FALL 2014

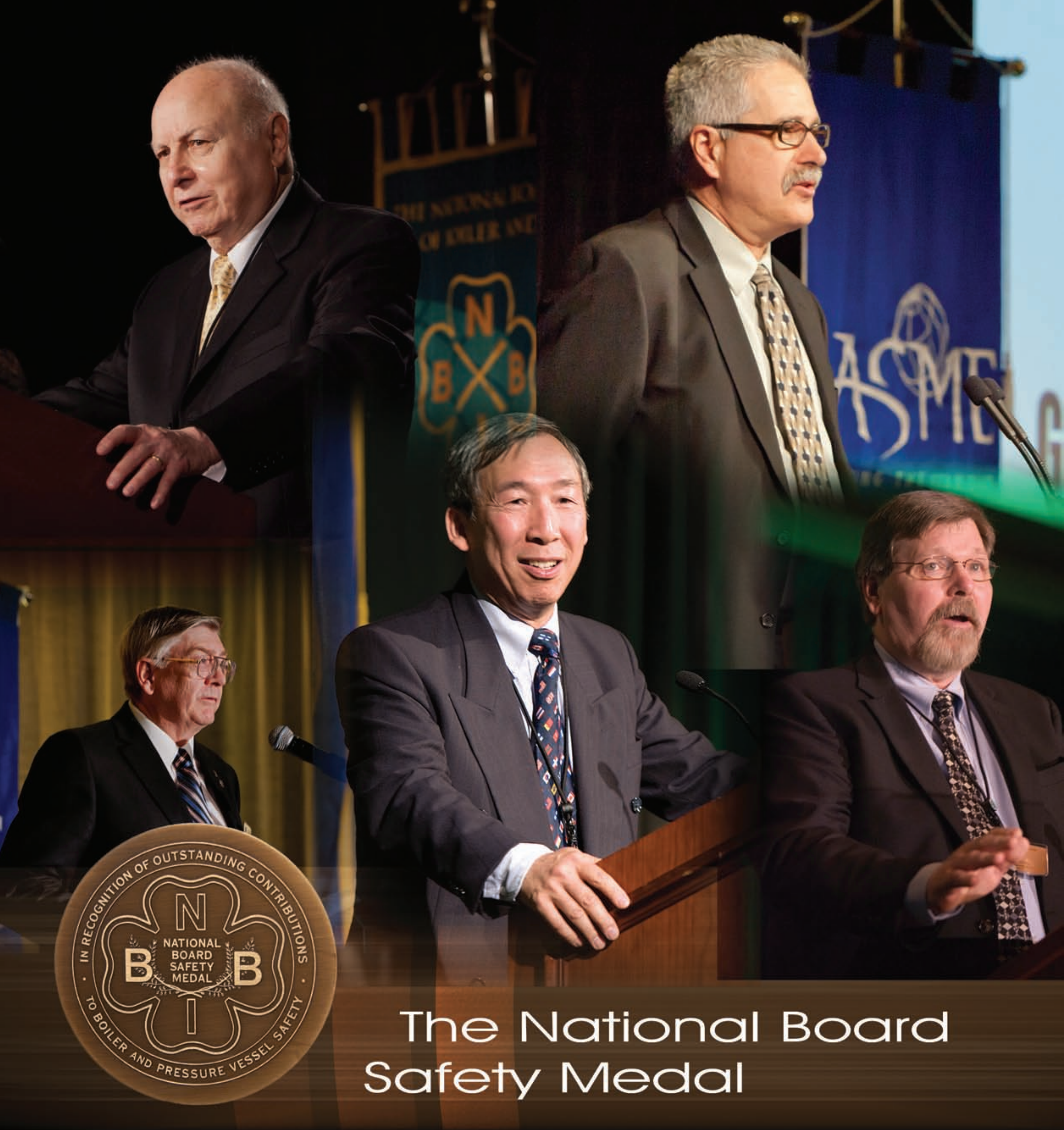
BULLETIN

TECHNICAL JOURNAL OF THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS

Casting A New Light On Leadership

An Interview with New National Board Chairman

John Burpee



Leader • Statesman • Mentor • Contributor
Candidate

Nomination period now through December 31, 2014. Award presented at the 84th General Meeting in Colorado Springs, Colorado, April 27, 2015. For eligibility requirements and submittal process, visit nationalboard.org

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TECHNICAL JOURNAL OF THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS

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The National Board of Boiler and Pressure Vessel Inspectors was organized for the purpose of promoting greater safety by securing concerted action and maintaining uniformity in the construction, installation, inspection, and repair of boilers and other pressure vessels and their appurtenances, thereby ensuring acceptance and interchangeability among jurisdictional authorities empowered to ensure adherence to code construction and repair of boilers and pressure vessels.

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A Chilly Day in December

BY DAVID A. DOUIN, EXECUTIVE DIRECTOR

In his interview (beginning on page 18 of this *BULLETIN*), newly elected Board of Trustees Chairman John Burpee says: *". . . the National Board has not endured for 95 years on pure luck. We have weathered world wars, disastrous economic downturns, political uncertainty, and countless challenges questioning the value of pressure equipment inspection."*

Unless having experienced a lifetime of 95 years, one would find it difficult to understand this kind of longevity. But in just a few weeks on December 2, the National Board will achieve the distinction of reaching its 95th anniversary.

It was on this date in 1919 that 31-year-old Ohio Chief Inspector C.O. Myers informally gathered inspectors from other state jurisdictions to create an organization that would become the bond through which pressure equipment codes and standards would be integrated among differing jurisdictions. The rest, as they say, is history.

The year 1919 was a turbulent one and December punctuated the end of a time in history when the world was experiencing a tumultuous menu of political and social issues.

In 1919 the Eighteenth Amendment to the United States Constitution authorizing prohibition was ratified and the United States Congress approved the Nineteenth Amendment guaranteeing suffrage to women. Benito Mussolini founded his fascist political movement. The Treaty of Versailles was signed, formally ending World War I. President Woodrow Wilson suffered a serious stroke that would leave him incapacitated for the rest of his life. The League of Nations was formed in Paris and the American Communist Party was established.

I cannot help but be impressed with what jurisdiction representatives accomplished on that chilly second day of December in Columbus, Ohio. Imagine the courage needed to commit to an organization that at that time looked good only in theory. Given the wide disparity in jurisdiction laws, there were no guarantees the National Board would ever be effective in its attempts to reduce the large number of pressure equipment accidents.

For such an organization to exist required not only blessings from the state governments involved, it needed some modest funding to sustain a continuity of purpose. Loosely organized at first, it existed for 36 years without a dedicated office or headquarters. Much of what was accomplished initially was handled through the Columbus office of Chief Inspector Myers. (Hence the National Board's 95-year Ohio address.)

Without the sophisticated media we enjoy today, a considerable amount of communication between early inspectors was accomplished through letter correspondence, telegraph, and telephone. The year 1921 marked the first gathering of national inspectors at what later would become known as the General Meeting.

During the organization's early years, newly franchised National Board members were tasked with a mission of colossal proportion. Using their authority to regulate, they began working with state and local jurisdictions, both of which had its own codes and standards.

At first there was no discernable drop in accidents. And there were still catastrophes to come. Many more catastrophes. And it would be years before the number of deaths and injuries would see a serious decline. But there was one important benefit realized almost immediately following formation of the National Board: chief inspectors from all over America became an organized fraternity dedicated to universal pressure equipment safety. That meant inspectors exchanging their vast collective knowledge with other inspectors. More important, it marked the beginning of an unshakable alliance with ASME that endures to this day.

Despite world events, convening jurisdiction inspectors on December 2, 1919, underscored the concern for a need to take action. For the next 95 years, that concern has evolved to the point that there are today more than 4,000 commissioned inspectors worldwide.

As the National Board counts down the next five years to its centennial, now is a good time to reflect on the exceptional work performed over the past 95 years. While it sometimes can be difficult to imagine the effectiveness of the National Board in its earlier stage, one need only look to the sprawling National Board campus, its focused and uncompromisingly professional membership, its eminently qualified staff, the incalculable impact on public safety, and an internationally renowned reputation.

And now is the time to give credit where credit is due – particularly to the visionaries who convened on a chilly December 2, 1919. . .

2014 Registrations

The National Board's *Certificate of Authorization to Register* ensures a third-party inspection process, providing for uniform acceptance of pressure-retaining equipment by member jurisdictions. This important safety process is documented via submission of data reports by the manufacturer to the National Board. These are the only reports for items carrying the National Board registration number. Once registered, each report is maintained in a permanent file by manufacturer name and National Board number.

The list below identifies boiler, pressure vessel, and nuclear vessel registrations by size for the past five fiscal years. The National Board fiscal year is from July 1 to June 30.

The total number of registrations on file with the National Board at the end of the 2014 reporting period was 51,772,445.

SIZE		FY 2014	FY 2013	FY 2012	FY 2011	FY 2010
BOILERS						
square feet of heating surface						
≤ 55	(A)	221,374	190,799	163,189	154,964	156,129
> 55 and ≤ 200	(B)	30,601	27,903	28,591	28,823	30,884
> 200 and ≤ 2,000	(C)	9,535	9,015	8,281	8,362	8,032
> 2,000 and ≤ 5,000	(D)	606	477	607	557	420
> 5,000	(E)	863	516	475	572	650
TOTAL		262,979	228,710	201,143	193,278	196,115
PRESSURE VESSELS						
in square feet						
≤ 10	(A)	916,056	911,754	927,192	788,752	680,873
> 10 and ≤ 36	(B)	266,031	207,702	207,621	202,902	183,449
> 36 and ≤ 60	(C)	59,416	43,805	44,401	40,017	35,798
> 60 and ≤ 100	(D)	19,323	17,261	16,162	12,924	11,039
> 100	(E)	25,950	24,098	21,189	16,784	13,783
TOTAL		1,286,776	1,204,620	1,216,565	1,061,379	924,942
NUCLEAR VESSELS						
in square feet						
≤ 10	(A)	345	476	443	482	481
> 10 and ≤ 36	(B)	133	181	79	51	30
> 36 and ≤ 60	(C)	33	21	9	14	7
> 60 and ≤ 100	(D)	3	8	6	18	5
> 100	(E)	156	143	169	94	14
TOTAL		670	829	706	659	537
TOTAL ATTACHMENTS*		108,465	96,557	103,175	92,158	90,117
GRAND TOTAL		1,658,890	1,530,716	1,521,589	1,347,474	1,211,711

*An attachment is any type of additional information submitted with the primary data report.

For more information on the Authorization to Register Program, access the National Board website at nationalboard.org

The VR Repair Program: Raising Standards Around the World

BY CHRIS SAWYER, NATIONAL BOARD REPRESENTATIVE AND ASME TEAM LEADER

The international acceptance of the American Society of Mechanical Engineers' (ASME) certification mark for pressure relief devices has seen major growth over the last 10 years in many foreign countries. As an independent consultant for The National Board of Boiler and Pressure Vessel Inspectors, I am often selected to serve as the ASME Team Leader designee for conducting code reviews with overseas companies who manufacture or assemble pressure relief devices. I have conducted numerous reviews in China, Japan, South Korea, Singapore, and Indonesia.

The ASME marks and codes are viewed with high respect in these countries. Most of my reviews are for new construction activities; very few are for repair activities, but this is changing. Repair reviews are growing in number.

As an instructor for the National Board's Pressure Relief Valve Repair Seminar (**VR**), I have noticed a growing number of attendees from numerous foreign countries and have met students from Canada, Argentina, Dominican Republic, Papua New Guinea, Kuwait, Brazil, Saudi Arabia, and the Republic of Trinidad and Tobago.

The growth in acceptance of the ASME code has been driven in part by United States manufacturers establishing production facilities in these locations, as well as good business opportunities for companies located in these countries. An excellent article on the growth and acceptance of the ASME and National Board **R** stamp program was published in the summer 2011 National Board *BULLETIN* and was written by ASME and National Board independent consultants Terry O'Connell and Sunil Sharma. They describe well the overseas growth opportunities and the work of raising awareness for acceptance of the National Board **R** *Certificate of Authorization* accreditation for repair companies.

My experience in the pressure relief device industry is similar. The rules established by the *ASME Boiler and Pressure Vessel Code* for new construction are understood by foreign-based companies who work diligently to meet the standards required by the ASME code. They are not as familiar with the *National Board Inspection Code* (NBIC) or the repair standards it includes, but this is changing. Overseas companies are becoming more informed about the **VR** Repair Program and its benefits.

New Valves Meet Stringent Code Standards, But What About Inservice Valves that Need Repaired?

The process manufacturers must go through to receive a code certification mark is very involved. For those performing an ASME audit at a manufacturer's or assembler's facility, part of the process involves reviewing its quality manual and procedures. Additionally, the company must demonstrate its ability to produce (or assemble) chosen valves; to select the proper spring; to calculate capacity; and to perform a test on the proper media using the ASME code, its quality manual, and OEM instructions.

Upon completion of an audit, the selected valves are sealed and the company must then send them to an accepted laboratory to verify the valves meet ASME tolerances for set pressure, capacity requirements, and operation. These requirements are demonstrated by actual full function testing. The lab checks for set pressure accuracy and proper functioning, and measures that the capacity is correct for the orifice size and nameplate-marked media.

These requirements are what each manufacturer or assembler must demonstrate in order to receive its ASME *Certificate of Authorization* and National Board *Certificate of Authorization*.

These steps are required to ensure pressure relief devices meet code performance and capacity standards. But what about a valve once it's in service? What process is in place to ensure a repaired valve is as reliable and safe as a brand new valve?

From conducting new construction audits for manufacturers and assemblers overseas, it's become apparent that very few countries have an accredited repair program requirement for pressure relief devices that have been in service. Often the manufacturer is asked to repair the product or the user repairs it himself. Other independent companies often solicit repairs from a user, but most of these do not have accredited repair programs either. So, repair activities for pressure relief devices are generally not controlled by any jurisdictional authority in other countries and are not performed to any documented standard. Knowing the importance of having such a program in place, I advocate the repair side of the business to raise awareness for better public safety.

I tell foreign companies that the National Board **VR** stamp is recognized in the US and Canada as the industry standard mark for valve repair and that the standard is growing in acceptance internationally. I explain that the National Board wrote the rules (NB-23) for how to organize repair activities for pressure relief valves, how to document these activities, and that these activities are required to be audited every three years for compliance to a documented and National Board-accepted quality program.

Each approved company holding a **VR** stamp demonstrates to a third party (National Board) its capability to perform repairs within its stated scope of work by having a National Board auditor come in and look at all the components of the repair, audit the quality system, and observe the testing processes.

Valves are then shipped to an approved testing lab for performance testing, which is what distinguishes the ASME and National Board **VR** program from all other new or repair valve programs in the world: the full performance test is the proof of the repair. The repair must return the valve to the standards required for new valves (ASME).

So, Why Should Overseas Companies Adopt the National Board VR Repair Program for Repaired Valves?

Before a manufacturer can assemble, test, and code stamp new ASME valves for a customer, it must clear a high hurdle of requirements before applying the ASME Certification Mark and designator. Why not establish a high hurdle of requirements for inservice valves that need tested or repaired?

Inservice valves are at risk of performance failures due to service factors, use, installation, and environmental issues; therefore, it's important to validate that repair work is performed and documented to a standard described in a third-party-accepted quality control program.

In review, I champion the following benefits of the **VR** Repair Program to overseas companies:

- The purpose of the **VR** Repair Program is to protect the public.
- The **VR** stamp holder's quality program is audited every three years by a representative of the National Board.
- The stamp holder must produce and maintain extensive documentation of each repair.
- The stamp holder must have documented and trained people to perform repairs.
- The stamp holder must demonstrate full function testing of each repaired valve, on the proper media, and on a documented and accepted test stand.
- Sample repaired valves must be sent to an accepted lab for performance testing to validate the repair skill and capability of the stamp holder.

Chris Sawyer (third from left) with employees of Jokwang, I.L.I Co. Ltd., a certificate holder in Busan, Korea.

A good business opportunity exists for overseas companies to embrace and perform accredited repair activities for end users of pressure relief devices.

Users or owners of pressure relief valves that contract out their repair work or perform it in-house should require the National Board **VR** stamp on every valve that is repaired that bears the ASME Certification Mark, one of the designators (**V, UV, HV, NV**), and the National Board mark. The **VR** stamp will ensure that every valve repair they purchase or contract meets the performance standard required for new valves. The **VR** stamp on the repair nameplate is evidence of a quality control program that is in place, audited, accepted, and tested.

Owners of pressure relief devices may apply for a **VR** stamp to repair their own valves but must meet the same criteria for obtaining authorization as a commercial stamp holder, with one exception: the owner-user can repair and test ASME Section VIII, Division 1, steam valves on air for their own use. No other stamp holder may routinely do this.

Users of pressure relief valves should ask themselves this question, *"Why would we require and purchase a pressure relief valve manufactured to ASME code standards and bearing an ASME certification mark, designator, and National Board mark, and then not require a repair company to meet the same requirements for performance testing and documentation of their repair as the ASME manufacturer (or assembler) met when they produced that valve?"*

The valve was *built* to safety standards – the repair should *maintain* those safety standards. The National Board **VR** Repair Program ensures repaired valves meet credible safety standards. ASME stamping on the original nameplate and a repair tag bearing the National Board **VR** stamp provide confidence to the user, and that's good business for everyone.

For more information about the National Board **VR** Repair Program, visit www.nationalboard.org and click the "Pressure Relief Devices" tab on the homepage. ✚

Fiber-Reinforced Plastics in Section IV Boilers

BY FRANCIS BROWN, SENIOR STAFF ENGINEER

ASME Boiler and Pressure Vessel Code, Section IV, boiler manufacturers may now fabricate boiler components from a nonmetal, fiber-reinforced plastic (FRP). On June 23, 2005, the Section IV Committee issued the first Code Case permitting use of a nonmetal in a boiler. This Code Case limited the use of FRP material to bolted box headers at low temperatures: 115°F (45°C). A second Code Case permitting the use of FRP material was issued April 4, 2012, for boiler components with a maximum temperature of 210°F (99°C).

Fiber-Reinforced Plastic Material

Fiber-reinforced plastic material is a polymer (plastic), strengthened by a material such as glass. There are two broad classes of polymers: thermoplastic and thermoset. Thermoplastic polymers soften with increasing temperature and eventually become a fluid. They may be reused and welded. By contrast, thermoset polymers once cured do not soften with increasing temperature, and cannot be welded or reused. The FRP materials permitted by these Code Cases are thermoplastic polymers with 30% glass fiber reinforcement.

The Code Cases limit the polymer materials to specific grades of plastic, water service, and a maximum temperature of 210°F. Obviously, plastics are flammable and cannot be exposed to flames, but Code Case 2725 permits plastics to be exposed to flue gases, provided the gas temperature does not exceed 212°F.

The plastic is supplied per ASTM D4349, which is a classification system for polyphenylene ether materials. This ASTM specification provides for consistent material from one batch of material to another batch, but does not provide mechanical properties.

Mechanical properties of plastics are significantly affected by the method of fabrication used to make a part. For the same plastic, mechanical properties may vary greatly between extruded parts, injection molded parts, cast parts, pressed parts, or rotational molded parts. Mechanical properties also may vary from one location in the component to another location in the component. The Code Cases specify boiler parts shall be fabricated by the injection molding process with rules appropriate for the process.

Injection Molding Process

Injection molding is the most common manufacturing process used today. It is a process where a normally solid material is heated to the fluid state, is forced into a mold, and then allowed to solidify. Metals, elastomers, polymers, etc. may be injection molded. Injection molding is used to make small parts such as bottle caps and large parts such as body panels for automobiles, and is ideal for making large quantities of the same part.

Design

Mechanical properties, such as tensile strength, published by the polymer manufacturer, cannot be used directly for the design of boiler components. The fabrication process significantly reduces mechanical properties. Many design features of a successful metal part must be changed to produce a successful FRP part. For long life, radii must be larger and the material around bolt holes must be thicker in an FRP part than in a corresponding metal part. Without adequate knowledge of mechanical properties, the design must be tested to demonstrate it is adequate for the intended purpose and for code compliance.

Fabrication

Fabrication of boiler components from FRP material is limited by the two Code Cases to injection molding. Polymer from the manufacturer, in the form of pellets, is heated to the liquid state, forced into a mold, and allowed to cool. The injection molding operation orients the length of the fibers in the polymer in the direction of flow. As a result, the mechanical properties of the FRP material are not uniform in the finished part. It should also be noted that mechanical properties may vary from one injection molding machine to another "identical" injection molding machine.

The manufacture of a steel box header is relatively straightforward. Material properties are considered to be constant in all directions, and an allowable stress for the material is published in Section IV. The manufacture of a box header fabricated from FRP material is considerably more complex. There are no code allowable stresses for the material, and design qualification is by extensive testing. The manufacturer must also control the injection molding process over the production of many units. Control of the injection molding process is demonstrated by testing of production units as specified in the Code Cases.

Although new to Section IV boilers, polymer materials have been used successfully for many years in a similar service: automotive radiators. Section IV boiler components manufactured of FRP materials can also be expected to provide a long and satisfactory service life. ✤

MDMT for the Inservice Inspector

BY JOHN HOH, SENIOR STAFF ENGINEER

Minimum design metal temperature (MDMT) of a pressure vessel is dependent on material toughness in regards to brittle fracture considerations. What does that mean? Some materials, including some common carbon steels, do not behave well at cold temperatures and may experience brittle fracture while under stress. That is an over-simplified explanation but it helps summarize what we want to avoid – a catastrophic failure.

In addition to the general material specification, material thickness plays a large part in establishing MDMT during the vessel design process. Thicker material has a higher MDMT value. A typical pressure vessel has many components of different thicknesses and, sometimes, different materials. A vessel designer must evaluate the individual components and determine the MDMT for each. The highest MDMT becomes the governing MDMT for the completed vessel. If the MDMT determined through the evaluation is higher than required for the specified operating conditions, the designer can select a different material, perform post-weld heat treatment (when not required for other reasons), or perform impact testing on material and weld specimens. The process is detailed in *American Society of Mechanical Engineers Boiler and Pressure Vessel Code* (ASME B&PVC), Section VIII. This article is not intended to explain all of the design considerations involving MDMT, but rather, highlight the conditions inspectors find in the field. Inservice inspectors, after all, stand in front of an operating vessel and must deal with what is in front of them, not what could have been.

Looking at the value for MDMT on the vessel nameplate is just as important as the maximum allowable working pressure (MAWP) or maximum temperature. How many vessel owners pay attention to the MDMT value on the nameplate? We would like to believe vessels are designed with the operating environment in mind, but there are many "stock" vessels (a common design for a common use – an air receiver is an example) operating in a wide range of environmental conditions. Consider the typical air receiver: the MDMT is usually -20°F. Some owners may locate the air receiver and its attached compressor outside under a shed roof to keep the noise out of the enclosed shop. During the winter, some regions can easily dip below -20°F ambient temperature. If the metal temperature of the air receiver measures below that -20°F stamped on the nameplate, it must not be pressurized. Granted, the air receiver can benefit from the heat generated through the compression of the air, but that can never be used as justification to operate with a metal temperature lower than rated on the nameplate.

Some might say ASME B&PVC Section VIII, Division 1, UG-20(f)(3), allows lower operating temperatures due to lower atmospheric temperatures, but UG-20(f) begins by stating that impact testing is not mandatory for materials satisfying <u>all</u> of the listed conditions. That includes the material P-number and Group number, thickness, pressure testing, thermal or mechanical shock loadings, cyclical loading, and a maximum and minimum design temperature. UG-20(f)(3) states, "Occasional operating temperatures colder than -20°F are acceptable when due to lower seasonal atmospheric temperature." That only applies when taken with the other stated restrictions. What does "occasional" mean and how much colder than -20°F is acceptable? Not seeing a definitive answer, it is this author's opinion to never accept operation below the stated MDMT.

Consider this situation: the inservice inspector is performing an inspection in the heat of summer. It's 95°F in the shade. That -20°F on the nameplate is the furthest thing from the inspector's mind at that point. The inspector has to consider where the vessel is located (heated or unheated) and the coldest winter temperature expected for that area.

The idea for this article began several months ago as an offshoot from an investigation. The vessels investigated were relatively thick carbon steel material intended for use at pressures ranging from 5,000 to 10,000 psi at oil and gas well sites. I noticed the MDMT (which was not part of the investigation) for most of the vessels was 20°F and a few were 40°F. That's above zero, not below. These vessels would be operating outside, subject to whatever temperatures winter would cast upon them. Last winter it got very cold, even in the southern part of the United States. Were some of those vessels still operating last winter? Probably.

As inspectors we owe it to the general public to keep all operating conditions in mind while performing inservice inspections. If you notice an MDMT value that could be exceeded (negatively) based upon environmental operating conditions, notify the vessel owner of those concerns and ensure the vessel is protected from cold temperatures or that it is not used during those situations. ✤

Senior Staff Engineers Brown and Schueler Retire

Combined 52 years of code work and industry experience hallmark of men's careers

Bob Schueler (left), Francis Brown (right).

"I mean it when I tell you I won the job lottery."

Those are the sentiments of a man who concluded a 30-year career at the National Board on July 31, 2014. Robert D. Schueler Jr, better known as "Bob" among professional peers and "Don" by friends and family, has earned his respite: he's logged 40 years of service on over 15 different National Board and *ASME Boiler and Pressure Vessel Code* committees over the course of his career.

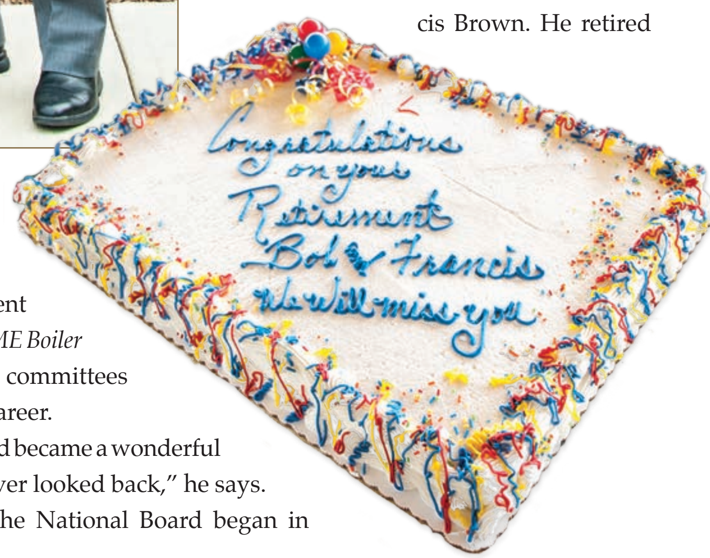
"The National Board became a wonderful home for me. I have never looked back," he says.

Bob's journey to the National Board began in Pennsylvania, where he grew up and attended Penn State University and Behrend College and earned a degree in drafting and design technology. At age 21 he went to work for Zurn Industries and was there for 22 years before employment with the National Board. Notable career highlights at Zurn included participation in the Lunar Lander and the F-111 fighter bomber projects.

Before Bob became a National Board employee, he was connected to the organization through his membership on the advisory committee representing the American Boiler Manufacturers Association. He also served on the ASME Section I Code Committee for four decades.

"I never figured I'd be on a code committee for 40 years," he laughs. "But working on the ASME code has been good. When I look at the work we're doing at the National Board, at the end of the day we've done a lot of good. I can't point my finger at exactly who we've saved, but I'm sure they're out there. That's pretty easy to live with," he says.

"The National Board has been a good place to work, and the people are what have made it a good place," reflects 22-year National Board veteran Francis Brown. He retired



from the organization on May 30, 2014.

An Ohio native, Francis graduated from The Ohio State University with a bachelor's degree in aerospace engineering and was employed with McDonnell Douglas, Boeing, GE, and Babcock & Wilcox before beginning his career with the National Board in 1992.

Francis's career at the National Board is marked by extensive involvement in code committee work. He served on 18 different National Board and ASME committees, two of which he established.

"I was tasked with putting together committees to write inservice inspection and repairs for the NBIC for graphite pressure equipment and fiber-reinforced plastics, and founded those NBIC subgroups. I know enough about those two subjects to be dangerous," he jokes.

Francis's code committee involvement has been a satisfying part of his career; accordingly, it is also something he has been reluctant to conclude.

"I look at everything going on with the NBIC and ASME code work and there's so much more I could contribute if I was here; things I would like to do. I haven't just been filling a seat at those meetings; I contribute. I've been deeply involved in what the committees are doing. A lot of that is going away with retirement. I'm going to miss it." he says. "It's bittersweet. I'd like to think I've made a contribution."

How do the recently retired men plan to transition into retirement?

Says Bob: "I'm switching back to my middle name, Don, which is the only name my friends and wife know me by. And then I'm taking the beautiful watch the National Board gave me for my 25th anniversary and putting it on a prominent place on my dresser. I'll only wear it on special occasions because I'm not going to work to a clock anymore."

He laughs. "I never thought I'd do it. It's taken me a little over a year to get it cranked into my head that yes, I'm going to retire, and no, it's not going to be the end of the world."

And Francis? "I'm taking it one day at a time," he says.

Both men celebrated their retirement with travel. Francis and his wife took a three-week trip out West, and Bob enjoyed some time on Virginia Beach with his family.

"Can I go cold-turkey?" Bob wonders as he considers life after the National Board. "I rather doubt it. But do I really plan to be involved from here on out? No. Maybe I'll come back once in a while and say hello."

We hope you both will. ♣

Fretting Over Steel

BY JAMES R. CHILES

In the animated movie Despicable Me, *two super-villains vie to possess a single shrink ray. This fantastic device reduces any object to pocket-size, even the Moon. But as the final scenes reveal, the ray's effects are iffy: given time, tiny objects tend to revert to full size.*

I thought of that movie while attending a work group meeting during the National Board/ASME annual meeting in May in Bellevue, Washington. The focus of the discussion was a wonder material of the 1980s known as ASTM Grade 91, specified for tubing as T91 and piping as P91. Some components manufactured from Grade 91 are failing early in heat recovery steam generators and other high-temperature settings. Forensic metallurgists are on the job, but there may be no single cause for its reversion from a high-strength crystalline micro-structure to a low-strength one.

The good news is that with proper care, Grade 91 steel can retain its original stellar qualities over the decades.

This article summarizes the status of concerns about Grade 91, and then draws a comparison to an even more daunting problem a century ago with railroad rails. These rails broke and derailed hundreds of trains in the US amid a full three decades of investigation. Good answers finally came, but would have come faster had there been less finger-pointing and more hand-shaking between key actors.

Grade 91

The history of the space-age steel alloy known as Grade 91 traces back four decades to Oak Ridge National Laboratory (ORNL) in Tennessee, which called it "Modified 9 Cr, 1 Mo-V" Grade 91, then, is shorthand for 9 percent chromium and 1 percent molybdenum. The term "modified" refers to the exact recipe, including small but vital quantities of vanadium and niobium.

Motivated by the oil embargo crisis of 1973-74, Oak Ridge hoped to use the new alloy in a fast breeder technology project called the Clinch River Breeder Reactor. (Fast breeders create fissionable plutonium from otherwise unfissionable uranium 238, and structural materials must resist high levels of radiation.) Though America's enthusiasm about new nuclear energy dwindled by 1980 – given changes in the energy picture and the Three Mile Island reactor's near-meltdown in 1979 – another driver took its place: the strategic mineral shortage.

Chromite ore was one of those strategic materials, because chromium metal is vital to stainless steel. In 1980 the US was drawing nearly all of its supply from the USSR and South Africa, both problematic. So designers, utilities, and steelmakers paid attention when Oak Ridge promoted Grade 91 alloy as helping to respond to the latest crisis. According to an Oak Ridge technical paper published in 1982, Grade 91 "can be substituted for stainless steels in many applications and, therefore, will reduce the consumption of chromium" (Sikka, 1982). Oak Ridge described it as a high-strength, ferritic-martensitic steel well suited for temperatures up to 600°C. That environment was too harsh for earlier-generation austenitic steels, which would creep and weaken.

Thinner pipe and tube walls would be possible because Grade 91 alloy offered high strength at high temperatures, good resistance to corrosion in air, low thermal expansion, and good heat conductivity. The reason for these fine qualities may have escaped casual readers, but metallurgists knew that the martensitic structure was the key: given the precise alloy mix, and given close attention to heating and cooling cycles, the metal took on a crystalline structure of tiny voids. In combination with carbon compounds that line these voids, the process gave Grade 91 both strength and hardness, even at high temperatures.

Because these qualities allowed Grade 91 to substitute in some settings for Type 304 stainless steel (which used twice as much chromium), the new alloy would reduce dependence on strategic minerals even while cutting plant construction costs. Remarkable claims, but they were supported by ORNL-sponsored tests at power plants beginning in 1980, using Grade 91 tubing that was alloyed and installed to the lab's specifications.

About those specifications . . . Oak Ridge did include some caveats about quality, not all of which would, or could, be captured in safety standards (such as the *ASME Boiler and Pressure Vessel Code*) that permitted use of the alloy. For one, Oak Ridge set strict limits on phosphorus, nickel, and sulfur. Why? Seemingly minor variations in such trace quantities could shift the allowable temperatures for normalizing and tempering, such that even careful fabricators could go wrong when setting their heaters. And everybody in the supply and installation chain had to safeguard the alloy's martensitic structure, the crystalline key to its fine high-temperature qualities. And by the way: Grade 91 was more vulnerable to steam corrosion than stainless steel.

Over the following decades, first in Europe and later in the US, Grade 91 components moved boldly into the power plant marketplace, taking the place of earlier-generation metals such as Grade 22.

Designers expect components to last 60 years in a power plant setting, but now, and well short of that, yellow flags are going up about problems with some Grade 91 components: steep declines in creep resistance that are difficult to detect with standard methods; failures around welds; and corrosion due to contact with steam, followed by overheating. That's because heat transfers poorly through the oxide layers.

Now changing the subject from layers to lawyers, litigants are gathering to argue about who should pay for tubing repair and replacement. The invitation list to that unhappy party is long: steelmakers who were supposed to correct for scrap inputs at the mill, steel wholesalers who sold the steel, general contractors, designers who drew up supports for the piping, fabricators who bent the pipe sections, welding companies who were responsible for proper heat treatment, suppliers of welding rods, or operators who might have exceeded temperature limits. And not just financial statements are at risk. Think of workers inside the plants who might be blasted by a sudden high-temperature leak.

Let's throw a spotlight on one of those concerns: welds during a tubing installation. The entire process – start to finish – must be "Grade 91 friendly." That extends from filler metal selection to preheating the tubing to postheating. The range of suitable post-weld heat treatment temperatures is quite narrow and mistakes can cut tubing strength drastically. Tempering practices that work fine for earlier austenitic steels like Grade 22 are entirely unsuited for Grade 91.

Another Metallurgical Mystery

The multitude of players in the Grade 91 drama, and the likelihood that no single root cause is responsible, remind me of a metallurgical mystery that surfaced early in the 20th century. The problem was steel rails that broke as trains passed. Because the railroad and steel industries strove to throw all blame on the other side, and because there was no single cause, fact finding went slowly.

In 1907 broken rails caused more than 300 railway accidents in this country, leading to public alarm and many headlines about the evils of Big Steel. But steel mills upped their quality game and by 1909 the hazard seemed to be fully under control. Then on August 25, 1911, a passenger train derailed near Rochester, New York, killing 29 people. A rail had shattered into 17 pieces as the train passed, sending the last nine cars over a berm and into a river. This was a time of growing government power, and the Interstate Commerce Commission used its brand-new investigatory authority to issue an accident report that pointed to cross-wise, or transverse, cracks in the rails. Lead investigator James Howard blamed the Lehigh Valley Railroad for putting excessive loads on the high-carbon steel rails with its twin locomotives, at 25 tons per axle.

Soon, rails with transverse cracks were being reported all over the country. It was especially alarming because inspection methods of the day could not spot early signs of such flaws. The broken-rail problem got worse the following year, wrecking 363 trains and killing 52 people.

Howard's laser-like focus on railroad operational practices appeared sound, because the nation's steel mills had clearly improved rail quality after the previous decade's disasters. Steelmakers had controlled the amounts of contaminants like phosphorus; added titanium and aluminum for strength; tightened inspections before delivery; and discarded the upper, less-uniform, portions of each ingot. Steelmakers sighed in relief at Howard's report and argued that railroads needed to buy heavier rail.

Years passed, and inventors figured out how to detect transverse flaws in rails by using electric current, but the root of the problem remained out of reach. Over the next 10 years the railroad gathered evidence that heavy axle loads didn't always cause problems, and cited a recently discovered phenomenon called "shatter cracks" as proof that the steelmakers needed to do more work.

It looked like a permanent stalemate, until more fractured-rail wrecks in 1923 and 1925 raised the prospect of government intervention. That finally brought the railroads and steelmakers to the same table.

More data-gathering and experiments, particularly in Europe, paid off in the mid-1930s. While there had been no one single cause behind the deadly rail-break accidents, taken together, many steps combined to slash the rate of rail breakage by 90 percent compared to the peak three decades earlier. Two of those fixes, identified late in the effort, were to change the cooling of freshly rolled rails, and keep wheel loads below 20 tons per axle.

What does this prewar history mean for today's Grade 91 investigations? All parties need to come to the same table, and the price of admission should be complete (and uncensored) data. That's much better than waiting for some headline-grabbing disaster to seize public attention and force a political response.

Reference: V.K. Sikka, *Substitution of Modified 9 Cr-1 Mo Steel for Austenitic Stainless Steels*, Oak Ridge National Laboratory, April 1982.

NBIC 2015

BY GARY SCRIBNER, MANAGER OF TECHNICAL SERVICES

Upon my arrival at the National Board in January, the first thing that stood out was the whiteboard covering one wall of my office. This board is broken down into 24 months detailing the steps, in sequence, of what is required in order to publish the *National Board Inspection Code* (NBIC). The details cover everything necessary for the code to be an ANSI Standard, from preparing for the first NBIC Committee meeting in a new book cycle, through public review comments and publication of the book. NBIC secretary Robin Hough was very quick to make sure I knew not to erase the board, and understood the importance of all the steps that were laid out in chronological order.

The NBIC has gone through several major changes since publication of the first book in 1946, with the last major change happening in 2007 when the book was split into three separate Parts. With this split the code started expanding quickly, providing more-detailed emphases on proper installation and additional guidance for proper inspection of pressure-retaining items. However, no matter how much information is provided in the NBIC, it is not useful unless it is readily available to the intended audience.

New technologies such as electronic books (e-books) have been embraced by people of all ages with paperback publications quickly becoming a thing of the past. In keeping up with today's technologies, the NBIC is scheduled to go through yet another major change with the publication of the 2015 Edition. This change will be subtle to the average user since the basic format will remain the same, but these changes will continue to require a great deal of effort by National Board staff in order to meet our ultimate goal of being able to provide the NBIC in not only the tried-and-true paperback version, but also as an e-book. Unfortunately, we have found that current e-publication technology has not evolved to the point that would make it possible to properly view all of the tables, figures, and pictures within a technical code. But we believe it will not take long for technology to achieve this capability. When it does, we will be ready to provide the NBIC in an e-publication format.

To the uninitiated, maintaining and updating the NBIC may seem like a pretty easy task, but trust me: It is not. I have quickly realized that this is a major undertaking that requires attention to many details. Since the NBIC was developed under ANSI procedures accredited as meeting the criteria for an

Example of new interpretation index.

Interpretation	Edition	Part	Section	Subject
11-06	2011	3	3.2.5	Calculations / Start of Work
11-05	2011	2	5.2.2 – 5.2.3	Replacement of Stamped Data on Corrugator Rolls
11-04	2011	3	1.7	Application of "VR" Stamp
11-03	2011	2	2.5.8	Test Frequencies
11-02	2011	3	4.4.2 a)	Liquid Pressure Test Requirements
11-01	2011	3	3.3.2	Routine Repair Considerations

American National Standard and developed by a consensus committee, much care must be taken in this process to avoid making any changes that would be technical in nature. The NBIC Committees comprise over 100 volunteers serving as members of task groups, sub-groups, sub-committees, and the main committee (or NBIC Committee). These volunteers come from a wide array of interest groups and backgrounds.

The majority of work on the NBIC is done by volunteers at their place of business and at home. The meetings bring the committees together twice a year to review proposed changes and work toward achieving a finished, approved version. With so many people having been involved with the NBIC over the years, changes to the code have been submitted in about every format imaginable, especially concerning tables and figures, which have been produced in a variety of formats from hand drawings to figures created in complex computer-aided design programs.

In an effort to add uniformity throughout all three Parts of the NBIC, almost every table and figure currently in the book was recreated. The detail in the figures will be to a specific line size to provide consistency throughout the NBIC. In some cases, figures and tables will be larger and easier-to-read than what is currently in the code.

Needless to say, all of these improvements are more than a one-person job. Numerous hours have already been put into the book – from recently retired Bob Schueler working on the tables, to a joint effort between Brandon Sofsky of the Public Affairs Department, a contracted illustrator, and myself, replacing the figures in the NBIC.

A great deal of emphasis is also being put on standardizing the format of the books. This includes providing consistency in not only numbering but also the placement of tables and figures to make them easier to find and thus more user-friendly.

An additional improvement to the book will be an enhanced index. Currently, the same index is utilized in each Part of the NBIC. Due to the growing size of each Part, the index will be split in the 2015 NBIC with each index being specific to the part of the NBIC it is found in.

And last but not least is the interpretations index. This area has undergone a drastic change from what is currently in Section 10 of each Part of the NBIC. In an effort to make interpretations easier to find, the new index will give users the ability to search interpretations several ways, including interpretation number, Edition, Part, Section, or Subject as shown in the table above.

The best part of this is that the new format has been made available on our website with the help of Brian Shafer from the Public Affairs Department. The index is broken down by year and is designed with links to allow users to navigate quickly from the index to the actual interpretation and back again. The complete index, along with interpretations, can be found on our website. Click the "National Board Inspection Code" tab and then select "Interpretations".

All of the changes and updates mentioned will become part of the 2015 Edition, which will be available in July 2015 in both the traditional paperback version and also in a user-friendly, downloadable e-book PDF format.

This process has been educational to me, but more importantly, we at the National Board believe these changes are the next logical steps in the progression of the *National Board Inspection Code*. I would encourage anyone who is interested in the development of the NBIC to attend our next meeting in January 2015 in Orlando, Florida, and become part of the process!

Improving Safety Through Violation Tracking

Device Type: Low-Water Cutoffs/Flow-Sensing Devices

BY CHUCK WITHERS, ASSISTANT EXECUTIVE DIRECTOR – TECHNICAL

A closer look at the major violations found on specific safety devices as reported to the National Board by participating member jurisdictions.

RECAP

- In July 2012, the National Board modified its Violation Findings Report to identify specific violations (per device type) commonly found on five types of pressure equipment during jurisdiction-required inspections.
- Quarterly violation reports are posted on the National Board website, and the annual report is published in the summer *BULLETIN*.
- Last fall the *BULLETIN* introduced a new violation tracking series that focuses on one safety device type and the top violations associated with that device per the reporting period.
- The first article in this series focused on violations identified for safety relief devices (fall 2013).

Low-water cutoffs/flow-sensing devices are basic safety devices that will shut down and protect a boiler from failure due to low water conditions or loss of flow. These protective devices are required by jurisdictional laws or regulations and are specified in jurisdictionally mandated codes and standards for each of the following types of boilers: high-pressure/high-temperature boilers; low-pressure steam boilers; and hot water heating/supply boilers.

For the three types of boilers noted above, there were 3,104 total violations for low-water cutoffs/flow-sensing devices identified by jurisdictions within the 2013 reporting period.

This article will focus on three key areas with a combined total of 2,850 violations out of 3,104 noted. The three key areas this article addresses (totaling 92% of violations) are inoperative devices, missing or uninstalled devices, and installed devices with no manual resets (see Table 1).

Low-water fuel cutoffs and flow-sensing devices are relatively simple in design and manufacture; therefore, design or manufacturing defects rarely contribute to failure. However, these devices are either mechanical or electronic and **do require** basic maintenance and testing to function properly and ensure safe operation.

Inoperable: A Hard-Layer Lesson

The following true experience illustrates the importance of regular maintenance and testing.

A low-pressure steam boiler operating in a business for over 20 years was recently inspected by a qualified boiler inspector. That boiler inspector had repeatedly inspected the boiler from the time of installation. Within three months of the annual required internal inspection, the boiler overheated and catastrophically failed, causing hundreds of thousands of dollars in property damage, not including loss of business revenue. (There was a happy ending, though: **no fatalities**!) The cause of the failure: the business was sold right after the inspection was performed and the original owner explained to the new owner the required maintenance needed for the boiler, including addition of chemicals, but the new owner continued to add chemicals without performing any required blowdowns of the boiler and low-water cutoff.

When the float-type and probe-type low-water cutoffs were found, disassembled, and inspected, both the float chamber and probe were completely covered with a hard layer of chemical deposits, rendering both devices inoperative. The connecting 1-inch piping for the float-type low-water cutoff was completely filled solid with chemical deposit. The boiler operated for 20 years without any problems. If the new owner had understood the importance of continual maintenance, this incident easily would have been avoided.

Since there is no man-made device

Table 1

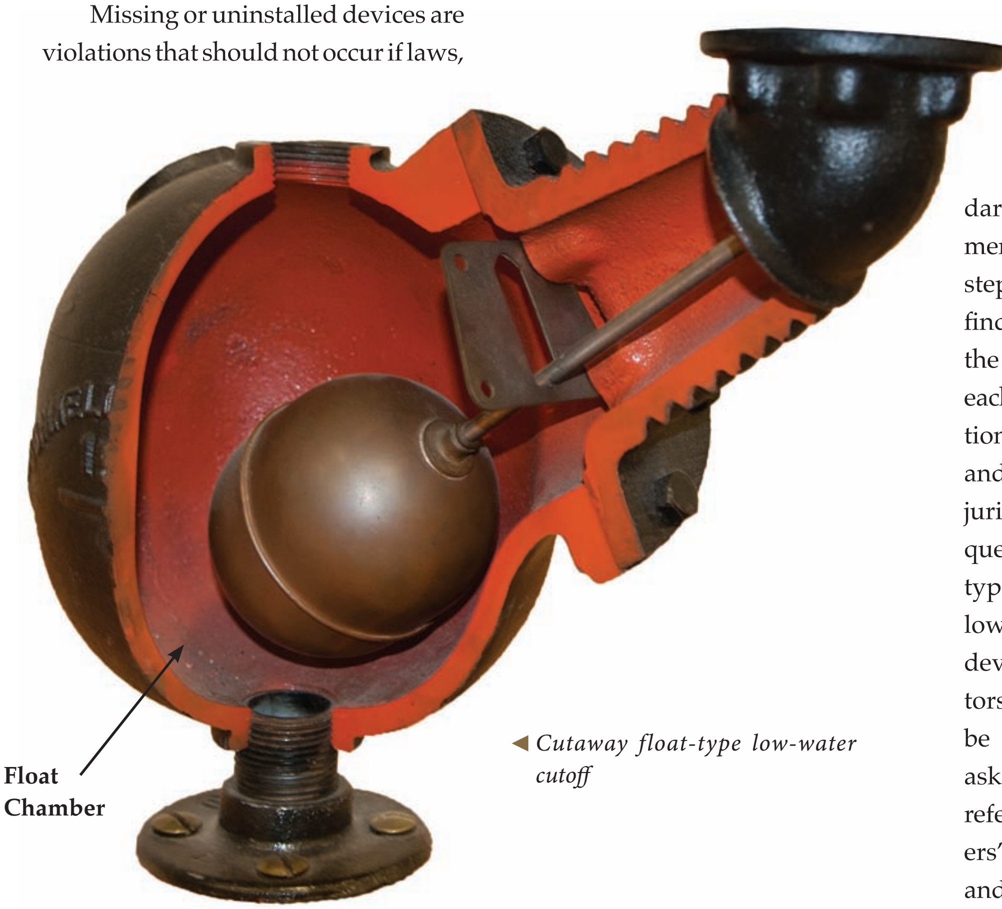
Violation Tracking Statistics for Low-Water Cutoffs/Flow-Sensing Devices Period: 1-1-2013 to 12-31-2013			
Device Type: Low-Water Cutoffs/Flow-Sensing Devices	**Inoperable**	**Device Missing/ Not Installed**	**No Manual Reset**
High-Pressure/High-Temperature Boilers (S)(M)(E)	144	21	25
Low-Pressure Steam Boilers (H)	206	289	168
Hot Water Heating/Supply Boilers (H)	461	879	657

which is maintenance-free, performing proper maintenance is extremely important for safety. Although maintenance is important, testing is equally important. It is recommended that low-water fuel cutoffs be tested weekly while in operation by performing either an evaporation test or a slow drain test.

Missing or Uninstalled Devices

Missing or uninstalled devices are violations that should not occur if laws, regulations, codes, standards, and even manufacturers' recommendations are reviewed, understood, and observed. Laws and regulations specified by jurisdictions are specific to the type of boiler and provide clear direction for installing low-water cutoffs and flow-sensing devices. These laws and regulations do provide the requirements for installation of these devices, but in doing so, they may refer to other codes or standards such as the *National Board Inspection Code* (NBIC); American Society of Mechanical Engineers (ASME) Section I, *Power Boilers*, and Section IV, *Heating Boilers*; ASME CSD-1, *Controls and Safety Devices for Automatically Fired Boilers*; International Mechanical, Plumbing or Fuel Gas codes; as well as some fire codes and electrical codes. It is imperative that owners/users, installers, and contractors obtain, read, and understand these referenced codes and standards.

Although these codes and standards strive to harmonize requirements, there are differences. The first step before any boiler installation is to find out what the jurisdiction (where the item is to be installed) requires for each type of boiler. Remember – jurisdictions are responsible for enforcing laws and regulations for public safety. Once jurisdictional requirements are known, questions such as how many, what type, when, where, and how to install low-water cutoffs and flow-sensing devices can easily be answered. Inspectors and jurisdictions should always be ready to offer guidance to those asking. Violations can be minimized if referenced standards and manufacturers' recommendations are understood and followed.

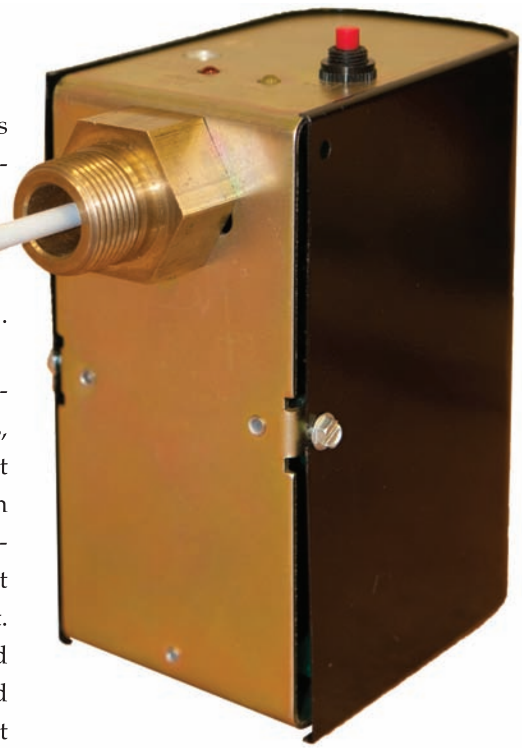


◀ *Cutaway float-type low-water cutoff*

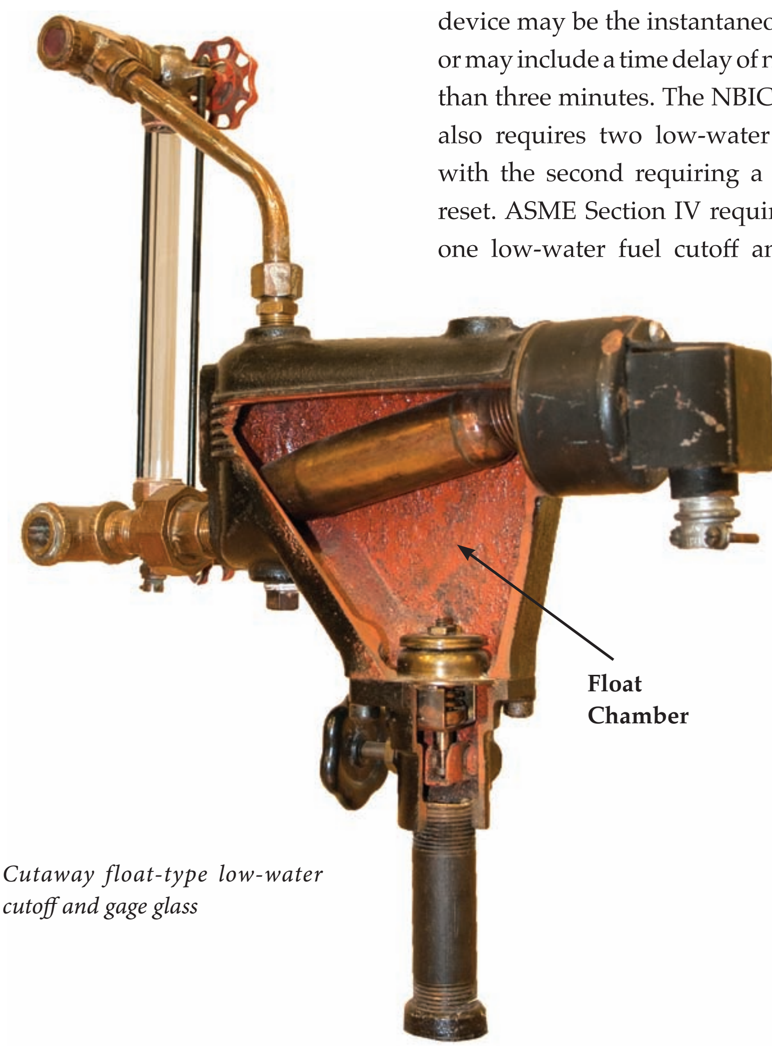
Manual Resets

For example, manual resets are not always required to be installed on low-water cutoffs and are governed by jurisdictional requirements or the referencing standards specified in the jurisdictional laws and regulations. Manual reset on controls adds an extra layer of safety to ensure the operator verifies the low-water condition of the boiler and the cause of the boiler shutdown before manually resetting the control and restarting the boiler. Presently, 32 states, five Canadian Provinces, and Puerto Rico mandate in some part ASME CSD-1. Additionally, the International Mechanical Code by reference adopts ASME CSD-1. Currently, the International Mechanical Code is adopted into state or local codes in 46 states, the District of Columbia, Guam, and the U.S. Virgin Islands.

To reinforce this need to understand differences between standards, let us look at the requirements for just one type of boiler: low-pressure steam boilers. ASME CSD-1 requires two low-water cutoffs. The lower-set cutoff must cause a safety shutdown and lockout. A manual reset may be incorporated in the low-water cutoff or be installed separately. The required manual reset device may be the instantaneous type or may include a time delay of not more than three minutes. The NBIC, Part 1, also requires two low-water cutoffs with the second requiring a manual reset. ASME Section IV requires only one low-water fuel cutoff and does not require a manual reset or a safety shutdown or lockout. Again, this is just for one type of boiler.



▲ Probe-type low-water cutoff



▲ *Cutaway float-type low-water cutoff and gage glass*

There are many other types, such as modular steam or hot water, hot water heating/supply, high-pressure steam, high-temperature, electric, or miniature boilers. All these various boilers have different requirements for installation and operation of low-water cutoffs. Without a detailed understanding of jurisdictionally mandated standards, it is no wonder that we find so many violations when performing boiler inspections.

For forced circulation-type boilers with no definitive water line, in lieu of the requirements for low-water cutoffs, flow-sensing controls are required to prevent burner operation when the circulating flow is below a safe minimum. Again, jurisdictional regulations and referenced standards will define the installation and operation requirements to be met for these devices.

Minimizing Low-Water Cutoff Device Violations

What can we do to minimize the number of low-water cutoff device violations? First and foremost, knowledge is key. Laws, regulations, codes, standards, and manufacturers' recommendations are continually being revised, which challenges inspectors to read, understand, and share this knowledge on an ongoing basis. Each and every boiler inspector, when performing inspections, should take the time to talk with the owners, maintenance personnel, operators, contractors, and installers and inform them of boiler safety requirements. Whether they are implementing old or new requirements, inspectors can make a difference by promoting public understanding and taking time to answer any questions users may have.

Of course, the National Board will always be a resource for information relating to codes and standards and pressure equipment safety, and inspectors should take advantage of the education and training the National Board offers through classroom and online (web-based) training courses, as well as 70-plus free technical articles accessible on the National Board website. The training courses are continually revised to reflect today's standards, new materials, and technology. The growing list of online training courses can be especially beneficial to the inspector, as they may be completed from home or office, all at once or in stages, as the inspector's time permits. A variety of general knowledge, inservice, new construction, and nuclear courses are offered. Visit the Training tab at www.nationalboard.org for more information.

▲ *Probe-type low-water cutoff*

◀ *Float-type low-water cutoff*

Just as safety relief devices are important to prevent over-pressure conditions in pressure equipment, operating boilers must be protected from low-water or flow conditions that can cause catastrophic failure if not corrected. Knowledge, understanding, and training are keys to success. Inspectors, contractor installers, jurisdictions, and even manufacturers can all play an important role in safety by continually striving to learn, understand, and most of all, take time to teach others the importance of proper installation, testing, and maintenance needed to minimize low-water cutoff and flow device violations. When we all work together for the same goal of pressure equipment safety, **we can succeed!**

Photos by J&R Ogden Photography

Casting a New Light on Leadership

AN INTERVIEW

WITH NEW NATIONAL BOARD CHAIRMAN

JOHN BURPEE

Maine Chief Boiler Inspector John Burpee came a long way to become the National Board's Board of Trustees Chairman.

And that doesn't mean traveling from Maine to the General Meeting site of Bellevue, Washington, where he was elected by National Board members on May 13. Unanimously.

Born in the small central Maine town of Newport, the new board chairman served as senior class president and yearbook editor, and was a member of the National Honor Society in high school. But back then, Mr. Burpee had no idea what direction he wanted to take professionally.

But then came a political science assignment where he was expected to interview a public official. While interviewing a marine engineer from Maine Maritime Academy (MMA), young John Burpee became captivated with thoughts of traveling the world on a ship. Such was his fascination that after high school he applied and was accepted to the academy in Castine, Maine.

Mr. Burpee earned a scholarship after the first year at MMA through his participation with the Naval ROTC program and received a commission as an ensign in the United States Navy upon graduation in 1986.

During his service, Mr. Burpee attended Surface Warfare Officer School and was deployed in 1987 to the

Persian Gulf, Spain, and Bahrain on the USS *Coontz*. As a surface warfare officer, his main responsibility was to oversee the ship's main propulsion engines and operate a 1,200-psi steam plant.

Interior facilities courtesy of the Sail & Steam Museum

> *"Not only have I been given a warm welcome and wonderful backing from the National Board administration and staff, I have been pleased with the marvelous support from my supervisor and staff at the Maine Department of Professional and Occupational Regulation."*

Following his initial sea duty in 1990, the Newport native returned to the Maine Maritime Academy as a Naval Reserve Officers Training Corps (NROTC) instructor of navigation, marine engineering, and naval operations, as well as officer in charge of the University of Maine NROTC unit.

In the fall of 1994, Mr. Burpee began his career as a boiler inspector with Hartford Steam Boiler Inspection and Insurance Company. A year later he transferred to central Vermont and finally to central Maine. In September of 1999, he submitted an application for and assumed the job of Maine chief boiler inspector.

One of the first challenges the new chief inspector faced was tallying how much equipment existed in the state. He reacted by putting into place a state boiler tracking system that today monitors more than 11,000 boilers and pressure vessels and approximately 2,500 licensed stationary steam engineers. Mr. Burpee also oversees regulation of the state's ski lifts and elevators.

The Maine official was elected as a member at large on the National Board's Board of Trustees at the 2010 San Antonio Members' Meeting.

He and his high school sweetheart, Patricia, are approaching nearly 30 years of marriage. The Burpees have two grown children: Heather and Alexander.

Still in the infancy of a three-year term as chairman, Mr. Burpee recently met with the *BULLETIN* to provide his take on his new role with the National Board.

Congratulations on your election as board chairman. Is it too early to ask how your professional duties have changed?

Thank you! It's very gratifying to be elected by your peers to such an honorable position.

At this point, I am still trying to learn the lay of the land. But it has been a very interesting several months. The transition to date has been quite smooth. Not only have I been given a warm welcome and wonderful backing from the National Board administration and staff, I have been pleased with the marvelous support from my supervisor and staff at the Maine Department of Professional and Occupational Regulation.

What would you identify as the biggest recent challenges for the National Board?

The last few years have been especially difficult for National Board members due to baby boomer retirements. Hundreds of years of experience have quite simply walked out the door. While not a surprise, it did present some challenges, which we have cleared to an appreciable degree. Members are younger, which opens up the opportunity to take advantage of new technology. While retirements will always be a challenge, the *board membership is stabilizing and moving forward.*

A continuing area of concern is the inability to replace retiring chiefs. While most jurisdictions are proactive, some have eliminated the positions or have failed to fill them on a timely basis, which can leave a gap in oversight. These essential safety programs need consistent regulatory involvement and unfortunately may not get the attention they deserve until an incident occurs.

Government officials should be made aware that not replacing their boiler chiefs is not only doing the public a grave injustice, the ramifications may result in injuries to persons or equipment.

At this early point of your tenure, do you have any long-term goals?

I have two actually: to keep growing the National Board and increase the profile of the National Board Testing Laboratory.

Expansion of our organization – any organization – is never an easy endeavor, particularly as a not-for-profit. While we have been fortunate over the years to have strong leadership and a staff with remarkable vision, the National Board has not endured for 95 years on pure luck. We have weathered world wars, disastrous economic downturns, political uncertainty, and countless challenges questioning the value of pressure equipment inspection.

A problem we face is related to working through new requirements due to changing federal regulations. This process is difficult at best, which can make expansion overly burdensome. An uncertain economic climate adds to the complexity of long term planning. But there are opportunities for the National Board and we must take advantage of those opportunities.

I think our testing lab is one area that has some increased opportunities.

For years, the lab has been perceived almost as an addendum to the National Board operation. And yet it represents outstanding potential. But to take full advantage of this potential, we have to raise the lab's profile. With recent improvements at this facility, we have reinforced our industry presence. However, we should be evaluating use of our lab services beyond traditional pressure equipment testing. Perhaps more research and development. Should that occur, I think we can provide safety services to markets that heretofore have been beyond our reach.

Any changes you would like to see in the short term?

One immediate change I would like to see is a reduction in the shortage of pressure equipment inspectors. Thanks to National Board training efforts, I can say without reservation that the inspector deficiency is easing.

Successful change is seldom abrupt. If one looked at the National Board since I joined 15 years ago, he or she would be astonished as to how our organization has evolved. And not just physically. Yes, our training facilities have expanded into a campus. But our training program has continued to evolve and has far surpassed what it used to be. Today, the program boasts more students taking courses in

> ***"A continuing area of concern is the inability to replace retiring chiefs. While most jurisdictions are proactive, some have eliminated the positions or have failed to fill them on a timely basis, which can leave a gap in oversight."***

> "While I understand the necessity of safety programs being administered by the government, I can't see how politicization of these efforts enhances public safety."

Columbus as well as an online training system that is second-to-none, an electronic method of testing students online, a new professional sophistication to the way our instructors teach, a menu of courses that appeals to journeymen and beginning inspectors alike, and a collection of pressure equipment that takes our hands-on instruction to new levels.

I have always said that new leadership is an opportunity to see things from a new perspective. I see us looking at the National Board under a new light. That means expanding on what we do well and jettisoning or modifying those things we don't. Under the direction of our past executive directors and board chairmen, we have done a lot of things right. It's important to keep that momentum moving forward.

If you had one wish for the pressure equipment industry, what would that be?

I would like to see politics removed from all government safety programs.

While I understand the necessity of safety programs being administered by the government, I can't see how politicization of these efforts enhances public safety. Not every jurisdiction does this, mind you. But there are certainly enough to warrant concern. Over the last decade we have witnessed a number of member inspection staffs downsized for purported economic reasons even though those programs supported themselves through inspection fees. We have also experienced loss of entire programs. The fact is: every jurisdiction needs pressure equipment oversight by someone professionally trained. While these oversight efforts are important to the general public, they are perhaps equal if not more so, to pressure equipment companies operating in the jurisdictions.

Is the National Board considering expanding its membership?

Currently, our Task Group on Membership is researching this possibility. The National Board has maintained a membership-based organization for 95 years and our methods are proven. Given our experience, we could assist in establishing similar safety programs in countries beyond North America.

It seems to me considering jurisdictions beyond North America would be a prudent way to add members. But as with any decision that could have a significant impact on National Board operations, we have elected to move carefully in our evaluation and research on expanding membership.

While expansion may seem to be a good idea from an outside perspective, it is more complicated than it appears. First and foremost, you have to consider the views of current members. Would increasing membership adversely impact the jurisdictions? Also, the regulatory environment of any

new members needs to be consistent with our goals of promoting boiler and pressure vessel safety.

The NBIC has changed quite a bit since you joined the National Board in 1999. Do you see any significant changes to that document in the future?

I do, but mainly due to the rapidly changing needs of industry. The nice thing about the NBIC is that it, too, changes according to the times and technology. With coal plants being shut down, the resurgence of natural gas, EPA regulations changing by the thousands, and green energy still a subject of considerable debate, the immediate future remains a question mark. New federal regulations will force our members to be more flexible. Discouraging use of fossil fuels means our industry will adjust our perspectives on newer technologies. Enhancing the NBIC to make it more relevant to users is a challenge without end.

Our NBIC committee professionals will be quite busy over the next 10 to 15 years. While I do foresee the NBIC expanding beyond its present three-volume set, it will continue to be relevant to all types of equipment.

How will changes in energy production impact National Board's training program?

Significantly. And I think National Board staff is keenly aware of what they must do to prepare for this energy evolution.

New technologies and environmental regulations will require inspectors to expand their professional knowledge. And that means additional training. I have always been a firm proponent of training and appreciate the benefits of learning, not only because I observed the value of teaching during my time as a Naval ROTC instructor at Maine Maritime Academy and the University of Maine in Orono. While in the service I witnessed firsthand the importance of training in building professional competence and confidence. This was reinforced when I taught several

"The regulatory environment of any new members needs to be consistent with our goals of promoting boiler and pressure vessel safety."

courses at those colleges. It is imperative we emphasize that as our industry changes, so does the need to update one's training. Having earned a particular designation or credential does not translate into ending the learning process.

It sounds like you are extremely optimistic about the National Board's future.

I think two critical requirements for a company to survive are financial stability and a solid staff. We are in a good place financially and I think our tradition of fielding a productive, viable staff goes without saying.

One of the things I have long admired about National Board staff has been its continuity. There are a number of employees who boast 20, 25, 35 years of service. And that has been instrumental to National Board's longevity.

Currently, however, we are observing several key staff people who have taken or will be taking retirement. While this might create some short-term issues, I believe the depth of the staff will enable the organization to meet this challenge and continue to provide quality operations that have been the hallmark of the National Board.

"*Having earned a particular designation or credential does not translate into ending the learning process.*"

What do you feel is the state of the National Board/ASME relationship?

It's never been better in my opinion.

First, coordination of the two-year NBIC/ASME Code distribution cycle has helped both organizations keep their codes and standards in harmony.

Secondly, National Board member Madiha Kotb's rise to the presidency of ASME signaled and perhaps reinforced the notion that two critical organizations could work together with professional coherence.

Next, I think cooperation on the part of both organizations in celebration of the 100th anniversary of the ASME Code at the General Meeting in May was truly remarkable.

If there are two people who are most responsible for this new energy level between the two organizations, it would be ASME's June Ling and National Board Executive Director David Douin. Several years ago, I don't know that anyone could have predicted the close working relationship that now exists. Having been on the Board of Trustees for the past couple of years, I have admired Dave's proactive support of ASME. His insight and vision were critical in putting our synergistic association in perspective.

How has the National Board's international efforts progressed?

I think we are making significant headway. But it should be remembered exporting codes and standards on an international scale is not new to our organization.

With translations of the NBIC into Chinese and Spanish, we have reached out *to two extraordinarily large population groups. Historically, the English version NBIC has been used internationally for over a half century. We were translating some of our instructional materials in Spanish as far back as the late 1990s. Our technical publication, the* BULLETIN *has been distributed internationally for more than 30 years. The National Board website has been accessed by visitors in more than 90 countries since 1996. Currently, we train pressure equipment professionals from all over the world as well as taking our training courses to a variety of countries including China. And each year we host a number of foreign companies who visit the Testing Laboratory for evaluation of their pressure relief products. Additionally, we have welcomed quite a few foreign company officials who have visited National Board headquarters.*

My point is that past international efforts have established a solid foundation for what is now occurring and what will occur in the future. This includes more personal communications such as meetings National Board executive staff and I will have in China next month.

How has digital communications technology impacted the National Board?

The obvious benefit of electronic communication is a reduction in postage and printing expenses. And that has been exceptional. But there is one profound benefit that I think has escaped many of us: digital communication has brought our members closer together. There was a time not too long ago when members physically got together only twice a year. Instead of depending on telephones and letters, the membership can now exchange information instantly. Same holds true for our committees such as the NBIC Committee. The free flow of information and ideas is essential in this regard. Not only have we been able to be more efficient with our time and the time of our users, we are able to distribute information on a timelier basis whether it's violation tracking, registration, or making training more convenient. And that is critical when it comes to safety.

Like many organizations, the National Board wouldn't be where it is today without new technology. When we launched our website back in 1996, the challenge was to offer electronic access to the National Board home page without getting beyond the technical capabilities of our users. Obviously, since then our audience has become not only more technically adept but dependent on the timely delivery of important information. That means we must stay current with new electronic media even though the investment in this area is considerable. We are in a very good position right now thanks to those before me who were able to strategically integrate electronic media with National Board's growth.

A word to those looking for an expansive library of pressure equipment articles: as we have provided since the beginning, there remains a considerable amount of free technical information on our website that can be accessed by anyone.

In addition to your duties as chief boiler inspector, you are also chief inspector for Maine's elevators and ski lifts. That's a lot of responsibility.

It is. And I, like most chief inspectors, rely heavily on our professionally trained staffs. In this regard, I am blessed to have a group of inspectors who are dependable, knowledgeable, and extremely dedicated. Naturally, with having responsibility for these different equipment types, there needs to be specialists. One doesn't normally transition from tramways to boilers and vice versa. I have the utmost confidence in my people. Their increased efforts have enabled me to take on these new challenges.

Thank you, Chairman Burpee.

"We are in a very good position right now thanks to those before me who were able to strategically integrate electronic media with National Board's growth."

Potential Concerns in Temperature and Pressure Relief Valve Application

BY JOSEPH F. BALL, P.E., DIRECTOR, PRESSURE RELIEF DEPARTMENT

Because you *can* do something doesn't always mean it is a good idea. The application of temperature and pressure relief valves (T&P valves, or sometimes called PT valves) exemplifies this principle. This article examines the function and application of these common pressure relief valves and some cases where, although permitted by the *ASME Boiler and Pressure Vessel Code* (ASME code), their application may not always be a sound technical solution.

T&P valves are used widely for ASME code Section IV hot water heater applications. These valves have pressure relief and temperature relief modes of operation and provide three different actions when protecting Section IV equipment: thermal expansion liquid pressure relief, emergency overpressure protection, and temperature relief.

The pressure relief function of the valve is the mode of operation most users are aware of. A spring provides a force acting downward on the valve disk. The valve is calibrated to open when the opening force developed by pressure in the protected vessel exceeds a specified value (usually 125 or 150 psig). Once the valve opens, the fluid flowing through the valve relieves the pressure in the system, the pressure will decrease, and the valve recloses at a lower pressure. As long as valve capacity is sufficient, pressure will not exceed the maximum permitted overpressure allowed in the ASME code.

Thermal Expansion – Liquid

The pressure in the protected item can be developed by two different mechanisms. First, when water is heated in a closed container, it tries to expand and exerts pressure on the container. As long as the container does not yield, pressure will continue to rise, leading to damage of the container if the pressure becomes too high. If the T&P valve is functioning properly, it will start to open due to the increase in pressure, and the released water will reduce the pressure until the valve recloses. The capacity needed in this case is very small with the valve needing only a slight opening to relieve the pressure. The ASME code does not mandate that the valve be capacity tested for its thermal expansion function.

Continual opening and closing of a T&P valve due to thermal expansion is not desirable because deposits from the released water may cause corrosion in the valve. Also, deposits of minerals and scale from the water will accumulate on the valve seat or in the valve outlet, which can eventually cause the valve to leak or seize shut. Continued opening of the valve wastes water and energy, and the discharge must be taken to a location where it cannot cause water damage. To address these issues, ASME code Section IV, paragraph HLW-809; and the *National Board Inspection Code* (NBIC) Part 1, paragraph 3.7.9, recommend that an expansion tank be considered. An expansion tank is partially filled with air, which allows water to expand in it, thus preventing pressure in the system from increasing.

Emergency Overpressure Protection

Pressure in a Section IV system can also increase due to a failure of temperature controls, which can result in uncontrolled heating of the water. For hot water heaters, if the normal temperature operating control fails, a high temperature limit control should prevent the temperature from rising over 210°F. If the high limit control fails, the temperature will continue to rise with an attendant increase in pressure. If the high heat and pressure cause a leak in the hot water heater, hot water above 212°F will uncontrollably and violently expand and flash into steam, which can result in an explosion with catastrophic results. To prevent this, the T&P valve will "pop" open under this absolute worst-case condition, and steam or a steam- and water-mixture will be released through the pressure relief valve. ASME code capacity testing is based upon this condition, and the ASME/NB-certified capacity marked on the valve tells the capacity which will be relieved. (*For more information on capacity testing of Section IV valves, see Thomas Beirne's article in the winter 2014* BULLETIN).

Temperature Relief

A hot water heater turning into a steam boiler is obviously not a good thing; therefore, the T&P valve was designed with an additional temperature relief function by use of a thermal element. This is a long, thin rod in the valve inlet which is filled with a wax-like substance that expands with increasing temperature. As it expands, it pushes up a small metal tip, which presses against the bottom of the valve disk, pushing the disk off of the seat. When the disk opens, hot water flows out of the valve outlet, and in a potable water system, is replaced by makeup water, which will be at a lower temperature. The thermal elements have a temperature rating of no higher than 210°F (99°C), which keeps the water temperature below the atmospheric pressure boiling point. Thus, steam or saturated water should never develop in the heater.

The tolerances on the thermal element temperature setting are always negative, so that a thermal element with a 210°F rating will open between 200°F and 210°F.

The ASME code does not mandate the use of T&P valves, but many other plumbing and gas standards do. In this author's opinion, they should be used on all hot water heaters for the additional high-temperature safety feature they provide. It should be noted that the thermal element is NOT designed to provide safety from scalding, which is done by other devices with lower temperature settings.

However, the ASME code and NBIC Part 1, paragraph 3.9.1.6, indicate another potential use of T&P valves. In ASME code Section IV, paragraphs HG-400.2(b) and HG-701.7, it is indicated that: "Hot water heating or supply boilers limited to a water temperature not in excess of 210°F (99°C) may have, in lieu of the pressure relief valves specified . . . above, one or more officially rated temperature and pressure relief valves . . . set at or below the maximum allowable working pressure of the boiler." Here the T&P valve is being used instead of a pressure relief valve. There are several issues with this permissive requirement.

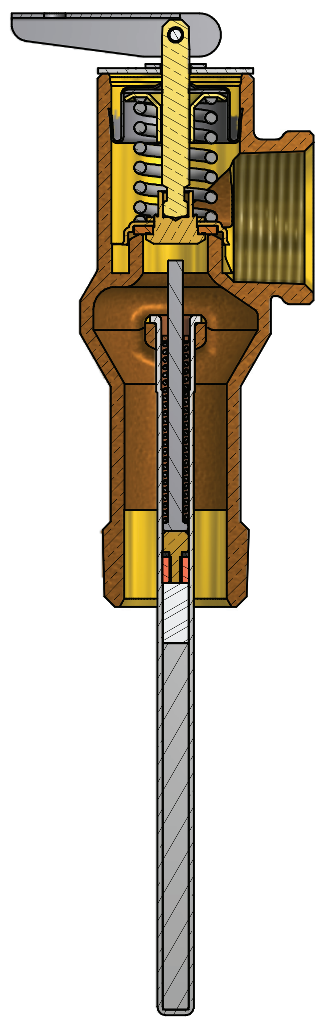
First, a hot water heating boiler (even when limited to 210°F) will typically operate at a higher temperature than a potable hot water heater. Normal water heater temperatures are around 120°F to 130°F. A temperature excursion above this will still be well below the T&P valve temperature setting, and valve openings due to high temperature should be rare. Hot water heating or supply boilers could operate as high as 180°F, much closer to the T&P valve temperature element opening temperature. Excessive openings on high-temperature water should be avoided because of the corrosion and mineral deposit issues noted above. Note that this is not a thermal expansion issue, because the temperature element opens the valve.

However, a bigger problem is encountered when T&P valves are used on hot water heating boilers. These boilers are not required to have a permanent water makeup connection, only a place where water can be added (Ref: HG-705(b)). The boiler will be filled using a temporary connection (perhaps a garden hose) which is then removed. In normal operation it is expected that this will be a closed system, and no additional makeup water will be needed. However, because of the higher operating temperature, if a T&P valve is used, the likelihood of it opening is much greater. When the T&P valve opens, water is removed from the system without any makeup. When water is lost, it is replaced by air, which will then lead to problems where heating efficiency can be affected and hot spots can form. Hot spots are especially problematic, and if severe enough, heating surfaces can potentially fail.

Another problem is encountered in units used in low-temperature locations. These heating boilers are often filled with a mixture of water and antifreeze instead of plain water. When this mixture is relieved through an unexpected T&P valve temperature opening, the loss of fluid is not just a potential boiler issue; it is also an environmental problem, particularly if the antifreeze can be ingested by animals, which can result in sad consequences.

Therefore, although the ASME code and NBIC may allow T&P valves to be used for hot water heating or supply boilers, they may not be the best choice, particularly for the hot water heating boiler application. Due to these problems, it has been reported that some jurisdictions will not permit T&P valves to be used on hot water boilers. Concerns over high temperature should be addressed by carefully following the temperature control requirements included in ASME code paragraph HG-613, where two temperature limit controls (operating limit and high limit) are specified (reference: NBIC Part 1, paragraph 3.8.2.3). Periodic inspection of these controls should be performed to ensure their continued functionality. Use of a T&P valve instead of a pressure relief valve seems like an additional layer of safety, but may lead to an installation with various unexpected problems.

My thanks to North Dakota Chief Inspector Bob Reetz for information on problems found with T&P valves on hot water heating boilers. We always recommend that your jurisdiction be consulted for any specific and unique requirements.



Cutaway view of a T&P valve. Courtesy of Watts Regulator Company.

CHRISTOPHER CANTRELL

Nebraska Boiler Inspection Program Manager

To understand how Nebraska Boiler Inspection Program Manager Christopher Cantrell got to where he is today, it's best to begin with what he originally wanted to do in life: be an actor.

In the middle of a Shakespeare play in January 1991, Chris's community theater performance was interrupted by an onstage announcement many feared and others had anticipated: the start of Desert Storm with the US bombing of and incursion into Iraq.

Beginning the story here marks a decision that altered the trajectory of the Nebraska chief's career.

"I had always enjoyed the theater arts," he shares with a smile. "And I had gotten all the parts I had auditioned for. But it was during a time in my life where I promised myself that either I was going to make it as an actor or enter the service."

During his enlistment process in the summer of 1991, the Navy tested Chris using the Armed Service Vocational Aptitude Battery (ASVAB) to determine where the military could best employ his yet-undefined talents. While achieving a whopping score of 99% on the test didn't surprise Chris, it did catch the attention of his recruiter.

"Knowing that my two-year commitment would not offer me the opportunities that such a score afforded, he relentlessly pestered me to get into the nuclear propulsion program," Chris recollects.

Entering the energy field would not be too much of a stretch for the Fort Worth, Texas-born official. At age 13 in the early 1980s, Chris began spending time in the summer at his father's oil and gas roustabout business.

"To get my older brother and me out of his hair, my dad would let us run a backhoe and on especially slow days he would pay us a quarter for each lizard we shot," he chuckles. And that was on top of

BULLETIN Photograph by Sam Swartz Photography

his regular pay of $3.35 an hour.

Chris's father also helped his boys in the summer of 1985 by purchasing them a truck to transport potable water to drilling-well sites.

"We netted about $3,500 each for three months' work," the Nebraska official smiles.

The senior Cantrell also employed Chris to help him run a side business pressure-testing oil wells for piping leaks.

Growing up in West Texas generated

a lot of memorable times for Chris and his brother. But the mid-1980s oil bust brought profound changes, beginning with a move to Houston with their mother.

"I suddenly went from being a big fish in a small pond in Odessa, Texas, to a small fish in a big pond," he recalls with a hint of regret. "We went from a 4,000-square-foot home to an 800-square-foot apartment overnight."

Chris says an active childhood involving recreational sports, participation in advanced academic courses, and the marching band was good tonic for his transition, both mentally and physically.

"During my freshman year of high school, my height shot up from five-foot-ten to six-foot-three he grins.

To begin her new life in Houston, Chris's mother took a job as an administrative professional purchasing time on oil and gas lines.

"Yes, I had a lot of exposure to the energy industry growing up," he explains. "But when I graduated high school in 1989, I had no desire to do anything involving this field. I just wanted to attend college and pursue theater arts."

For the next two years, the Texas native attended community and junior colleges with two goals: first, to become an actor and second, to get into Texas A&M.

After two years of failed attempts at college, he informed his mother he wasn't returning to school.

"She wasn't very happy when I told her I was dropping out of college and going into the military."

And so began Chris's six-year commitment to the Navy.

"The first two years were primarily spent attending nuclear power school," he explains.

His first tour of duty began in January 1994 aboard the guided missile cruiser USS *Truxtun*. A year and a half later the ship was decommissioned and Chris began a new two-and-a-half-year tour aboard the guided missile cruiser USS *California*.

"Being on the USS *California* afforded me the opportunity to see quite a bit of the Pacific Rim countries," Chris explains with a grin. "Over a six-month period, we visited Japan, Hong Kong, Singapore, the Persian Gulf, the Panama Canal, Ecuador . . . ."

Chris left the Navy in early 1998 as an E-5 machinist's mate, and, according to the Nebraska official, not a second too soon.

"Imagine," he emphasizes, "working in a 130°F engine room 10-15 hours a day!"

For a month after his honorable discharge, Chris "played the role of vagabond." He drove from Bremerton, Washington; through Montana and Nebraska; caught a Chicago Cubs game; visited the Bass Pro Shop headquarters in Springfield, Missouri; and then finally ended up in Houston.

Prior to leaving the Navy, Chris had enrolled in the Navy Transition Assistance Program. "I posted my resume on the Internet and got five or six calls," he says.

Chris considered taking a job offshore Houston on an oil rig. "It wouldn't be that bad," he assumed. "Three weeks on the rig, three weeks off."

As for college, well, that was moved down the state official's priority list.

While considering the pros and cons of offshore life, it wasn't long before Chris received a call from an insurance company inquiring about his interest in boilers. And they asked if Chris would be willing to sit for an interview.

"Although the rig work offered more money, this company addressed all of the right things: new construction work and the independent nature of what I would be doing," he continues.

Hired in April of 1998, the newly designated inspector attended a precommission course and passed the National Board examination one month later.

Sixty days following his hire, Chris officially became an authorized inspector at a full-time shop in the Denver area. Three months later, Chris was transferred to Lincoln, Nebraska, to assume the role of authorized inspector in a local boiler manufacturer's shop.

The year 1998 saw the Texas native work in three states before arriving in Lincoln. While moving from city to city, Chris never lost focus of what was important to him: the Texas A&M Aggies football team.

"I made a stipulation when I was hired that any transfers would only be to states in the Big 12 [college football conference] so that I could still follow the Aggies on TV each Saturday," he chuckles.

While the Aggies may have been important up until 1998, the year 1999 brought a new interest that eclipsed even Chris's enthusiasm for college football. Having met initially in Lincoln at a tavern on a Friday night, Jeny and Chris Cantrell enjoyed meeting each other, but no phone numbers were exchanged. Happenstance brought the two together the following day at a sports bar where – to no one's surprise – Chris's beloved Aggies were playing on TV. Several weeks would pass before the two would "officially" have a first date and begin a two-and-a-half-year courtship and engagement. They married in May of 2002.

In the years that followed, Chris began to travel more extensively for his job. Finally realizing that this was too much travel, Chris left the inspection industry in early 2007 in order to keep his growing family in Lincoln and to be a full-time husband and father. Chris worked several months for the Nebraska Public Power District before accepting the Nebraska boiler program manager position in September of 2007.

A member of the National Board since, Chris was also elected a member at large on the Board of Trustees in May 2011 and then again in May of 2014.

Now with over 20 years in the pressure equipment profession, Chris still has an occasional itch to become a thespian.

"There is no business," he reminds with a wink and a nod, "like show business!"

Seeking Clarity: NDE Procedure Demonstration Versus NDE Qualification

BY WALTER BEACH, NATIONAL BOARD CONSULTANT, AND JIM WORMAN, NATIONAL BOARD SENIOR STAFF ENGINEER

The demonstration of written nondestructive examination (NDE) procedures has been accepted and executed for many years in accordance with the ASME Boiler &Pressure Vessel Code. *However, in the 2013 Edition, revisions were made to Section V, Article 1,* General Requirements, *paragraphs T-150 (a) through (c) in an effort to clarify the intent of demonstrating examination procedures. In addition, a new subparagraph (d) was added, which caused general confusion in the industry regarding when procedural qualifications for NDE are required. This article attempts to explain why there is confusion with T-150 paragraph (d) and what might be done in the future to address these concerns.*

Background

The various Articles of Section V have been revised in the last few years to include a table of essential and nonessential variables (and other details needed for each examination method) in an effort to prepare for the possibility of a referencing code Section invoking a requirement to "qualify" written examination procedures. Though the Articles provide the detailed technical requirements for performing the examinations, there are no guidelines for how the process of procedure qualification should be carried out within the specific Articles. It may have been presumed that the referencing code Section would provide the necessary details whenever making it a requirement to qualify the written examination procedure before its application in code construction.

In the 2003 Addenda, Section V added Article 14, *Examination System Qualification*, for qualifying NDE systems with Mandatory Appendix 1 of Article 14 being used for the purpose of establishing standard terms and definitions of terms, which appear in Article 14. Article 14 was written to accommodate the ASME Post Construction Standards Committee but it hasn't been required. It is currently available as API 579-1 / ASME FFS-1, which is a fitness for service and evaluation code.

The 2013 Edition of Section V provides the qualification model. The minimum technical requirements believed necessary for the qualification of a written NDE procedure are in a new subparagraph (d) under Article 1, T-150.

Section V, Article 6, *Liquid Penetrant Examination*

As an example, in Section V, Article 6, *Liquid Penetrant Examination*, paragraph T-621.2 begins, "When procedure qualification is specified by the referencing code Section. . ." So, where in the ASME construction code Section is an NDE procedure qualification specified? To the best of the authors' knowledge, it is not there. Therefore, the requirement for qualifying an NDE procedure must be invoked by the referencing ASME construction code Section. This means that unless the construction code specifically requires NDE procedure qualification, the procedure qualification is not required. If the referencing code Section were to solicit this requirement, perhaps the referencing code Section would provide criteria for qualification of the procedure as well, such as what is expected for a test object, flaw types, sizes, etc.

The current 2013 Edition states in paragraph T-150 (d)(2)(a) that "The *maximum acceptable flaw size, required flaw orientation, and minimum number of flaws* **shall be as specified by the referencing code Section**." This further supports that the current ASME codes of construction only require procedure demonstration of T-150(a) and not procedure qualification since the requirements are not specified in T-150(d)(2)(a).

Qualification vs Demonstration

Procedure *qualification* is not the procedure *demonstration* as specified in T-150(a). The two terms are not the same as defined by ASME Section V. Mandatory Appendix 1 of Article 1, paragraph I-130, lists terms used in conjunction with Article 1. Following are terms for procedure demonstration and procedure qualification:

Procedure demonstration: when a written procedure is demonstrated, to the satisfaction of the Inspector, by applying the examination method using the employer's written nondestructive examination procedure to display compliance with the requirements of this Section, under

(a) normal examination conditions per T-150(a), or

(b) special conditions as described in T-150(b).

Procedure qualification: when a written nondestructive examination procedure is qualified in accordance with the detailed requirements of the referencing code Section.

Remember, Section V is not a construction code, but a code that construction codes *reference* for NDE compliance. At this point in time, no ASME construction code references any NDE procedures to be qualified.

Here is an example of how ASME Section VIII, Division 1, Mandatory Appendix 6, *Methods for Magnetic Particle Examination*, makes reference to T-150 of Section V:

6-1 Scope

(c) Magnetic particle examination shall be performed in accordance with a written procedure, certified by the Manufacturer to be in accordance with the requirements of T-150 of Section V.

It is clear that the current ASME non-nuclear construction codes do not contain a specific reference to procedure qualification with the required specified details of T-150 (d)(2)(a). At the surface, it appears all of T-150 has been imposed, but without the specific details (such as test object, flaw type, size, etc.), procedure qualification is not possible.

Qualifying Personnel

If one reads Article 1, paragraph T-120 (g), in order to get a better understanding, he or she would come to the conclusion that personnel demonstration is required.

T-120 General

(g) When the referencing Code Section does not specify qualifications or does not reference directly Article 1 of this Section, qualification may simply involve a personnel demonstration to show that the personnel performing the nondestructive examinations are competent to do so in accordance with the Manufacturer's established procedures.

Article 1, paragraph I-130, defines personnel demonstration as:

Personnel demonstration: when an individual displays an understanding of the examination method and proficiency in conducting the examination, by performing a demonstration examination using the employer's written non destructive examination procedure.

Liquid penetrant procedure demonstration.

The construction codes are requiring personnel demonstration, but require that the manufacturer (certificate holder) certify that the written procedure (not personnel) be in accordance with T-150 of Section V regarding procedure demonstration.

The Section V committee has made the changes as indicated above, but the construction code committees have yet to respond to the impact of these changes, which has caused this general confusion in the industry. Until there is further clarification from the Section V Committee through interpretations or rewrites, it appears that T-150, paragraph (d) is not applicable to the current construction codes.

Off-Site National Board Training Available

BY KIMBERLY MILLER, MANAGER OF TRAINING

The National Board Training Department is no stranger to travel; in fact, all of the seminars and courses offered at our campus in Columbus, Ohio, can be conducted off-site at a company's facility or at another venue in their city.

Over the last few years, National Board training staff has traveled across the United States to conduct training, as well as outside our borders with classes in Canada, Germany, and China. These training classes have been held at the request of insurance agencies, refineries, utilities, jurisdictions, etc. – for *their* employees at *their* facilities. Everything from our three-day Boiler and Pressure Vessel Repair **(RO)** Seminar to our 10-day New Construction Commission and Authorized Inspector **(A)** Course is available to be taught off-site. Enrollment for off-site training sessions has been as few as 10 students but as many as 40, depending on the exact training needs of the organization.

The National Board Training Department can also design and deliver custom training addressing an organization's specific needs. For example, a company may want to provide its employees with in-depth training on one of the *ASME Boiler and Pressure Vessel Code* Sections, such as Section I, *Power Boilers*. We can customize a one- or two-day training session covering code requirements established by Section I. This can be made-to-order on topics provided to us by the company, or we can work with the company to determine the exact content they truly need, and then generate a training session suited to their audience. We have even personalized training around a company's quality control manual to be as specific as possible to their requirements and what they do on a daily basis.

The National Board Training Department can also design and deliver custom training addressing an organization's specific needs.

So, what are the steps for requesting to have a National Board class conducted at your facility?

- First, determine if one of the classroom courses is what your group needs, or if what you are truly interested in is a customized training session. For reference, there are complete course descriptions located on the National Board website under the TRAINING menu.
- Second, determine the number of students who will attend the training. It is recommended to have a minimum of 10 students for off-site training. We have found it is not always cost-effective to have fewer than 10.
- Third, decide on an approximate timeframe in which your organization would like to hold the training. On average, the training department needs between four and six months notice to schedule off-site training in order to avoid conflicts with previously scheduled class dates, instructor schedules, etc.

Once you have a firm idea of what type of training your organization needs and approximately when you would like the National Board to conduct the training, simply send an email directly to me at kmiller@nationalboard.org, or go to the TRAINING tab on the website, choose Off-Site/Contract Training in the dropdown menu, and click the email link found in that section. All inquiries will be acknowledged as soon as possible via email. At that time, additional questions may be asked in order to provide the best estimate, with customized estimates then delivered via email. ✤

Training Courses and Seminars

The 2015 classroom courses and seminars training calendar is coming soon. Check the National Board website for up-to-date availability.

ONLINE TRAINING COURSES

Visit www.nationalboard.org for complete online course descriptions.

General Knowledge Courses/$99 per course

- ASME Code Reading Primer
- ASME Nuclear Code Reading Primer
- ASME Nuclear Inservice Code Reading Primer *NEW!*
- Basic Mathematics: Operations and Formulas

Inservice Inspection Courses/$150 per course

- 2012 CSD-1: Controls and Safety Devices for Automatically Fired Boilers
- *2013 Ed. National Board Inspection Code*, Part 1, *Installation*
- *2013 Ed. National Board Inspection Code*, Part 2, *Inspection*
- *2013 Ed. National Board Inspection Code*, Part 3, *Repairs and Alterations*

Continuing Education Courses/$100 per bundle

Important Note: All courses listed under a continuing education heading must be completed to meet the requirements of NB-263.

New Construction (A, B, A_R*)

- Material Control / Monitoring
- Welding Documents

Inservice (IS, O)

- Boiler Feedwater Basics
- Inspection Techniques for Firetube Boilers
- Local Postweld Heat Treatment

Nuclear (N, NS)

- Fracture Toughness Requirements for Material
- Quality Assurance Records Monitoring and Auditing Activities

Nuclear Inservice (I, NS_I)

- Nondestructive Examination (NDE) Personnel and Methods
- Repair / Replacement Activities

Nuclear Concrete (C, NSc) *NEW!*

- Duties and Responsibilities
- Materials and Testing

*The A_R Endorsed Inspector must complete the New Construction training as well as the NBIC Part 3 training course to meet the continuing education requirements. A "New Construction with Repairs" bundle is available through the online training center.

Certified Individual Courses/$150 per course

- Cast Aluminum Boilers
- Cast Iron Boilers
- Electric Boilers
- Reinforced Thermoset Plastic Corrosion-Resistant Equipment
- Unfired Miniature Pressure Vessels
- Pressure Relief Devices

Member Retirements


Paul M. Wilcox

Paul M. Wilcox retired as chief boiler inspector of Milwaukee, Wisconsin, on June 1. Mr. Wilcox served in the US Air Force. He earned an associate degree in heating, ventilation, and refrigeration from Milwaukee Area Technical College. From 1983 to 1997 he worked as a heating, ventilation, air-conditioning, and refrigeration (HVAC/R) technician for multiple contractors. He joined the city of Milwaukee as a boiler inspector in 1997 and remained in that position until assuming the role of chief boiler inspector. Additionally, Mr. Wilcox has been a member of the Refrigeration Service Engineers Society since 1985.


Jack Given Jr.

Jack Given Jr. retired as bureau chief of North Carolina on June 30. Mr. Given served in the US Naval Reserve from 1968 to 1974. Following his exit from the Reserve program, he joined the state of North Carolina and worked as a deputy inspector until 1978. He left the state for other opportunities in nuclear work before rejoining North Carolina in 1996, and was named chief in 2003. He served on the National Board's Board of Trustees as a member at large from April 2008 to September 2010. In October 2010, he was elected chairman to complete the unexpired term of retiring Michigan chief Robert Aben, and in 2011 he was elected chairman for a full term.


Donald Jenkins

Donald Jenkins retired as chief boiler inspector of Kansas on June 30. Mr. Jenkins served in the US Navy from 1962 to 1966. Shortly after his discharge, he was employed with the Bureau of Indian Affairs in northern Arizona as a boiler operator. He transferred to the Bureau's central heating plant in Tuba City, Arizona, where he oversaw the plant's operation and maintenance. He also served as Tuba City's fire chief and taught at a Navajo area fire school. In 1982, he became chief boiler inspector for the Bureau of Indian Affairs in Albuquerque, New Mexico, where he pioneered a training school for Native American boiler operators. Mr. Jenkins served the Bureau of Indian Affairs for 29 years. When the boiler program was eliminated, he accepted the position of chief inspector for the state of Kansas in 1996 and remained in that role until his retirement. Mr. Jenkins served on a variety of ASME subcommittees and NBIC committees, and also served on the National Board's Board of Trustees as a member at large and 2nd vice chairman.


Roy L. Perry

Roy L. Perry retired as chief inspector of Nevada on August 1. Mr. Perry studied general education at Golden West Community College. He began his career in boiler inspection with the US Navy, where he served from 1965 to 1973, and then from 1976 to 1978. In 1978, he joined Factory Mutual as a consultant, and then worked for various insurance companies from 1985 to 1992. He then joined the state of Nevada and worked as a boiler specialist and supervisor before becoming chief inspector. He served the state for over 20 years.


Lawrence R. Kline

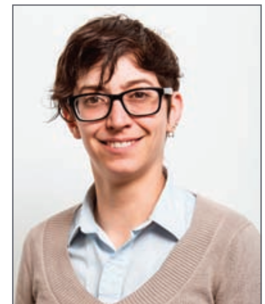
Lawrence R. Kline retired as director of the boiler division for the commonwealth of Pennsylvania on August 8. Mr. Kline's professional work experience included installation and maintenance of all types of boiler systems. He worked for Conrail Maintenance of Way and also served as a local-level instructor for the Pennsylvania Fire Academy. In 1980, he joined the Pennsylvania Department of Labor & Industry (liquid petroleum gas safety), and transferred to the boiler division in 1983. In June 2011, he assumed the role of director, boiler division, and maintained that post until his retirement.

New Members

Representing North Carolina and accepted into National Board membership is Cliff Dautrich. Mr. Dautrich's professional experience includes 17 years with Chevron USA. Additionally, he served as a chemical operator/shift supervisor at Perth Amboy Oil Refinery, and he also worked in design and construction. Mr. Dautrich assumed the role of North Carolina bureau chief in July.

Cliff Dautrich

Milwaukee Chief Boiler Inspector Jillian Klug has been accepted to National Board membership. Ms. Klug earned a bachelor's of science in mechanical engineering from Marquette University. She began her professional career in 1999, working at We Energies/Wisconsin Electric Power Company as a fossil operations power plant engineer with the steam generation system and later as the fossil operations welding engineer. In 2007, she transitioned to Cleaver Brooks and held positions as an industrial watertube aftermarket product engineer and aftermarket applications specialist/technical specialist. She joined the city of Milwaukee as a boiler inspector in 2012 before assuming the role of chief.

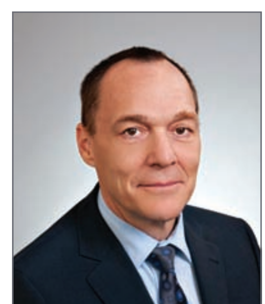


Jillian Klug

Massachusetts Chief of Inspections Edward Kawa Jr. has been accepted to National Board membership. Mr. Kawa earned a certificate of steam engineering from the Peterson School of Engineering and Steam Engineering Institute. From 1985 through 2005, he worked at the Merrimac Paper Company and served as a watch engineer, chief steam engineer, and corporate energy engineer. In 2005, he joined the Commonwealth of Massachusetts and served as a district engineering inspector and manager of engineering inspectors until assuming the role of chief of inspections. From 2011 through July 2014, he worked for Liberty Mutual Insurance Company as a risk engineering specialist. Mr. Kawa returned to the Commonwealth of Massachusetts to assume the role of chief of inspections for the Department of Public Safety.

Edward Kawa Jr.

Representing Alberta and accepted to National Board membership is Mike Poehlmann. Mr. Poehlmann began his career in 1976 in the pipe trades union before becoming a process operator in a chemical plant. He then attended St. Lawrence College and studied stationary engineering. From 1986 to 1988 he was an inspector with the Northwest Territories, and from 1992 to 1996 he was an inspector with the Province of Saskatchewan. In 1996, he joined the Alberta Boilers Safety Association (ABSA) where he served in a variety of positions, including shop inspector, inspection supervisor, manager of education and certification, manager of inspection (10 years), and acting general manager and technical director before assuming the role of chief inspector and administrator.



Mike Poehlmann

ABMA New President/CEO

In June, the American Boiler Manufacturers Association (ABMA) announced the selection of Scott R. Lynch as the organization's new president and CEO. Mr. Lynch comes to ABMA from SmithBucklin, an association management and services company, where he served as association executive. Prior to that, Mr. Lynch was executive director for the US Apple Export Council and president of the American Bearing Manufacturers Association.

Scott R. Lynch

Code Interpretations

The *National Board Inspection Code* (NBIC) and the American Society of Mechanical Engineers' *Boiler and Pressure Vessel Code* (ASME B&PVC) each issue responses to technical questions submitted by their respective user communities. Interpretations clarify the meaning or intent of existing rules. Section 10 of the NBIC contains an index of all approved interpretations at the time of publishing. A comprehensive index of NBIC interpretations is available at nationalboard.org under the NBIC tab.

The ASME B&PVC contains an index of all approved interpretations at the time of publishing, along with the written interpretations for a given date range, at the end of each Section. All written interpretations are also published online at: http://cstools.asme.org/interpretations.cfm.

Following is a selection of interpretation questions currently posted on the respective websites. To see the corresponding answers and the complete collection of questions, refer to the websites listed above.

2014 NBIC Interpretations

- **Interpretation 13-03,** Subject: Part 3, 3.3.2 d) 1), Edition: 2011
  Question: Is a standard threaded fitting welded through an ASME Section VIII, Division 1, vessel considered a nozzle?

ASME B&PVC Interpretations posted July 2014

Section I

- **Interpretation: I-13-14**, Subject: PW-16.6(a) and Figure PW-16.1, Sketch (z-2) (2013 Edition), Date Issued: August 20, 2013
  Question (1): Should there be a through-hole at Section 2-2 in Figure PW-16.1, sketch (z-2)?
  Question (2): May the tube extend into the shell, drum, or header beyond its inside surface in Figure PW-16.1, sketch (z-2)?

- **Interpretation: I-13-15,** Subject: PG-61.5, Feed Water Supply for a Steam Generator With No Fixed Water Level (2010 Edition With 2011 Addenda), Date Issued: August 28, 2013
  Question (1): In PG-61.5 is "maximum designed steam capacity" only specified as a value to be used in calculating the maximum sustained pressure required at the boiler inlet?
  Question (2): Does PG-61.5 specify a pump flow rate?
  Question (3): Does PG-61.5 mandate that the coincident conditions of maximum steam flow rate and maximum sustained pressure have to be met by the source feeding the boiler?

Section IX

- **Interpretation: IX-13-20,** Subject: QW-200 and QW-300, Date Issued: August 27, 2013
  Question (1): When preparing Procedure Qualification Records (PQR) and Welding Performance Qualification (WPQ) test records in accordance with the requirements of QW-200 and QW-300, is it required to use the word "Certify" on the PQR and WPQ documents?
  Question (2): Are Welding Procedure Specifications (WPSs) required to be certified?
  Question (3): Is it required that a manufacturer or contractor be an ASME certificate holder in order to certify qualification records?

- **Interpretation: IX-13-17,** Subject: QW-404.4 and QW-404.30, Change in F-Number and Base Metal Thickness Range, Date Issued: August 27, 2013
  Background: A WPS with supporting PQR was written and qualified without impact testing in 1978 to the 1977 Code without addenda, on a NPS 2 (EN50) diameter × 0.432 in. (11 mm) wall thickness pipe. The procedure was qualified in 6G position using an E6011 (F-No. 3) electrode on the root pass and completed with two fill passes with E7018 (F-No. 4) electrodes. The deposit thickness for the root and fill passes was not recorded on the PQR or specified individually on the WPS.
  Question (1): Provided the WPS and PQR meet all requirements of the 1977 Edition of ASME Section IX Code, may the WPS continue to be used without revision for work being completed to the 1977 ASME Code?
  Question (2): May a new WPS be written or revised without specifying weld metal thickness range for each welding electrode (E6011 and E7018) with the WPS prepared to the 2010 Edition of ASME Section IX Code with 2011a Addenda, using the PQR qualified to the 1977 Code?
  Question (3): Is the deposit thickness required to be recorded individually on the PQR and WPS for each F-Number electrode used for the root pass deposited with the E6011 electrode and the fill passes deposited with E7018 electrodes qualified to the 2010 Edition of ASME Section IX Code with 2011a Addenda?

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