall be located as close as possible to the economizer outlet.

Proposed Language:

2.9.4 ECONOMIZERS

An economizer that may not be isolated from a boiler does not require a safety relief valve. Economizers that may be isolated from a boiler or other heat transfer device, allowing the economizer to become a fired pressure vessel, shall have a minimum of one safety relief valve. Discharge capacity, rated in lbs/hr (kg/hr), of the safety relief valve or valves shall be calculated from the maximum expected heat absorption rate in Btu/hr (Joules/hr) of the economizer, and will be determined from manufacturer data, divided by 1000. The safety relief valve shall be installed in a locationed recommended by the manufacturer, when no recommendation exists the location shall be as close as practical possibleto the economizer outlet.

Statement of Need

Victory Energy intends to design isolatable economizers, in accordance with ASME Section I and VIII Div1, and have the PSV located on the uppermost chamber instead of the Outlet connection. ASME requirements for PSVs ensure that the PSV is large enough to vent the energy in the form of steam. The same size PSV venting hot water potentially releases many more times the energy as venting steam. The amount of energy released in a given time is often excessive for vent piping, condensate tanks, and drains to handle. It is preferred to vent the energy as steam, over a longer period of time. Rapid draining of the economizer also allows the economizer to rapidly increase in temperature, causing undue stress. Furthermore, this request should serve to more closely align this part of the code with the ASME codes.

Background Information

An example would be a vertical counterflow economizer where the inlet header is located above the outlet (as in Figure 1) If the designer can specify where the PSV be located then the PSV may be placed such that the release of energy, via steam, happens more slowly through the same size PSV.

Figure 1 illustrates a counter-flow economizer, in a vertical up gas path, having horizontal headers, with the outlet header below the inlet. When this type of economizer is isolated during operation, and the PSV is tripped, steam will begin to collect in the upper "inlet" header. This design allows a more controlled venting of isolatable economizers by venting steam instead of hot water. Figure 1 also illustrates moving the safety relief valve from the outlet to the preferred location.

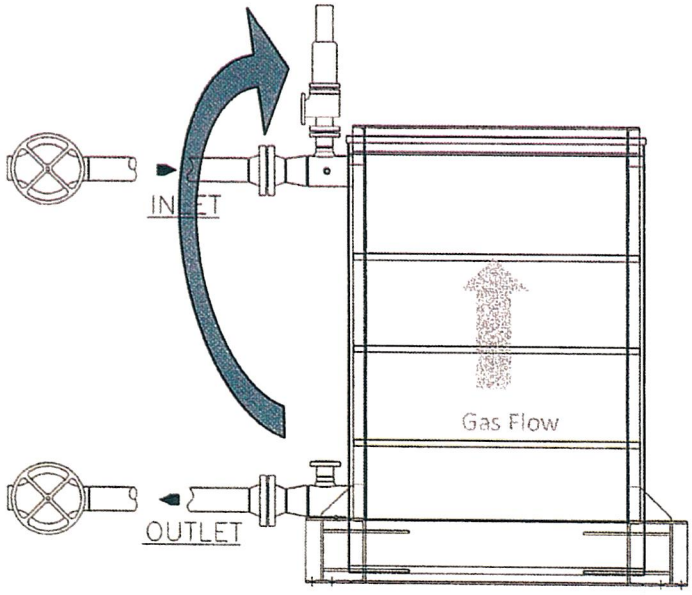

Figure 1

David Olson

QCM

Victory Energy Operations, LLC

918-340-9942

NB12-0304 **NBIC Part 1**

SUPPLEMENT 3
INSTALLATION OF LIQUID CARBON DIOXIDE STORAGE VESSELS

S3.1 SCOPE

This section provides requirements for the installation of Liquid Carbon Dioxide Storage Vessels (LCDSV's), 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 1,000lbs or less of liquid CO_2.

S3.2 GENERAL REQUIREMENTS

STORAGE TANK LOCATION

LCDSV's should be installed in an unenclosed area whenever possible. LCDSV's that do not meet all criteria for an unenclosed area shall be considered an enclosed area installation.

An unenclosed area:

- Shall be outdoors
- Shall be above grade
- Should not have a roof or overhead cover
- 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 a) General Requirements (enclosed and unenclosed areas)

1) LCDSV's shall not be located within 10 feet of elevators, unprotected platform ledges or other areas where falling would result in dropping distances exceeding half the container height.
2) LCDSV's shall be installed with sufficient clearance for filling, operation, maintenance, inspection and replacement.
3) Orientation of nozzles and attachments shall be such that sufficient clearance between the nozzels, attachments, and the surrounding structures is maintained during the installation, the attachment of associated piping, and operation.
4) LCDSV's shall not be installed on roofs.
5) LCDSV's 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.
6) LCDSV's shall not be installed within 36 in. (914 mm) of electrical panels.

7) LCDSV's 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.
8) LCDSV's shall be equipped with isolation valves in accordance with paragraph S3.6.

S3.2 b) Unenclosed area LCDSV installations.

If LCDSV's 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_2 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 supply line should be protected via conduit or appropriate covering.

S3.2 c) Enclosed area LCDSV Installations

1) Permanent LCDSV installations with remote fill connections.
   a. Shall be equipped with a gas detection system installed in accordance with paragraph S3.4
   b. Shall have signage posted in accordance with paragraph S3.5
   c. Shall be equipped with fill boxes; fill lines and safety relief/vent valve circuits installed in accordance with paragraph S3.6

2) Portable LCDSV installations with no permanent remote fill connection. Warning: LCDSV's 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.
   a. Shall be equipped with a gas detection system installed in accordance with paragraph S3.4
   b. Shall have signage posted in accordance with paragraph S3.5
   c. Shall have safety relieve/vent valve circuit connected at all times except when the tank is being removed for filling. Connects may be fitted with quick disconnect fitting meeting the requirements of paragraph S3.6
   d. 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 FILL BOX 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:

a) At least three (3) feet from any door or operable windows.
b) At least three (3) feet above grade.
c) Shall not be located within ten (10) feet from side to side at the same level or below, from any air intakes.
d) Shall not be located within ten (10) feet from stair wells 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_2 gas release. Alarms will be designed to activate a low level pre-alarm at 1.5% concentration of CO_2 and a full high alarm at 3% concentration of CO_2 (which is the OSHA & ACGIH 15 minute and NIOSH 10 minute Short Term Exposure Limit for CO_2.) These systems are not designed for employee personal exposure monitoring. Gas detection systems shall be installed and tested in accordance with manufactures 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 problem.

S3.5 SIGNAGE

Warning signs shall be posted at the entrance to the building, room, enclosure, or enclosed area where the container is located. The warning sign shall be at least 8 in (200mm) wide and 6 in (150mm) high. The wording shall be concise and easy to read and the upper portion of the sign must be orange as shown in figure 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 signs shall state the following:

"WARNING – CARBON DIOXIDE GAS. Ventilate the area before entering. A high carbon dioxide (CO_2) gas concentration in this area can cause suffocation."

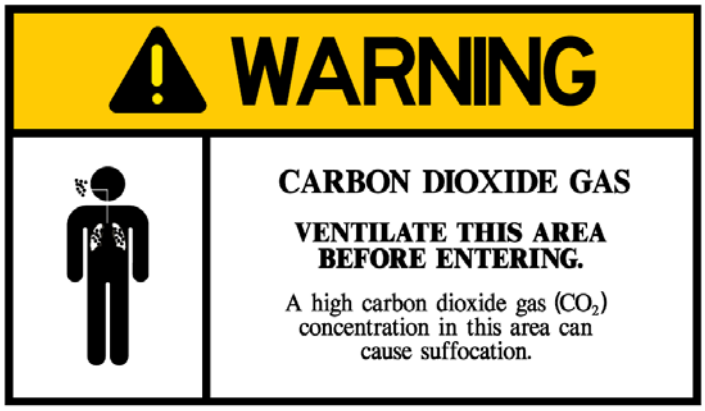

Figure S3.5

a) Additional instruction signage shall be posted outside of the area where the container is located and such signage shall contain at minimum the following information;

   Carbon Dioxide Monitors for general area monitoring (not employee personal exposure monitoring) are provided in this area. These monitors are set to alarm at 15,000ppm (1.5% concentration) for the low level alarm and at 30,000ppm (3% concentration) for high level alarm.

   Low Level Alarm (15,000ppm) – 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.

   High Level Alarm (30,000ppm) – 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_2 is reduced below the high alarm limit.

S3.6 VALVES, PIPING, TUBING AND FITTINGS

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

a) Components must be compatible for use with CO_2 in the phase, (gas, or liquid) it encounters in the system.
b) Components shall be rated for the operational temperatures and pressures encountered in the applicable circuit of the system.
c) Shall be stainless steel, copper, brass, or plastic/polymer materials rated for CO_2.

d) Only fittings and connections recommended by the manufacturer shall be used for all hoses, tubes, and piping.
e) All valves and fittings used on the LCDSV shall be rated for the maximum allowable working pressure stamped on the tank.
f) 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.

Relief Valves – Each LCDSV shall have at least one ASME stamped relief valve 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 CGA S-1.3 recommendations. Discharge lines from the relief valves shall be sized in accordance with tables S3.6a & S3.6b Note: due to the design of the LCDSV the discharge line may be smaller in diameter than the relief valve outlet size.

Caution: Company's and or individuals filling or refilling LCDSV's shall be responsible for utilizing fill equipment that is acceptable to the manufacture to prevent over pressurization of the vessel.
Question - What is the ANSI number for CGA S-1.3?

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:

a) Isolation valves shall be located on the tank or at an accessible point as near to the storage tank as possible.
b) All valves shall be designed or marked to indicate clearly whether it is open or closed.
c) All valves shall be capable of being locked or tagged in the closed position for servicing.
d) Gas Supply and Liquid CO_2 Fill Valves shall be clearly marked for easy identification.

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 shall be a continuous run from PRD to outside vent line discharge fitting, without any splices. 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. The minimum size and length of the lines shall be in accordance with table S3.6a and S3.6b. Fittings or other connections may result in a localized reduction in diameter have been factored into the lengths given by the tables S3.6a and S3.6b.

Tank Size (Pounds)	Fire Flow Rate Requirements (Pounds per Minute)	Maximum length of 3/8" ID Nominal Metallic Tube Allowed	Maximum length of ½" Metallic Tube Allowed
Less than 500	2.60 maximum	80'	100'
500-750	3.85 maximum	55'	100'
Over 750 to 1000	5.51 maximum	18'	100'

Table S3.6a Minimum LCDSV System Safety Relief/Vent Line Requirements (Metallic)

Tank Size (Pounds)	Fire Flow Rate Requirements (Pounds per Minute)	Maximum length of 3/8 ID plastic/polymer materials Tube Allowed	Maximum length of ½ ID plastic/polymer materials Tube Allowed
Less than 500	2.60 maximum	100'	100'
500-750	3.85 maximum	100'	100'
Over 750 to 1000	5.51 maximum	N/A (See ½" column)	100'

Table S3.6b Minimum LCDSV System Safety Relief/Vent Line Requirements (plastic/polymer**)**

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- **Note: Place the System Description at the beginning of S3**

~~4.6.1~~ System Description

The Liquid Carbon Dioxide Beverage systems include the Liquid Carbon Dioxide Storage Vessel -or LCDSV (tank) and associated sub-system circuits - Liquid CO_2 fill circuit, and Pressure relief / vent line circuit. The LCDSV s are vacuum insulated pressure vessels, constructed of stainless steel, with Super Insulation wrapping between the inner pressure vessel and the outer vacuum jacket. (See Figure ….) These Pressure vessels are typically designed for a Maximum Allowable Working Pressure (MAWP) of either 300 psig or 283 psig. The LCDSV come equipped with a ASME/NB certified "UV" Primary Relief Valve (PRV) set at or below the MAWP of the vessel. Additionally as recommended by CGA S-1.3, (PRESSURE RELIEF DEVICE STANDARDS PART 3 - STATIONARY STORAGE CONTAINERS FOR COMPRESSED GASES) a secondary relief valve may be installed. This secondary relief valve is beyond the scope of ASME Section VIII, Division 1 and is not required to be ASME/NB stamped and certified. This additional PRV is typically rated no higher than 1.5 times the vessel MAWP.

Operating conditions of the system can cause temperatures and pressures to range from 90 psig (-56° F) to 300 psig (+2°F). Below 60 psig in the tank, liquid CO_2 begins changing to solid phase (dry ice). If the tank becomes completely depressurized to 0 psig, temperatures inside the tank could reach -109°F (solid dry ice). When liquid CO_2 turns to solid dry ice in a completely depressurized tank, all CO_2gas flow in the system ceases and the tank becomes non-functional. See the attached CO_2 Phase Diagram figure 4.6.xxx, showing the typical operating range of these systems. Components external to the LCDSV inner tank pressure vessel may encounter temperatures and pressures between 90 psig, (-56°F) and 300 psig (+2°F). Typical operating pressures and temperatures vary in each of the associated sub-system circuits. See Table 4.6.xxx

➢ **Note: Place the Figures at the end of S3**

Figure 4.6.xxx **Carbon Dioxide Phase Diagram**

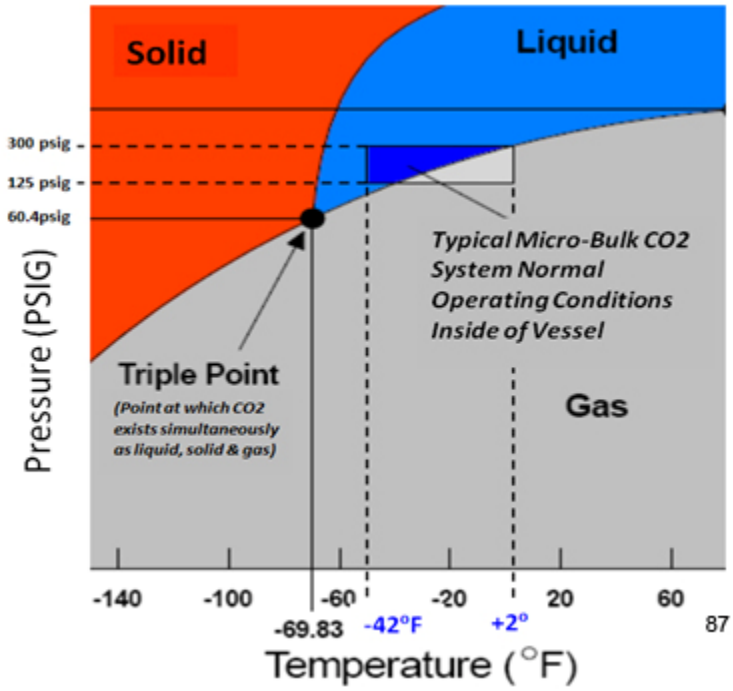
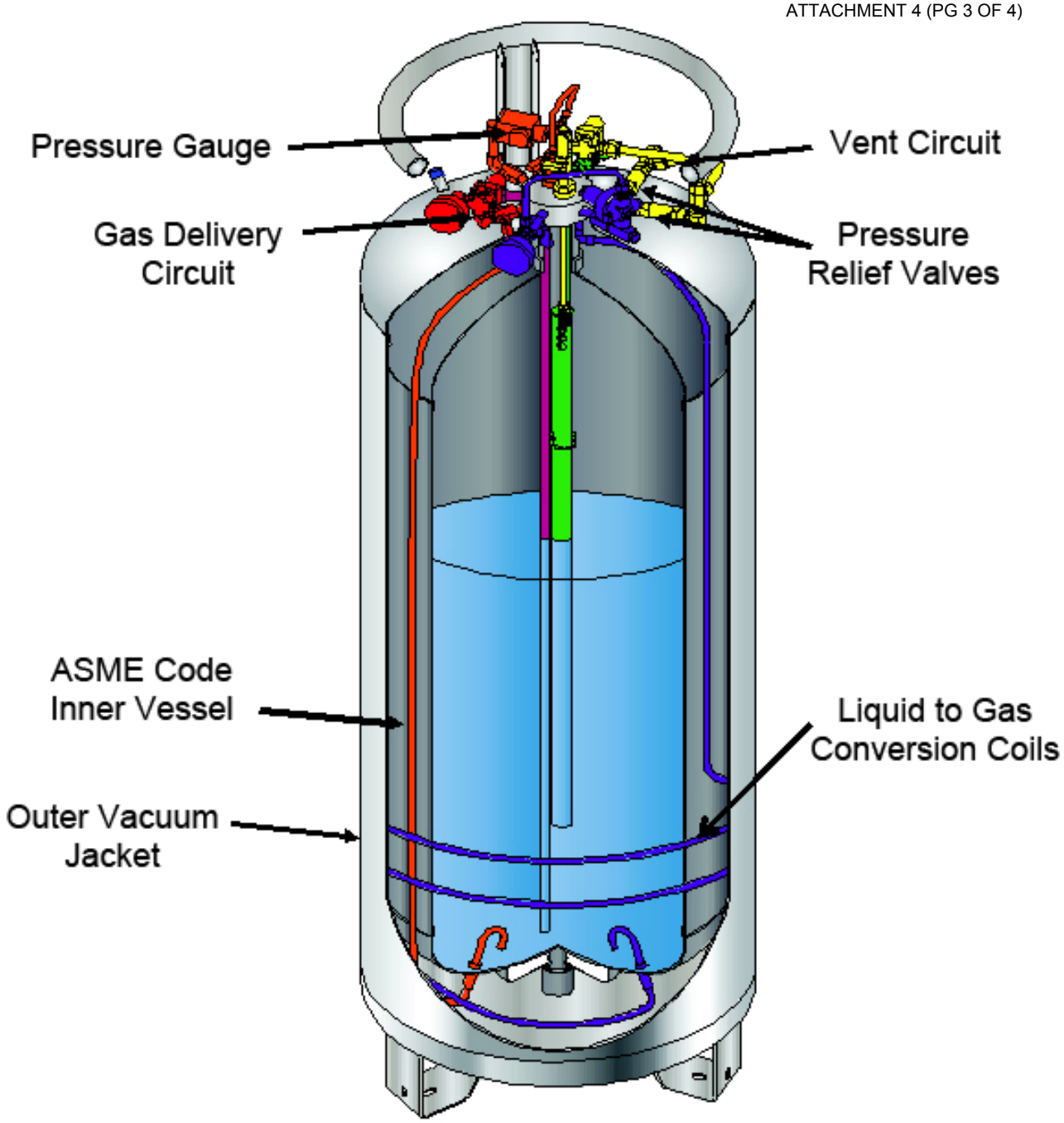


Table 4.6.xxx Typical Operating Pressures & Temperatures of the LCDSV System

System Component	Operating Pressure	Operating Temperature
Storage Vessel (tank internal conditions)	90 - 300 psig	-56°F to +2° F
Liquid CO_2 Fill Line	150 - 300 psig	-34°F to +2° F
Pressure Relief **Gas** Vent Line	0 - 120 psig	ambient to -50° F


Pressure Gauge
Vent Circuit
Gas Delivery Circuit
Pressure Relief Valves
ASME Code Inner Vessel
Liquid to Gas Conversion Coils
Outer Vacuum Jacket

NB13-0101 – Explanation of negative vote

1. The phase diagram included as part of the proposal is not consistent with publically available data. For example, the published triple point is -56.6°C (-69.88°F) at 5.11 atmospheres (60.417 psig) (1 atm = 14.7 psia). Four significant figures of precision requires the change.

   Alternative: If the figure is changed to -70.0°F (three significant figures consistent with 60.4), I would withdrawn my negative.

2. The figure shows an intersection at 125 psig and -42°F with no corresponding explanation in the text.

   Suggested solution: delete the axis labels and intersection lines or provide and explanation in the text.

1. The second paragraph of the System Description confusing as written. I suggest the following revision:
   Operating conditions ~~of~~ in the system, components, and inner pressure vessel can vary between ~~cause temperatures and pressures to range from~~ 90 psig (-56° F) ~~to~~ and 300 psig (+2°F). Below about 60 psig in the tank, liquid CO2 begins changing to solid phase (dry ice). If the tank becomes completely depressurized to 0 psig, temperatures inside the tank could reach -109°F (solid dry ice). When liquid CO2 turns to solid dry ice in a completely depressurized tank, all CO2 gas flow in the system ceases and the tank becomes non-functional. See the attached CO2 Phase Diagram ~~figure~~ Figure ~~4.6.xxx~~S3.2xxx, showing the typical operating range of these systems. ~~Components external to the LCDSV inner tank pressure vessel may encounter temperatures and pressures between 90 psig, (-56°F) and 300 psig (+2°F).~~ Typical operating pressures and temperatures vary in each of the associated sub-system circuits. See Table ~~4.6.xxx~~S3.2xxx.

Brian W. Moore, P.E.