“The Test of Time”

How Manufacturers & Key Contributors Helped Standardize an Industry

General Session Presentation
May 6th, 2019
Pat Becker - Pressure Vessel Design Engineering Technology

Babcock & Wilcox
What to Expect...

1. Introduction
2. History – Lots of it - The Power of Steam
3. The Need for Change
4. A Common Cause – The People, Volunteers
5. Developing a Standard – One Code
6. The Early Years
7. From Testing Experience to Application – Implementing Rules
8. Working Together - Changes in Jurisdictional Requirements
9. Steady Progress – One Goal, Many Hands
Who is Pat Becker?

- Sr. Technical Designer
  The Babcock & Wilcox Company
  2006 – Present
  Pressure Vessels (Headers & Drums)

- ASME BPVC Section I
  Subgroups Fab & Exam
  General Requirements & Piping

- National Board Advisory Committee
  Representing Boiler Manufacturers

- A Journeyman Patternmaker
  25 years making patterns for the Steel Industry

Patternmaker
1981 - 2006
Devastating Accidents involving Steam explosions were common in the Mid to Late 1800s

Industry was booming...(no pun intended)

Steam Engine and Boiler Design and Operation were not regulated

There was A LOT of fear ...especially related to Travel
“It is a fact that more lives have been lost by accident this year than in some of the severest battles of the war.”
The Sultana – Memphis, TN April 27, 1865...

- Had Safety Valves set at 150 psi
- Death Toll Estimated at 1500 - More lives than were lost on the Titanic

- Not publicized due to Lincoln’s Assassination, the End of Civil War and wanting to minimize fear.
150 psi, not a lot? Some Perspective...

Not withstanding physics, 150 psi is enough energy to send...

A can...
(350+ Miles)

A truck...
(800 ft.)

A 55 gal. drum...
(0.67 Miles)
(3500+ ft.)
The Need for Change... The ‘Water Tube Steam Boiler’

B&W Contributes to Progress...

With a patent awarded in 1856 (S. Wilcox and O.M. Stillman), George Babcock and Stephen Wilcox joined forces to design and market a boiler that increased heating surfaces for better efficiency and was both effective and safe.

1867

B&W establishes itself in Providence, Rhode Island, when George H. Babcock, Stephen Wilcox, Jr., and Joseph P. Manton form Babcock, Wilcox & Company to manufacture and market a water-tube steam boiler. This invention patented by Babcock and Wilcox marks the beginning of and sets the standard for safe, reliable steam-generated power.

B&W sells its first boiler to Carpenter & Cross.

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1876 World’s Fair
Philadelphia, PA

• Demonstration of Full Size B&W Centennial Boiler
• Captivated Attendees
• 150 Horsepower
• Gold Medal Winner
• Orders began to pour in…
Powering the Industrial Age... Inventions related at the Fair.

Scientific American
December 2, 1876

Feed Water Heater

Steam Engine

Furnace Feeder
length of hand and wrist is about eleven feet, the second finger is six feet long, and the thumb nail is thirteen inches square. The circumference of the forearm is sixteen feet six inches. The
Still have it
Canton, OH
May 11, 1910

25 OR 30 DEAD IN EXPLOSION AT SOUTH

80 OR 90 MEN REPORTED INJURED; SEVEN BOILERS LET GO AT ONE TIME

Catastrophe Probably The Worst In Canton's History; Bodies Are Strewed Over Territory For Yards Around

WOMEN IN ANGUISH SEEK LOVED ONES AMONG VICTIMS.

One Body Is Blown Entirely Through House Block And Half Away; Another Lands Near Smoked Plant

Picture Courtesy of:
Blowback
Author
Paul Brennan
(NBIC)
B&W has maintained the History by retaining the Minutes and Transactions of the ASME. From 1914.....to the Present.
It’s the People.
Then...

Dr. Jacobus
(David Schenk)

During a career at B&W that spanned 35 years, D.S. Jacobus was solely or jointly responsible for 192 patents, more than anyone else in the Company's history. Jacobus, who came to Babcock & Wilcox in 1906 from the faculty of the Stevens Institute of Technology, acquired patents for his advances in boiler, furnaces, superheaters, steam purifiers, and other power plant equipment. Aside from his technical exploits, Jacobus provides an excellent example of the traits we highly value in people. “The Doctor,” as he was known to friends, had a reputation for being practical, diplomatic and approachable—always willing to help younger colleagues with problems or questions. His spirit of teamwork and cooperation helped to make Babcock & Wilcox a superior organization.

Babcock & Wilcox

C.O. Myers
(Carl Owen)
An excerpt from the Transactions...

"At the December 1911 meeting of the Society, Dr. D. S. Jacobus presented a paper giving the results of the first performance tests on the 2365-h.p. Stirling boilers at the Delray generating plant of the Detroit Edison Company. At the time of his tests three of these boilers were in service, one having been run about 18 months and the others nine months. Since that time six more of the type have been installed at the rate of two a year, the last two in the autumn of 1912. It is the object of this paper to present some of the everyday experiences in operating the boiler..."
A paper detailing performance experience gained from the operation of the Detroit Edison boilers was shared at Code...

Pilot Steam Gage and Indicators. At the end of each firing aisle is mounted a large pilot steam gage. The dial is graduated in divisions of 1½ in. on its circumference but with no figures, and each scale division registers 1 lb. per sq. in. It is found and marked at just what point on this sensitive gage the boiler safety valves will lift and the steam pressure is carried accordingly. On the same gage board with the pilot gage
Regarding the Information Presented by Dr. Jacobus paper on the Edison Boilers...

Reginald P. Bolton said that these boilers were a wonderful exhibition of what might be expected in the future construction of boilers intelligently designed to give the gases a chance to burn themselves out, giving complete combustion before the gases got out of the boiler. Another lesson to be learned from these boilers was the effect which such large power uses had in improving the morale and the conditions of the working forces.
Cost of Firing a 12 Boiler Plant in 1914?

About $100 a Day
Advertising in the 1914 Transactions of ASME
From Testing... to Experience... to Application
Sharing Knowledge & Implementing Rules

The Babcock & Wilcox Company
1867-1967
A Century of Progress
M. Nielsen

the United States in the past 60 years. We supplied over 90 per cent of the boilers for all combat ships in World War II. In addition, B&W destroyer boiler designs were given to two other companies so that the units they produced would be identical with ours and repair and spare parts could be used interchangeably.

Seventy-five per cent of all merchant ships built in that war were equipped with boilers designed by B&W. The Company built the majority of these boilers. It also gave its detail drawings to eleven competitors, most of whom had never built a marine boiler before. This greatly speeded construction of the wartime emergency fleet and also insured that repair and spare parts would be identical for all such vessels.
Bailey Meter Company is in the business of conceiving, developing, and manufacturing instrumentation, controls, and automation systems for public utilities, industrial plants, and the process industries. It was incorporated in 1916 and became a B&W subsidiary in 1925.

Bailey Meter grew out of the need early in this century for more efficient and economical combustion of fuels in boiler furnaces. This required an accurate means of measuring the many factors entering into the combustion process. Bailey invented and developed effective tools in the form of meters, indicators, recorders, and complete control and monitoring systems for the power and process industries.

Automatic control was the logical step after metering, and in 1923 the first Bailey Meter combustion control was installed. This was the first automatic method of adjusting and maintaining optimum air and fuel supply to the furnace as the demand for steam increased or decreased. It was the forerunner of today’s highly sophisticated control systems.
Firebrick and Insulation development...

By World War I, it was apparent that further development of boiler size and rating was being limited by the quality of firebrick available. They simply would not stand up in large furnace walls at high temperatures.

Very little scientific work had been done up to that time on firebrick. Therefore, the group of outstanding young men assem-

and by 1930 they invented the first practical insulating firebrick—a development which revolutionized industrial furnace design.

These brick weigh one-eighth to one-fourth as much as ordinary firebrick, and combine high heat resistance, excellent insulating properties, and low heat storage. They can be used directly exposed to furnace gases, and because of their high resistance to the flow of heat require no back-up insulation. Their use makes it possible to design furnaces with light, thin walls, less supporting
In typical B&W fashion, once we were in the business of steel-making, it was only natural for someone in the organization to insist that there was a better way to go from the molten steel to semi-finished forms such as billets and slabs. This led to the establishment of a research and development project for the continuous casting of steel. As a result of this effort, B&W in 1963

The Tubular Products Division took another pioneering step in 1952 when it introduced in the United States the extrusion method of fabricating alloy and stainless steel tubes and shapes.
Boiler Shops & Contd. Product Development

Package
Boiler
Bayonne Works, NJ

Foundry
Barberton Works, OH

Train

› Hoover Dam Pipe Segment
B&W Barberton Machine Shop – 1930s

Manufacturing & Early X-ray Equip.
Barberton Works
Machine Shop
Barberton, OH
1930s...
Developing a Standard...

ASME to NBIC

"In 1911 The American Society of Mechanical Engineers appointed a committee to formulate standard specifications for the construction of steam boilers and other pressure vessels and for their care in service which committee has since come to be known as the Boiler Code Committee."

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Constitution and By-laws.

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State of Ohio

Specific Designs of Boilers and Other Pressure Vessels

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Joseph F. Scott
Claude E. Connally
D. B. Hedcoff
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State of Ohio
State of New Jersey
State of Pennsylvania
Province of Ontario, Canada
At a legislative hearing on the 1909 edition of the Massachusetts boiler rules, B&W sent a representative to express his views. Several people at the hearing questioned why a New York company would send a representative to Massachusetts to upset their plans to further their regulations. Surprising everyone, the representative stated that B&W would be willing to cooperate with the legislation, considering it a “movement for the protection of human life and property”.
Internal B&W Memo...

NEW YORK CONTRACT DEPARTMENT - H.B. JONES, MANAGER

BARBERTON CONTRACT DEPARTMENT - J. C. RICHEY

In line with your recent suggestion regarding the history of the State, A.S.M.E. and National Board serial numbers for stationary steam boilers, I am writing this letter to make a record of some principal dates and facts relating to this subject.

The State of Massachusetts authorities originated their steam boiler rules during the year 1907 and the first boiler built by Babcock & Wilcox Company in accordance with their rules was contract number B&W-6391 and which was stamped, as required, with Massachusetts serial number 1. This job was sold July 10, 1908 to the New York, New Haven & Hartford Railroad and was installed at Readville, Massachusetts.

The State of Ohio followed the example set by Massachusetts and the special requirements of this state went into effect in January, 1912. The first boiler built by our company in accordance with Ohio rules was contract B&W-7491, City of Urbana, Ohio and which was stamped with Ohio serial #1. This job was sold December 28, 1911, and shipped in January, 1912. The first Stirling job built in accord with Ohio rules was S-4758 for Goodyear Tire & Rubber Company, Akron, Ohio, which was stamped with Ohio serial #2. This order was entered January 9, 1912.
Section 8.
1. The standard size of the certificate of inspection, as authorized by section 2 of chapter 146, General Laws (section 26, chapter 465, Acts of 1907), shall be eleven inches (11") in length and eight and one-half inches (8 1/2") in width, and shall be made up and worded in accordance with the following copy, space having been provided for the insertion of the State Division of Inspection of the Department of Public Safety or the name of the insurance company using the same—

Commonwealth of Massachusetts

ANNUAL CERTIFICATE

of

STEAM BOILER INSPECTION

To the Governor's Office or Commissioner of Public Safety—Inspection Bureau

This is to Certify that the above-named steam boiler inspected by

This boiler has been inspected by the State Division of Inspection of the Commonwealth of Massachusetts.

Form U

The Commonwealth of Massachusetts

DEPARTMENT OF PUBLIC SAFETY

STEAM BOILER RULES

FORMULATED BY THE

BOARD OF BOILER RULES

ENFORCED BY THE BOILER INSPECTORS OF THE DIVISION OF INSPECTION OF THE DEPARTMENT OF PUBLIC SAFETY

STATE OF MASSACHUSETTS

In assigning National Board Numbers to Pressure Parts for use in the State of Massachusetts it is further necessary to assign a Massachusetts Number for these parts. This is due to the fact that the State of Massachusetts, at the present time, does not accept A.S.M.E. and National Board Standards but have their own Code. We, however, do assign National Board Numbers to these Pressure Parts in the event that should the unit or parts be later resold and transferred to another State there will be no trouble in doing so because the National Board Numbers will already be stamped on these parts.
The entire first day was devoted to the hearing of addresses. Dr. D. S. Jacobus, acting chairman of the A. S. M. E. Boiler Code Committee, told of the genesis and development of the Code, emphasizing the fact that no decision was reached that was not unanimous and mutually agreed upon. This was...

appreciated from the following list of the inspectors present:

National Board of Boiler and Pressure Vessel Inspectors Organizes

Detroit Meeting Fills Long-Felt Need for Permanent National Body of Boiler Inspectors

THE first annual meeting of the National Board of Boiler and Pressure Vessel Inspectors brought together at the Hotel Statler in Detroit on Feb. 2, 3 and 4 about sixty people, including members of the Board itself, of the Boiler Code Committee of the A. S. M. E. and others interested.

February 15, 1921
B&W Log Books for NBIC...

...and ASME
1909 Data Report & Steam Drum Drawing
ASME, NBIC.......The State Codes.
California, Maine, Massachusetts, Michigan, New York

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Standardizing Stamping Practices...

American Uniform Boiler Law Society. He told of seeing on his recent trip to the Coast a boiler with the stamps of 22 different states on it, which absurd practice, now not uncommon, would be avoided by the facilities and simple procedure offered by the organization of the National Board.
A Common Cause – One Code

Together...

- The NBIC, ASME, Inspectors, Manufacturers and Users have worked hand in hand for more than 100 years to Standardize and keep the Boiler Industry safe.

- It is the key contributions of thousands of volunteers along the way that are responsible for the longevity of the Code.
• The fact that many of the rules are the same today as they were 50, or even 100, years ago is a testament to the forward thinking ingenuity of those involved in the writing of the Code.

This code specified that boilers which were built in accordance with the rules should be stamped with the Code symbol and bear the manufacturers’ serial number which became known as the A.S.M.E. number to distinguish it from the numbers required by the various states. These state numbers were also included in the stamping on the pressure parts.

For a historic background we give on the following pages the entire constitution and by-laws of the national board of boiler and pressure vessel inspectors as it existed at the time this organization was founded.
Together...

As new technology developed and new manufacturing techniques were introduced, it was the consistent participation by ‘Users’ of the Code that kept the rules relevant, safe, and in all possible cases, practical.

I believe that it is generally conceded that John A. Stevens, the chairman and Dr. D. S. Jacobus were the outstanding personalities on the original committee.
STEAM - From the 1<sup>st</sup> Edition in 1875...

...to the 42nd Edition in 2015
FROM THOSE WHO CAME BEFORE US….

National Board of Pressure Vessel Inspectors
(1930)
At Left: (ASME BPV I) 2014
Below:
(National Board Chiefs, Board of Trustees & Advisory Committee) 2018

TO THOSE WHO WORK TO MAINTAIN THE LEGACY...
To the Manufacturers, Users, Inspectors and Visitors at ASME & NBIC who contribute their experience to make us all a little safer...

THANK YOU!!!

"This year, the National Board celebrates its 100th anniversary. These 100 years of success began with C. O. Myers’ perseverance and dedication to making the boiler and pressure vessel industry safer and more effective."

Thank you, Mr. Myers, for leading us by example, for 100 years and counting.
One Code.  
One Inspector.  
One Stamp.  
Keeping the Industry Safe.  
For the next One Hundred Years...
THANK YOU!

(AND HAVE AN ENJOYABLE AND PRODUCTIVE WEEK 😊)

QUESTIONS?

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