Date Distributed: January 5, 2022

THE NATIONAL BOARD
OF BOILER AND PRESSURE VESSEL INSPECTORS

NATIONAL BOARD INSPECTION CODE SUBGROUP INSPECTION

AGENDA

Meeting of January 18th, 2022
San Diego, CA

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**
   8:00 AM Pacific Time. For those attending in person, the meeting will be held in Regency on the second floor of the hotel.

2. **Introduction of Members and Visitors**

3. **Check for a Quorum**

4. **Awards/Special Recognition**

5. **Announcements**

   - The National Board will be hosting a reception on Wednesday evening from 5:30pm to 7:30pm at The Smoking Gun.

   - The National Board will be hosting breakfast and lunch Thursday. Breakfast will be served from 7:00am to 8:00am, and lunch will be served from 11:30am to 12:30pm. Both meals will be served at the hotel in Le Fontainebleau.

   - A coffee station will be provided outside of the meeting rooms on each floor.

6. **Adoption of the Agenda**

7. **Approval of the Minutes of the July 13th, 2021 Meeting**

   The minutes are available for review on the National Board website, www.nationalboard.org.

8. **Review of Rosters (Attachment Page 1)**
   a. **Membership Nominations**

   b. **Membership Reappointments**
   The following Subgroup members are up for reappointment: Mr. Venus Newton.

   c. **Officer Appointments**

9. **Open PRD Items Related to Inspection**

   - Item 21-76 - Update ASME paragraph reference in Part 4, 3.2.4.3 and Part 2, 2.5.5.3

10. Interpretations

Item Number: 21-65	NBIC Location: Part 2, 2.3.6.2 b) 4)	Attachment page 2
General Description: Air receiver tank manual drain valve **Subgroup:** Inspection **Task Group:** None assigned **Explanation of Need:** The inquirer remembers this requirement some 12 years ago but could no longer find the specific code requirement. Their client wants to know where and what code provides this requirement.		
January 2022 Meeting Action:		

11. Action Items

Item Number: 19-46	NBIC Location: Part 2, S5.1	Attachment Page 5
General Description: Revisions to Yankee dryer supplement in Part 2 **Subgroup:** Inspection **Task Group:** T. Barker (PM), V. Newton, D. Lesage, J. Jessick **Explanation of Need:** Ensure that wording in Part 2, S5.1, is identical to that found in Part 1, S1.1.		
July 2021 Action: PROGRESS REPORT: Mr. Barker gave a progress report of what Mr. Jessick and the task group has been working on. Mr. Newton recommended combining Items 19-63 & 19-64 with this item to create just one item for the Revisions to the Yankee Dryer Supplement. Mr. Scribner noted that we will need the names of anyone else working on this item, outside of the assigned task group, and their meeting schedule. Change General Description to: Revisions to Yankee dryer supplement in Part 2 **Task Group Update: Add Jerry Jessick.**		

Item Number: 20-46	NBIC Location: Part 2, 5.3.2	Attachment Page 17
General Description: Updates to Forms NB-5, NB-6, & NB-7. **Subgroup:** Inspection **Task Group:** D. Buechel (PM), M. Sansone, V. Scarcella, D. LeSage **Explanation of Need:** On the current forms NB-5, NB-6, & NB-7 there are fields that are already on the ASME Manufactures Data Report making them repetitive. Other fields that ask for in- depth technical information would be hard if not impossible for an inspector to determine and are irrelevant to the inspection process.		
July 2021 Action: PROGRESS REPORT: Mr. Buechel, has stated they are still working on the proposal.		

Item Number: 20-57	**NBIC Location: Part 2, 4.4.1 a)**	**No Attachment**
General Description: Evaluate revision to Part 2, 4.4 FFS scope roles and responsibilities (submitted by Mr. George Galanes). **Subgroup:** Inspection **Task Group:** M. Horbaczewski (PM) and B. Ray **Explanation of Need:** Currently, there is confusion surrounding implementation of FFS for Part 2 inspection activities, where the FFS form is located and Part 3 activities regarding Part 3, 3.3.4.8 because it references Part 2 for FFS. In addition, we need to have a Part 2 Inspection member to be assigned to assist in the development of roles and responsibilities.		
July 2021 Action: PROGRESS REPORT: Mr. Horbaczewski discussed this item with the group. The document is still a work in progress. The TG is waiting on a document from EPRI & ASME before they make any further revision to their proposal.		

Item Number: 21-25	**NBIC Location: Part 2**	**Attachment Page 23**
General Description: Autoclave/Quick opening device PP (submitted by Kevin Hawes) **Subgroup:** Inspection **Task Group:** V. Scarcella (PM), T. Bolden, M. Horbachewski, J. Peterson, J. Clark, W. Hackworth, M.A. Shah. **Explanation of Need:** Upon our AIA (Intact) QRR I produced a Power point presentation on Autoclave inspections. Your NB team leader Gary Scribner suggested I forward this inspection presentation to the NB for review of content as mention of good reference material for next NBIC edition. I have attached a copy of this PP for your considerations.		
July 2021 Action: The group briefly reviewed the PowerPoint presentation submitted by Kevin Hawes and decided they would assign a task group to review the information further.		

New Items:

Item Number: 21-40	**NBIC Location: Part 2**	**Attachment Page 25**
General Description: Define "Remote" in the NBIC Glossary **Subgroup:** Inspection **Task Group:** None assigned **Explanation of Need:** With the use of indirect inspection equipment from borescopes to tethered drones/vehicles for confined space inspections, there is a need to clarify what is considered a "remote" inspection vs an "indirect" inspection.		
January 2022 Action:		

Item Number: 21-41	NBIC Location: Part 2, 4.2 c)	No Attachment

General Description: Requirements for NDE procedures and personnel

Subgroup: Inspection
Task Group: None assigned

Explanation of Need: Lacking qualification requirements has resulted in poor NDE.

January 2022 Action:

Item Number: 21-42	NBIC Location: Part 2, 5.3.3	No Attachment

General Description: Review ASME 579 to make sure we are aligned for FSS requirements

Subgroup: Inspection
Task Group: None assigned

Explanation of Need: FSS is a critical component of high-risk equipment and we need to make sure those that comply with ASME 579 are also in compliance with Part II.

January 2022 Action:

Item Number: 21-46	NBIC Location: Part 2, 1.3 & 9.1	No Attachment

General Description: Defining Listed and Labeled

Subgroup: Inspection
Task Group: None assigned

Explanation of Need: Main Committee asked about having these defined in the NBIC.

January 2022 Action:

Item Number: 21-47	NBIC Location: Part 2, 2.2.4 & 2.2.5	No Attachment

General Description: To provide better guidance as it relates to carbon monoxide

Subgroup: Inspection
Task Group: None assigned

Explanation of Need: Need to provide more comprehensive items to be reviewed to guide the inspector on carbon monoxide and combustion air.

January 2022 Action:

Item Number: 21-50	**NBIC Location: Part 2, 2.3.6.4 & S7**	**No Attachment**
General Description: Ensure IIAR PV Integrity codes are aligned with NBIC II **Subgroup:** Inspection **Task Group:** None assigned **Explanation of Need:** NH3 growing exposure.		
January 2022 Action:		

Item Number: 21-56	**NBIC Location: Part 2, 2.3.6.4 f) 5) c.**	**Attachment Page 26**
General Description: Clarify what action is necessary after determining the acceptance criteria. **Subgroup:** Inspection **Task Group:** None assigned **Explanation of Need:** There is no guidance in the Liquid Ammonia 2.3.6.4 f) 5) paragraphs for the acceptance criteria for corroded areas of considerable size as there are for dents and bulges, for example.		
January 2022 Action:		

12. Future Meetings

- July 2022 – TBD
- January 2023 – TBD

13. Adjournment

Respectfully submitted,

Jodi Metzmaier
Subgroup Inspection Secretary

Graf	Darrell	National Board Certificate Holders	Chair	08/30/2024	Details
Clark	James	Manufacturers	Vice Chair	08/30/2024	Details
Metzmaier	Jodi		Secretary	01/30/2099	Details
Barker	Timothy	Authorized Inspection Agencies	Member	01/30/2024	Details
Brantley	Ernest	Authorized Inspection Agencies	Member	07/30/2022	Details
Buechel	David	Authorized Inspection Agencies	Member	07/30/2022	Details
Calvert	James	National Board Certificate Holders	Member	07/30/2024	Details
Getter	Jim	Manufacturers	Member	07/30/2024	Details
Horbaczewski	Mark	Users	Member	07/30/2024	Details
Hackworth	William	Authorized Inspection Agencies	Member	07/30/2024	Details
Jessick	Jerry	Users	Member	07/30/2024	Details
LeSage	Donnie	Jurisdictional Authorities	Member	07/30/2023	Details
Mangas	John	General Interest	Member	07/30/2024	Details
Morgan	Joseph	Users	Member	07/30/2024	Details
Newton	Venus	Authorized Inspection Agencies	Member	01/30/2022	Details
Petersen	Jeffrey	Users	Member	01/30/2023	Details
Ray	Brent	Users	Member	07/30/2023	Details
Roberts	James	Manufacturers	Member	08/30/2023	Details
Rose	David	Users	Member	10/30/2022	Details
Safarz	Jason	General Interest	Member	07/30/2023	Details
Sansone	Matthew	Jurisdictional Authorities	Member	01/30/2024	Details
Scarcella	Vincent	Authorized Inspection Agencies	Member	01/30/2023	Details
Vandini	Thomas	National Board Certificate Holders	Member	01/30/2023	Details

THE NATIONAL BOARD
OF BOILER AND PRESSURE VESSEL INSPECTORS

PROPOSED INTERPRETATION

Item No. 21-65	
Subject/Title Air receiver tank manual drain valve	
Project Manager and Task Group	
Source (Name/Email) Luciano Tuason / Luciano.Tuason@tuvsud.com	
Statement of Need In preparing an inspection of a Texas cement plant, I put this requirement indicated in my proposed reply above.	
Background Information I remember this requirement some 12 years ago, but I could no longer find the specific code requirement. The client want to know where and what code provide this requirement.	
Proposed Question Is the requirement for air receiver tank manual drain valve mandatory even if the system has an automatic condensate drain?	
Proposed Reply Yes.	
Committee's Question 1	
Committee's Reply 1	
Rationale	
Committee's Question 2	
Committee's Reply 2	
Rationale	

	VOTE:						
COMMITTEE	Approved	Disapproved	Abstained	Not Voting	Passed	Failed	Date

CODE INTERPRETATIONS

Requests for code Interpretations shall provide the following:

a) Inquiry
Provide a condensed and precise question, omitting superfluous background information and, when possible, composed in such a way that a "yes" or a "no" reply, with brief provisos if needed, is acceptable. The question should be technically and editorially correct.

b) Reply
Provide a proposed reply that clearly and concisely answer the inquiry question. Preferably the reply should be "yes" or "no" with brief provisos, if needed.

c) Background Information
Provide any background information that will assist the committee in understanding the proposed Inquiry and Reply Requests for Code Interpretations must be limited to an interpretation of the particular requirement in the code. The Committee cannot consider consulting type requests such as:

A review of calculations, design drawings, welding qualifications, or descriptions of equipment or Parts to determine compliance with code requirements;

A request for assistance in performing any code-prescribed functions relating to, but not limited to, material selection, designs, calculations, fabrication, inspection, pressure testing, or installation; or

A request seeking the rationale for code requirements.

SUPPLEMENT 5
INSPECTION OF YANKEE DRYERS ~~(ROTATING CAST-IRON PRESSURE VESSELS) WITH FINISHED SHELL OUTER SURFACES~~

S5.1 SCOPE

This supplement provides guidelines for the in service inspection of a ~~Yankee~~yankee dryer as defined in NBIC Part 1 Supplement 1. ~~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. It is characterized by a center shaft connecting the heads. While traditionally made of cast iron, bolted or welded steel vessels are in use.

~~a)~~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~~yankee dryer; and a steam-heated or fuel-fired hood. After drying, the paper web is removed from the dryer.

~~b)~~c) The dryer is typically manufactured in a range of outside diameters from 8 to 23 ft. (2.4 m to 7 m), widths from 8 to 28 ft. (2.4 m 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~~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).

~~c)~~d) The typical ~~Yankee~~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.

S5.2 ASSESSMENT OF INSTALLATION

a) The Inspector verifies that the owner or user is properly controlling the operating conditions of the dryer. ~~The Inspector does this by reviewing the owner's comprehensive assessments of the complete installation, operating environment, maintenance, and operating history.~~

b) The dryer is subjected to a variety of loads over its life. Some of the loads exist individually, while others are combined. Consideration of all the loads that can exist on a ~~Yankee~~yankee dryer is required to determine the maximum allowable operating parameters. There are four loads that combine during normal operation to create the maximum operating stresses, usually on the outside surface of the shell at the axial center line. These are:

1) Pressure load due to internal steam pressure;

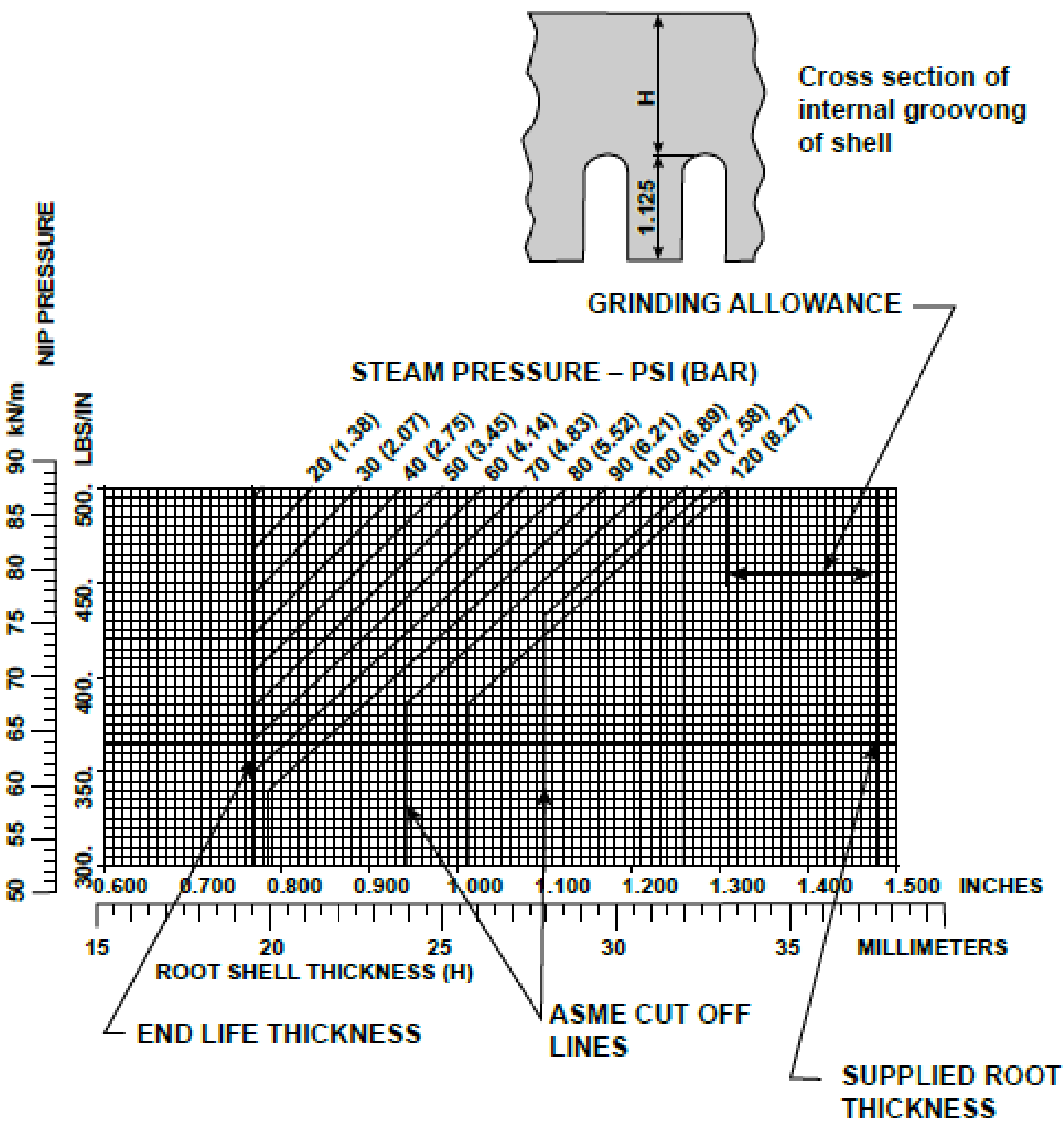
2) Inertial load due to dryer rotation;

3) Thermal gradient load due to the drying of the web; and

4) Pressure roll load (line or nip load) due to pressing the wet web onto the dryer.

c) Steam pressure, inertial, and thermal gradient loads impose steady-state stresses. These stresses typically change when the dryer shell thickness (effective thickness for ribbed dryers) is reduced to restore a paper-making surface, the grade of tissue is ~~changed~~changed, or speed of the dryer is changed.

~~FIGURE S5.2~~
~~DE-RATE CURVE~~



d) The pressure roll(s) load imposes an alternating stress on the shell face. The resulting maximum stress is dependent on the magnitude of the alternating and steady-state stresses.

e) ASME Section VIII, Div. 1, only provides specific requirements for the analysis of pressure loads. Although the code requires analysis of other loads, no specific guidance for thermal, inertial, or pressure roll loads is provided. Hence, additional criteria must be applied by the manufacturer to account for all the steady-state and alternating stresses.

f) To maintain product quality, the dryer surface is periodically refurbished by grinding. This results in shell thickness reduction. Therefore, the manufacturer does not provide a single set of maximum allowable operating parameters relating steam pressure, rotational speed, and pressure roll load for a single design shell thickness. The manufacturer, or another qualified source acceptable to the Inspector, instead provides a series of curves that graphically defines these maximum allowable operating parameters across a range of shell thicknesses. This document is known as the "De-Rate Curve." See NBIC Part 2, Figure S5.2. In cases where no derate curve is provided the manufacturer, or another qualified source, may provide a set of operating conditions and a minimum shell thickness.

g) Yankee dryers may be spray-coated with metallizing materials to extend and improve dryer operations. Metallizing is almost always sprayed onto the exterior of a steel shell. Metallizing may be sprayed onto the exterior of a cast iron shell. Metallizing provides a more wear-resistant surface. Typically, a metallized coating is ground several times before it is removed from the shell. If the dryer needs to be re-sprayed with metallizing, the steel or cast iron is lightly ground and then re-sprayed. The grinding of the shell material results in a shell thickness reduction which needs evaluation for any necessary pressure and safety device re-settings.

~~a)~~h) In addition to the loads on the dryer due to normal operation, other nonstandard load events can occur. These nonstandard load events should be recorded in an operation or maintenance log. Examples of nonstandard load events include:

1) ~~Excessive thermal load due to local or global heating rate during warm-up~~Local or overall thermal loads due to exceeding the warm-up rate;

2) ~~Excessive thermal load due to local or global cooling rate during shut-down~~Local or overall thermal loads due to exceeding the cool-down rate;

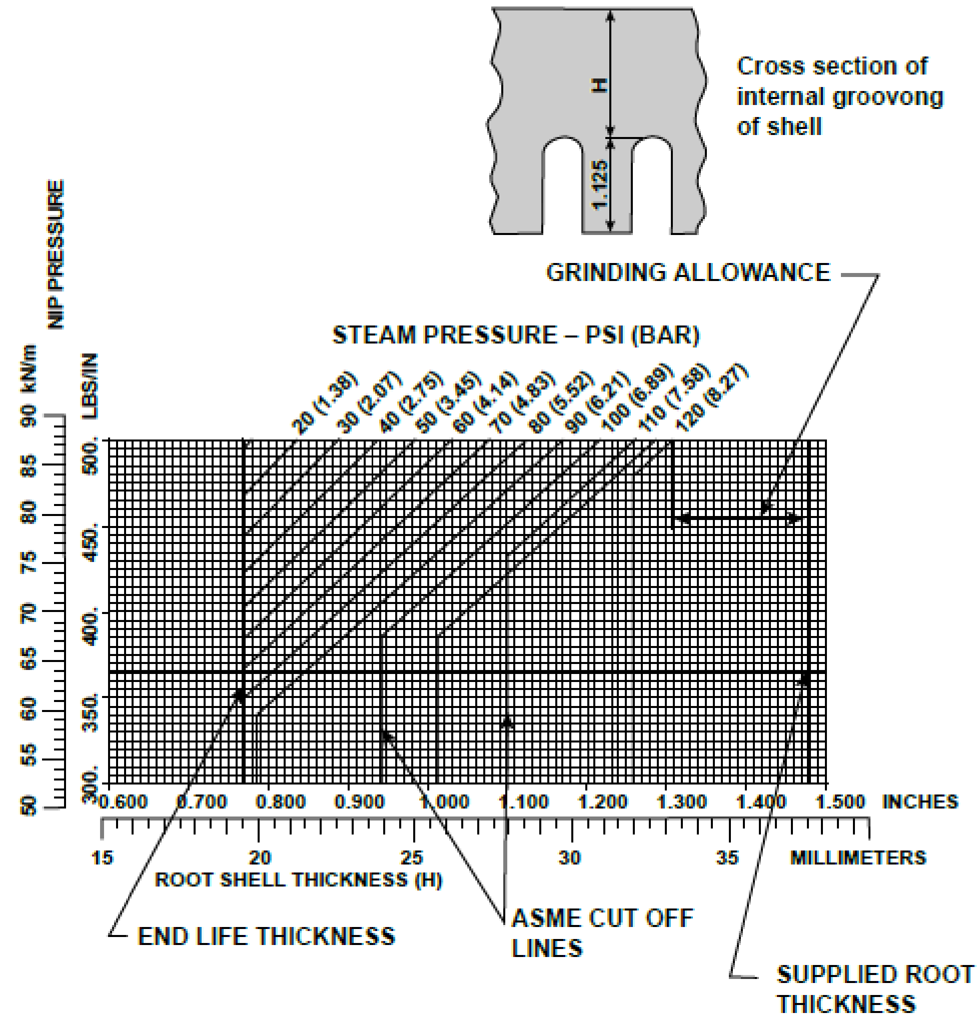
3) ~~Excessive t~~Thermal load due to inappropriate use or malfunctioning auxiliary heating devices causing localized heating;

4) ~~Excessive t~~Thermal load due to the misapplication or uncontrolled application of water or other fluids for production, cleaning, or ~~fire fighting~~firefighting; and

5) Impact load.

~~b)~~i) If nonstandard load events have occurred, then the Inspector should ensure that an appropriate ~~risk based~~risk-based assessment of the ~~structural integrity on the~~ dryer has been performed.

FIGURE S5.2
DE-RATE CURVE



S5.2.1 DETERMINATION OF ALLOWABLE OPERATING PARAMETERS

a) A ~~Yankee~~yankee dryer is designed and intended to have its shell thickness reduced over the life of the vessel through routine wear and grinding. The ~~Yankee~~yankee dryer shell is ground on the outside surface to restore the quality or shape of the papermaking surface, essential to the manufacturing of tissue or other paper products.

b) Design documentation is required that dictates the maximum allowable operating parameters as shell thickness is reduced. Calculations used to determine those parameters are in accordance with ASME Code requirements for primary membrane stress and design criteria based upon other relevant stress categories; (e.g., fatigue and maximum principal stress). Calculation of these parameters requires that the respective stresses, resulting from the imposed loads, be compared to the appropriate material strength properties. Hence, knowledge of the applied stresses in the shell and the tensile and fatigue properties of the material are essential.

c) Yankee dryers are subjected to a variety of loads that create several categories of stress. Yankee dryers are designed such that the stress of greatest concern typically occurs on the outside surface at the axial centerline of the shell.

1) Steam Pressure Load — The internal steam pressure is one of the principal design loads applied to the ~~Yankee~~yankee dryer. The steam pressure expands the shell radially, causing a predominately circumferential membrane tensile stress. Because the shell is constrained radially by the heads at either end of the shell, the steam pressure also causes a primary bending stress in the vicinity of the head-to-shell joint. The ends of the shell are in tension on the inside and compression on the outside due to the steam pressure. The steam pressure also causes a bending stress in the heads.

2) Inertia Load — The rotation of the ~~Yankee~~yankee dryer causes a circumferential membrane stress in the shell similar to that caused by the steam pressure load. This stress is included in the design of the shell and increases with dryer diameter and speed.

3) Thermal Gradient Load — The wet sheet, applied to the shell, causes the outside surface to cool and creates a thermal gradient through the shell wall. This thermal gradient results in the outside surface being in tension and the inside surface in compression. With this cooling, the average shell temperature is less than the head temperature, which creates bending stresses on the ends of the shell and in the heads. The ends of the shell are in tension on the outside and compression on the inside.

a. Other thermal loading also occurs on a ~~Yankee~~yankee dryer. The use of full width showers for a variety of papermaking purposes affects the shell similar to a wet sheet. The use of edge sprays produces high bending stress in the ends of the shell due to the mechanical restraint of the heads.

b. Warm-up, cool-down, hot air impingement from the hood, moisture profiling devices, ~~fire fighting~~firefighting, and wash-up can all produce non-uniform thermal stresses in the pressure-containing parts of the ~~Yankee~~yankee dryer. Heating or cooling different portions of the ~~Yankee~~yankee dryer at different rates causes these non-uniform stresses.

4) Line Load — The line load from the contacting pressure roll(s) results in an alternating, high cycle, bending stress in the shell. This stress is greatest at the centerline of the shell. The load of the pressure roll deflects the shell radially inward causing a circumferential compressive stress on the outside surface and a tensile stress on the inside. Because the shell has been deflected inward at the pressure roll nip, it bulges outward about 30 degrees on each side of the nip. The outward bulge causes a tensile stress on the outside shell surface at that location and a corresponding compressive stress on the inside. Since the shell is passing under the pressure roll, its surface is subjected to an alternating load every revolution.

S5.2.2 ~~ADJUSTING THE MAXIMUM~~ ALLOWABLE OPERATING PARAMETERS ~~OF THE YANKEE DRYER DUE TO A REDUCTION IN SHELL THICKNESS FROM GRINDING OR MACHINING~~ AND SHELL THICKNESS

a) The maximum allowable operating parameters are a function of shell thickness and are addressed in one of the following two manners in the industry.

1) Adjusted throughout life of dryer

The maximum allowable operating parameters are reduced throughout the life of the dryer as the shell thickness is reduced. This method is commonly used for cast iron shells.

Required design documentation called a de-rate curve dictates the maximum allowable operating parameters based on imposed loads over a range of shell thicknesses. The documentation shall be obtained from the original dryer manufacturer or from another qualified source acceptable to the Inspector.

After the maximum allowable operating parameters are adjusted per the de-rate curve, the appropriate load limiting devices are reset (e.g., steam safety relief valve, line load limiting device).

2) Held constant throughout life of dryer

The maximum allowable operating parameters are held constant throughout the life of the dryer, until the shell thickness is reduced to a minimum end-of-life value. This method is commonly used for steel shells.

Required design documentation dictates the maximum allowable operating parameters and the minimum shell thickness. The documentation shall be obtained from the original dryer manufacturer or from another qualified source acceptable to the Inspector.

b) The current shell thickness and maximum allowable operating conditions shall be documented throughout the life of the ~~Yankee~~yankee dryer.

~~a) The outside surface of the Yankee dryer shell is routinely ground to restore the quality of the papermaking surface. The papermaking surface degrades due to wear, corrosion, and local thinning. As the shell thickness is reduced, the maximum allowable operating parameters are adjusted. Adjustment of the maximum allowable operating parameters requires accurate shell thickness measurements.~~

~~b) Over the life of the Yankee dryer, the adjustment of the maximum allowable operating parameters will require that the original design pressure and/or the pressure roll line load be reduced. After the maximum allowable operating parameters are adjusted per the De-rate Curve, the appropriate load limiting devices are reset (e.g., steam safety relief valve, line load limiting device).~~

~~S5.2.3 DOCUMENTATION OF SHELL THICKNESS AND ADJUSTED MAXIMUM ALLOWABLE OPERATING PARAMETERS~~ (21)

~~a) Design documentation, a De-rate Curve, is required, which dictates the maximum allowable operating parameters, based on imposed loads over a range of shell thickness. The documentation shall be obtained from the original dryer manufacturer or from another qualified source acceptable to the Inspector.~~

~~b) Yankee dryer shell grinding requires accurate shell thickness measurements in conjunction with the Derate Curve in order to set load-limiting devices. The resulting shell thickness and maximum allowable operating parameters after grinding shall be documented, and the Inspector notified that load-limiting device settings have changed.~~

S5.3 ~~CAUSES OF~~ DETERIORATION AND DAMAGE

Three types of deterioration or damage typically encountered in ~~Yankee~~yankee dryers are local thinning, cracking, and corrosion. Many times, the mechanisms are interrelated, one being the precursor of another.

S5.3.1 LOCAL THINNING

a) Internally, a Local Thin Area (LTA) can occur on the pressure-retaining surfaces due to steam and condensate erosion, mechanical wear and impact, and removal of material flaws. These assume features ranging from broad shallow areas washed out by erosion, to more groove-like flaws, including gouges and indentations from contacting metal parts.

b) Externally, the process is typically one of wear-corrosion in circumferential bands. Except on the shell edges, local thinning never achieves significant depth because the papermaking process will tolerate only the smallest departure from surface contour. On the shell edges, beyond the papermaking surface, wear-corrosion may advance to comparatively greater depths. However, the stresses are far less in this area than under the papermaking surface, so the wear is inconsequential in considerations of load-carrying ability. Only in the instance of steam leakage between flanges has the resultant local thinning ever been implicated in ~~Yankee~~yankee failure.

c) Steam leakage is detrimental to the long-term structural integrity of the vessel, in that the escaping steam, under high velocity, erodes ever-widening paths in the ~~cast-iron~~ surfaces over which it passes, thinning the cross-section. Steam cutting of connecting bolts is another possible outcome. Either result reduces load-carrying capacity of the part. A safety hazard can also be created for operating personnel, who may be burned by the high-velocity steam jets.

~~d) Interface leakage, including joints and bolted connections.~~

~~1) Joint Interface Corrosion~~

~~Jacking forces, which develop from the expansion of corrosion products between head-to-shell flanges, cause flange separation and create leakage paths between the flanges and/or through the bolt holes.~~

~~2) Insufficient Joint Clamping Force~~

~~Through inadequate design, improper assembly, loss of washer/gasket, or stress corrosion cracking of connecting bolts, the clamping force between mating flanges is insufficient to retain internal pressure.~~

~~3) Washer/Gasket Functional Loss~~

~~Deterioration, caused by corrosion or expulsion, provides a path for escaping steam and condensate.~~

~~4) Flange Machining Variation~~

~~Variations in surface contour of flange faces may create leakage paths.~~

~~e) Through-Wall Leakage~~

~~Cast iron inherently exhibits shrinkage porosity. Where porosity linkages occur between internal and external surfaces, a path for steam leakage is made available. Such leakage is largely an operational issue, as holes are formed in the paper product, demanding expedient attention.~~

S5.3.2 CRACKING

~~Cracks in cast-iron parts are problematic because of the relatively low fracture toughness compared with standard, more ductile pressure vessel materials and because strengthening repair through welding is prohibited. Furthermore,~~ Yankee dryers are subject to both low-cycle and high-cycle fatigue loading; c~~. C~~onsequently, considerable emphasis is placed upon ~~quality inspection for~~crack detection and timely remediation of cracks~~, the central causes of which (in Yankee dryers) are:~~. Possible causes include:

S5.3.2.0 EXCEEDING MAXIMUM ALLOWABLE OPERATING CONDITIONS

~~a) Overpressurization~~

~~As shell thickness is routinely diminished through time,~~ Yankee dryers are designed to operate within the ~~pressure~~ limitations set down by ASME Section VIII and the safety factors inherent to the ~~"De-rate Curve" calculated~~documentation provided by the vessel manufacturer or equally qualified source. Failure to maintain operation within the ~~steam pressure~~parameters established by those criteria can~~, in the extreme,~~ lead to cracking.

~~b) Pressure Roll Overload~~

~~Included in Yankee dryer shell design is a fatigue factor of safety. Exceeding allowable roll load, in combination with other stress-elevating or strength-reducing conditions, can precipitate fatigue cracking and failure.~~

S5.3.2.1 ~~THROUGH~~ JOINTS AND BOLTED CONNECTIONS

a) Joint Interface Corrosion

Jacking forces, which develop from the expansion of corrosion products between head-to-shell flanges, cause flange separation and create leakage paths between the flanges and/or through the bolt holes. The products of corrosion occupy a larger volume than the base metal. The forces created by this expansion are sufficient to cause cracking in flanges or bolts. Without remediation, expansion will continue until failure occurs. Corrosion products form in the presence of moisture in the crevice created between flanges, wherever the clamping force is insufficient to maintain contact between the mating surfaces. ~~Jacking forces, which develop from the expansion of corrosion products between head-to-shell flanges, cause flange separation and create leakage paths between the flanges and/or through the bolt holes.~~

b) Insufficient Joint Clamping Force

Through inadequate design, improper assembly, loss of washer/gasket, or stress corrosion cracking of connecting bolts, the clamping force between mating flanges is insufficient to retain internal pressure.

c) Washer/Gasket Functional Loss

Deterioration, caused by corrosion or ~~expulsion~~gasket damage, provides a path for escaping steam and condensate.

d) Flange Machining Variation

Variations in surface contour of flange faces may create leakage paths.

S5.3.2.2 THROUGH-WALL LEAKAGE

Cast iron inherently exhibits shrinkage porosity. Where porosity linkages occur between internal and external surfaces, a path for steam leakage is made available. Such leakage in a cast iron~~the~~ shell is largely an operational issue, as holes are formed in the paper product, demanding expedient attention. Steel shells are not cast, and any through-wall leakage would likely be due to a through-wall crack which should be addressed immediately.

S5.3.2.3 IMPACT FROM OBJECTS PASSING THROUGH THE ~~YANKEE/~~PRESS~~URE ROLL~~ NIP

An object passing through the nip can create a localized impact that leads to elevated stress within fatigue loaded material.
~~Because of cast iron's low fracture toughness, it is especially intolerant of local, high-impact loads.~~

S5.3.2.4 STRESS MAGNIFICATION AROUND DRILLED HOLES

Surface defects, caused by porosity and indentations, are frequently repaired with driven plugs, having some level of interference fit. Pumping ports, threaded for a tapered pipe fitting, are often installed as a standard ~~Yankee~~yankee design feature for sealant injection into flange interfaces. When installed, both produce an area of increased stress, local to the hole's edge. In the case of driven plugs, this stress can be exaggerated by excessive interference fits and by closely-grouped or overlapping plugs. Over-torque of threaded, tapered plugs can cause cracks to develop at the periphery of the hole.

S5.3.2.5 ~~THERMAL STRESS AND/OR MICRO-STRUCTURAL CHANGE FROM~~ EXCESSIVE LOCAL HEATING AND COOLING

Transient thermal stresses are usually the highest encountered by a ~~Yankee~~yankee dryer. Temperature differential through and between parts can be of such magnitude as to exceed the strength of the material. When abnormal thermal loads occur, nondestructive examination is crucial to ensure the vessel's fitness-for-service. Micro-structural change and transient thermal stresses, sufficiently high to cause cracking in ~~Yankee~~yankee dryers, have resulted, or could result, from:

a) Bearing failure;

b) Rapid warm-up;

c) Excessive steam temperature;

d) Heat from fires;

e) Application of water sprays to fight fires and remove paper jams;

f) Continuous and excessive local cooling from water sprays;

g) Operating heating or cooling systems while the ~~Yankee~~yankee dryer is stationary; (e.g., high-temperature air impingement hoods, infra-red heating devices, coating showers);

h) Welding and electrical arcs ~~on cast-iron parts; and~~

i) Excessive local temperature due to improper thermal spray application.

~~S5.3.2.6 JOINT INTERFACE CORROSION~~

~~The products of corrosion occupy a larger volume than the base metal. The forces created by this expansion are sufficient to cause cracking in cast-iron flanges. Without remediation, expansion will continue until failure occurs. Corrosion products form in the presence of moisture in the crevice created between flanges, wherever the clamping force is insufficient to maintain contact between the mating surfaces.~~

S5.3.2.6~~7~~ STRESS-CORROSION CRACKING OF STRUCTURAL BOLTS

Stress-corrosion cracking (SCC) is the result of the combination of a corroding agent, material sensitivity, tensile stress, and temperature. At stress levels sufficiently high to induce SCC in the presence of a corrosive medium, attack proceeds along or through grain boundaries perpendicular to the direction of maximum tensile stress. Cracking can initiate with little or no evidence of general corrosion.

S5.3.3 CORROSION

Corrosion culminates with a failure in component functionality by diminishing load-carrying capacity or by generating forces beyond the material's strength. In addition to SCC, corrosion-jacking of joints ~~(head to shell joint)~~, wear-corrosion, and deterioration of washers described above, oxygen pitting, and general corrosion wastage need to be considered as potential failure causes. These latter two corrosion conditions are the result of inadequate boiler water treatment. ~~Oxygen pitting has been encountered, but rarely.~~.

S5.4 INSPECTIONS

a) ~~Yankee dryers should be inspected on a routine-periodic basis. However, as a minimum,~~ T~~t~~he ~~Yankee~~yankee dryer should be inspected internally and externally at least one time every two years. The degree and frequency of inspection should be determined based on OEM recommendations, owner/user experience, and risk-based considerations.

b) As appropriate, the following items should be included depending on material of construction and design:~~:~~

1) Head-to-shell joint;

2) Shell out-of-roundness;

3) Shell centerline thickness;

4) Tilt of head flange;

5) Integrity and security of internal parts;

6) Spigot fit of flanged joints (head-to-shell, head-to-journal);

7) Integrity of structural bolts and studs; ~~and~~

8) Previously identified areas of deterioration and damage; and~~.~~

9) Welds within pressure-retaining items.

~~1) Head-to-shell joint;~~

~~2)~~1)~~Shell out-of-roundness;~~

~~3)~~1)~~Shell centerline thickness;~~

~~4)~~1)~~Tilt of head flange;~~

~~5)~~1)~~Integrity and security of internal parts;~~

~~6)~~1)~~Spigot fit of flanged joints (head-to-shell, head-to-journal);~~

~~7)~~1)~~Integrity of structural bolts and studs; and~~

~~8)~~1)~~Previously identified areas of deterioration and damage.~~

c) When a nonstandard load event occurs, or a material non-conformity is noted, an inspection should be performed to assess fitness for continued service. This inspection may involve testing methods not typically used in routine inspections and may also involve removal of material samples for destructive testing.

S5.5 NONDESTRUCTIVE EXAMINATION

a) Nondestructive examination (NDE) methods shall be implemented by individuals qualified and experienced with the material to be tested using written NDE procedures. For cast ~~Yankee~~yankee dryers, cast-iron knowledge and experience are essential.

b) Typical nondestructive examination methods should be employed to determine indication length, depth, and orientation (sizing) of discontinuities in ~~Yankee~~yankee dryers. Magnetic particle, specifically the wet fluorescent method, and dye penetrant methods are applicable in the evaluation of surface-breaking indications. Ultrasonic testing is the standard method for evaluation of surface-breaking and embedded indications. Radiographic methods are useful in the evaluation of embedded indications. Acoustic emission testing can be used to locate and determine if a linear indication is active, i.e., propagating crack. Metallographic analysis is useful in differentiating between original casting discontinuities and cracks.

c) When nondestructive examination produces an indication, the indication is subject to interpretation as false, relevant, or non-relevant. If it has been interpreted as relevant, the necessary subsequent evaluation will result in a decision to accept, repair, replace, monitor, or adjust the maximum allowable operating parameters.

S5.6 PRESSURE TESTING

a) Water pressure testing in the field is not recommended because of the large size of the ~~Yankee~~yankee dryers and the resulting combined weight of the ~~Yankee~~yankee dryer and the water used in testing. This combined weight can lead to support structure overload. Several failures of ~~Yankee~~yankee dryers have occurred during field pressure testing using water. If this test must occur, the following review is recommended:

   1) The testing area should be evaluated for maximum allowable loading, assuming the weight of the ~~Yankee~~yankee dryer, the weight of the water filling the ~~Yankee~~yankee dryer, and the weight of the support structure used to hold the ~~Yankee~~yankee dryer during the test.

   2) The building and supporting structures should be assessed for overload.

   ~~2) The manufacturer should be contacted to provide information on building the Yankee dryer support structure for the water pressure test. Typically, the Yankee dryer is supported on saddles that contact the testing area and should be evaluated for maximum allowable loading, assuming the weight of the Yankee dryer, the weight of the water filling the Yankee dryer, and the weight of the support structure used to hold the Yankee dryer during the test.~~

~~PL. 5~~

   3) The ~~Yankee~~yankee manufacturer should be contacted to provide information on building the ~~Yankee~~yankee dryer support structure for the water pressure test. Typically, the ~~Yankee~~yankee dryer is supported on saddles that contact the ~~Yankee~~yankee dryer shell at each end near the head-to-shell joint. The manufacturer can provide information on saddle sizing and location so that the ~~Yankee~~yankee dryer is properly supported for the test.

b) Steam or air is recommended when pressure testing is performed. Acoustic emission testing is recommended in conjunction with pressure testing when there are concerns for deterioration or fitness for service.~~When pressure testing is desired to evaluate forms of deterioration, acoustic~~

~~emission testing, with steam or air, is recommended. Typically, the test pressure used is the operating pressure~~.

~~S5.7 TABLES AND FIGURES~~

~~c) FIGURE S5.2, De-Rate Curve.~~

FORM NB-5 BOILER OR PRESSURE VE

FIRST INTERNAL INSPECTIO

Standard Form for Jurisdictions Operating under

1	DATE INSPECTED MO / DAY / YEAR	CERT EXP DATE MO / YEAR	CERTIFICATE POSTED [] YES [] NO	OWNER NUMBER	JU
2	EQUIPMENT LOCATION NAME				NA
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3	CERTIFICATE BUSINESS NAME				CERT CO
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7	PRESSURE ALLOWED MAWP__________ THIS INSPECTION__________ PREVIOUS INSPECTION__________			# OF PRVS ______________ TOTAL CAPACITY SET PRESSURE ___________ CAPACITY____ SET PRESSURE ___________ CAPACITY____ SET PRESSURE ___________ CAPACITY____	
8	ARE THERE ANY OUTSTANDING (OPEN) VIOLATIONS FOR THIS EQUIPMENT? [] YES [] NO (IF YES, EXPLAIN FULLY UNDER ADVERSE CONDITI				

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TY	CERT STATE	
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CITY	INVOICE STATE	
STALLED	MANUFACTURER	[] NEW [] REINSTALL
)ILER)	METHOD OF FIRING (BOILER)	LOCATION IN PLANT
______________ _______________ _______________ ________________	EXPLAIN IF PRESSURE CHANGED	
)NS FOUND)	HYDRO PRESSURE TEST [] YES ______________PSI DATE________________ [] NO	

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FORM NB-6 BOILER-FIRED PRES

REPORT OF INSPECTION

Standard Form for Jurisdictions Operating under

1	DATE INSPECTED MO / DAY / YEAR	CERT EXP DATE MO / YEAR	CERTIFICATE POSTED [] YES [] NO	OWNER NUMBER	JURISDI
2	EQUIPMENT LOCATION NAME				NA
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3	CERTIFICATE BUSINESS NAME				CERT C
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4	INVOICE BUSINESS NAME				CERT IN
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5	TYPE [] FT []WT [] CI []OTHER___________________________________			YEAR BUILT	MANUFA
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8	ARE THERE ANY OUTSTANDING (OPEN) VIOLATIONS FOR THIS EQUIPMENT? [] YES [] NO (IF YES, EXPLAIN FULLY UNDER ADVERSE CONDITI				
9	INSPECTORS COMMENTS:				
10	ADVERSE CONDITIONS FOUND:				
11	REQUIREMENTS:				
12	NAME AND TITLE OF PERSON TO WHOM REQUIREMENT WERE EXPLAINED				E-MAIL
	I HEREBY CERTIFY THIS IS A TRUE REPORT OF MY INSPECTION INSPECTOR SIGNATURE			NB COMMISSION #	

THIS FORM MAY BE OBTAINED FROM THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS, 1055 CRUPPER AVE, COLUMBUS, O

ͯSURE VESSEL

the ASME Code

ͻTIONAL NO		NAT'L BD NO [] OR SERIAL # (IF CAST IRON) []	
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CITY		INVOICE STATE	
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	METHOD OF FIRING		LOCATION IN PLANT
______________ _______________ _______________ ________________	HEATING SURFACE OR BTU (INPUT/OUTPUT)		
ͻNS FOUND)	PRESSURE TEST [] YES ______________PSI DATE________________ [] NO		
	PHONE #		
EMPLOYED BY			IDENT. NO.

ͻH 43229

FORM NB-7 PRESSURE V

REPORT OF INSPECTION

Standard Form for Jurisdictions Operating under

1	DATE INSPECTED MO / DAY / YEAR	CERT EXP DATE MO / YEAR	CERTIFICATE POSTED [] YES [] NO	OWNER NUMBER	JURISDI
2	EQUIPMENT LOCATION NAME				NA
	EQUIPMENT LOCATION STREET ADDRESS				EQUIP L
3	CERTIFICATE BUSINESS NAME				CERT C
	CERTIFICATE MAILING STREET ADDRESS				CERT CI
4	INVOICE BUSINESS NAME				CERT IN
	INVOICE STREET ADDRESS				INVOICE
5	TYPE [] AIR TANK [] WATER TANK []OTHER____________________________________			YEAR BUILT	MANUFA
6	USE [] STORAGE [] PROCESS [] HEAT EXCHANGE [] OTHER ____				VERTICA
7	PRESSURE ALLOWED MAWP___________ THIS INSPECTION___________ PREVIOUS INSPECTION___________			# OF PRVS _______________ TOTAL CAPACITY SET PRESSURE _____________ CAPACITY____ SET PRESSURE _____________ CAPACITY____ SET PRESSURE _____________ CAPACITY____	
8	ARE THERE ANY OUTSTANDING (OPEN) VIOLATIONS FOR THIS EQUIPMENT? [] YES [] NO (IF YES, EXPLAIN FULLY UNDER ADVERSE CONDITI				
9	INSPECTORS COMMENTS:				
10	ADVERSE CONDITIONS FOUND:				
11	REQUIREMENTS:				
12	NAME AND TITLE OF PERSON TO WHOM REQUIREMENT WERE EXPLAINED				E-MAIL
	I HEREBY CERTIFY THIS IS A TRUE REPORT OF MY INSPECTION INSPECTOR SIGNATURE			NB COMMISSION #	

THIS FORM MAY BE OBTAINED FROM THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS, 1055 CRUPPER AVE, COLUMBUS, O

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CTIONAL NO	NAT'L BD NO [] OR SERIAL # []	
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VOICE CONTACT NAME	INVOICE E-MAIL	
CITY	INVOICE STATE	
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L / HORIZONTAL	LENGTH	DIAMETER
______________ _______________ _______________ ________________	EXPLAIN IF PRESSURE IS CHANGED	
ONS FOUND)	PRESSURE TEST [] YES ______________PSI DATE________________ [] NO	
	PHONE #	
EMPLOYED BY		IDENT. NO.

H 43229

2.3.6.5 INSPECTION OF PRESSURE VESSELS WITH QUICK-ACTUATING CLOSURES

a) This section describes guidelines for inspection of pressure vessels equipped with quick-actuating closures. Due to the many different designs of quick-actuating closures, potential failures of components that are not specifically covered should be considered. The scope of inspection should include areas affected by abuse or lack of maintenance and a check for inoperable or bypassed safety and warning devices and review of the integrity testing program.

b) Temperatures above that for which the quick-actuating closure was designed can have an adverse effect on the safe operation of the device. If parts are found damaged and excessive temperatures are suspected as the cause, the operating temperatures may have exceeded those temperatures recommended by the manufacturer. Rapid fluctuations in temperatures due to rapid start-up and shutdown may lead to cracks or yielding caused by excessive warping and high thermal stress. A careful observation should be made of the condition of the complete installation, including maintenance and operation (review completed operator inspection weekly log), as a guide in forming an opinion of the care the equipment receives. The history of the vessel should be established, including: year built, materials of construction, extent of postweld heat treatment, previous inspection results, NDE results, and repairs or alterations performed. Any leak should be thoroughly investigated and the necessary corrective action initiated.

1) Inspection of parts and appurtenances

a. Seating surfaces of the closure device, including but not limited to the gaskets, O-rings, or any mechanical appurtenance to ensure proper alignment of the closure to the seating surface, should be inspected. This inspection can be made by using powdered chalk or any substance that will indicate that the closure is properly striking the seating surface of the vessel flange. If this method is used, a check should be made to ensure that:

1. Material used shall not contaminate the gasket or material with which it comes into contact; and

2. The substance used shall be completely removed after the examination.

b. The closure mechanism of the device should be inspected for freedom of movement and proper contact with the locking elements. This inspection should indicate that the movable portions of the locking mechanism are striking the locking element in such a manner that full stroke can be obtained. Inspection should be made to ensure that the seating surface of the locking mechanism is free of metal burrs and deep scars, which would indicate misalignment or improper operation. A check should be made for proper alignment of the door hinge mechanisms to ensure that adjustment screws and locking nuts are properly secured. When deficiencies are noted, the following corrective actions should be initiated:

1. If any deterioration of the gasket, O-ring, etc., is found, the gasket, O-ring, etc., should be replaced immediately. Replacements should be in accordance with the vessel manufacturer's specifications;

2. If any cracking or excessive wear is discovered on the closing mechanism, the owner or user should contact the original manufacturer of the device for spare parts or repair information. If this cannot be accomplished, the owner or user should contact an organization competent in quick-actuating closure design and construction prior to implementing any repairs;

3. Defective safety or warning devices should be repaired or replaced prior to further operation of the vessel;

4. Deflections, wear, or warping of the sealing surfaces may cause out-of-roundness and misalignment. The manufacturer of the closure should be contacted for acceptable tolerances for out-of-roundness and deflection; and

5. The operation of the closure device through its normal operating cycle should be observed while under control of the operator. This should indicate if the operator is following posted procedures and if the operating procedures for the vessel are adequate.

c) The Integrity testing program should be developed by a professional familiar with the design and applications of quick-actuating closures that can identify high stress areas of the closure and the appropriate NDE method needed such as the Original Equipment Manufacturer (OEM) or equivalent professional. Personnel performing NDE must be qualified to ASNT SNT-TC-1A (Recommended Practice for Nondestructive Testing Personnel Qualification and Certification) or ANSI/ASNT CP-189 (Standard for Qualification and Certification of Nondestructive Testing Personnel. The NDE test interval should be at a minimum every five years, more often if deemed necessary by the Original Equipment Manufacturer (OEM), equivalent professional, inspector or jurisdiction. The Integrity Testing Program, NDE Procedure and NDE Written Practice shall be reviewed by the inspector.

Add to NBIC Part I, at a minimum, the requirement for the following safety devices:

- Pressure vessels with quick-actuation closers: A Safety interlock device that prevents the opening mechanism from operating unless the vessel is completely depressurized.
- Automatic dump to safe point on door travel safety switch or occupant activation switch.

THE NATIONAL BOARD
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PROPOSED REVISION OR ADDITION

Item No.

A 21-40

Subject/Title

Define "Remote" in the NBIC Glossary

NBIC Location

Part: Inspection; Section: 9; Paragraph: Section 9

Project Manager and Task Group

Source (Name/Email)

Terrence Hellman / thellman@nationalboard.org

Statement of Need

Remote Inspections need to be better clarified.

Background Information

With the use of indirect inspection equipment from borescopes to tethered drones/vehicles for confined space inspections, there is a need to clarify what is considered a "remote" inspection vs an "indirect" inspection.

Existing Text	Proposed Text
	Remote Visual Examination: an indirect examination technique used with visual aids for conditions where the area to be inspected is inaccessible for direct physical examination.

	VOTE:						
COMMITTEE	Approved	Disapproved	Abstained	Not Voting	Passed	Failed	Date

THE NATIONAL BOARD
OF BOILER AND PRESSURE VESSEL INSPECTORS

PROPOSED REVISION OR ADDITION

Item No.

A 21-56

Subject/Title

Clarify what action is necessary after determining the acceptance criteria.

NBIC Location

Part: Inspection; Section: 2; Paragraph: Part 2, 2.3.6.4 f) 5) c)

Project Manager and Task Group

Source (Name/Email)

Luis Ponce / lponce@nationalboard.org

Statement of Need

There is no guidance in the Liquid Ammonia 2.3.6.4 f) 5) paragraphs for the acceptance criteria for corroded areas of considerable size as there are for dents and bulges, for example.

Background Information

The Liquid Ammonia acceptance criteria for corrosion does not provide the option available to the owner/user as it is currently provided for in the other 2.3.6.4 f) and Compressed Air Vessel paragraphs.

Existing Text	Proposed Text
	Add the options in 2.3.6.2 b) 2) b. in a new 2.3.6.4. f) 5) d) to follow 2.3.6.4 f) 5) c). Included below is 2.3.6.2 b) 2) b. b. If the corrosion exceeds any of the above criteria, the following options are available to the owner/user. 1. The owner/user may conduct a complete UT survey of the vessel to verify remaining vessel wall thickness. 2. The vessel shall be removed from service until the vessel is repaired by an "R" stamp holder. 3. The vessel shall be removed from service until it can be de-rated to a lower MAWP subject to review and approval by the Jurisdiction. 4. A fitness-for service analysis is performed by a qualified organization. 5. The vessel is permanently removed from service.

	VOTE:						
COMMITTEE	Approved	Disapproved	Abstained	Not Voting	Passed	Failed	Date