Pressure Vessel Newsletter

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Celebrating Tenth Year

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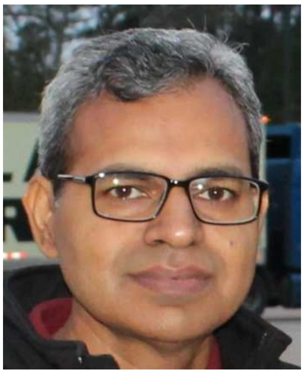
From The Editor's Desk:



The petrochemical boom in the Houston region is built around the manufacture of base chemicals like ethylene which is made using cheap abundant domestic natural gas as feedstock. Most chemical plants outside of US rely on feedstocks derived from oil, so Gulf Coast petrochemical plants had a huge price advantage when natural gas was cheap and oil sold for over $100 a barrel as recently as 2014. Now that oil is selling at $35 a barrel, much of that US advantage has gone away. As the profit margins tighten, the petrochemical sector in the Gulf Coast region is looking at other ways to make money.

Base chemical prices are tied to the costs of the commodities like natural gas and oil prices, while specialty chemical prices are linked to the performance of the products they are used in. All ethylene is virtually equal, but some specialty pigments or resins function better than those made by competition. So the chemical companies are now focusing on producing specialty chemicals and materials. Even if the oil prices go back up, they are not expected to go back to the heights where they were before. The advantages that the US manufacturers traditionally had will not be as significant as now.

This new realization has stimulated a new wave of investment along the Gulf Coast. Many of these investments won't come online for another couple of years. The trend of focusing on specialty chemicals is expected to last for next five years or so.

Some of the biggest specialty chemicals growth areas are in pharmaceutical in gradients, specialty polymers, electronic chemicals, cosmetics, fragrances and construction chemicals. Although much of the specialty chemical growth in future is going to be manufactured in developing areas such as China, India and Middle East, there is growth in Houston area as well. Several companies have announced plans to set up specialty fluids facilities in Houston area.

The base chemical manufacturing is not dead though. At least one global oil major has announced plans to build a $2 billion facility in Port Arthur to produce Ethylene which is the primary building block of most plastics.

In this issue…

IMPROVEMENTS IN THE STEELS USED IN OIL AND GAS PROCESSING EQUIPMENT OVER THE LAST HALF CENTURY

In the post-World war II period, the steels used in the oil and gas industry were quite different from what we use today. This tip of the month (TOTM) presents a brief overview of improvements in the steels used in oil and gas processing equipment for safer and more reliable operations.

Plate was SA-285C a 55,000 psi (379 MPa) tensile steel that was relatively soft and easy to fabricate. It was not killed steel and therefore, not fine grain steel. The low tensile strength meant thicker vessels and because of poor welding techniques, spot or no radiography at all was common, making the items even thicker. Figure 1 shows a vacuum tower made of SA-285C from the 1950's. ***This tower was constructed in 1961 by Chicago Bridge and Iron for the Shell Martinez Refinery in California.***

Figure 1. A vacuum tower made of SA-285C from the 1950's. ***Shell Martinez serial #C-4201***

A plate designated SA-212B Firebox was in use for higher tensile applications. It had a 70,000 psi (482 MPa) tensile, but was coarse grained and had the undesirable characteristic of fracturing in the parent metal after thermal expansion and contraction over a period of time.***Due to repeated failures in service, this material was removed from the ASME Boiler and Pressure Vessel Code Section II in 1968 as being unfit for thermal cycling.***

Figure 2. An example of fracturing in a vessel made from the SA-212B Firebox steel.

High Pressure Mole Sieve. This vessel fractured from thermal cycling.

Pipe used in the 1950's was SA-53B, which could be Electric Resistance Welded or seamless. It was not killed steel. It had a 60,000 psi (413 MPa) tensile and was the pipe of choice for vessel, tank, and piping fabrication at the time.

The forging of the 1950's was SA-181, a 60,000 psi (413 MPa) tensile steel used for flanges, forged steel fittings, and heavy nozzles. It was not killed steel.

Since none of these steels were killed, fine grained steels, their use declined rapidly as the industry moved into harsh environments such as the North Slope of Alaska and the processing of acid gases and sour crudes.

Killed steel came into wide use during the 1960’s. Killed steel is produced in the ladle by adding silicon or aluminum to prevent further deoxidation of the heat. Molten steel contains dissolved oxygen which can cause bubbles in the cooling and solidification process. The addition of silicon or aluminum stops the reaction of the oxygen with carbon, producing a fine grain steel free from dissolved gases, highly homogenous with excellent fabrication properties.

During the 1960’s, the SA-516 family of plate steels was introduced. These steels were silicon killed, fine grained, and produced excellent properties. The fine grain gave the steel impact resistance at temperatures down to -50 °F (-45.5 °C). The SA-516 suffix defines the tensile strength, 55,000, 60,000, 65,000, and 70,000 psi (379, 413, 448, and 482 MPa).

- SA-516-55 was designed to replace SA-285C
- SA-516-60 was designed for use in very cold service.
- SA-516-65 was for intermediate tensile requirements
- SA-516-70 was to replace SA-212B Firebox plate

The chemical and mechanical properties of these four grades of steel overlap to the extent that one plate can actually meet all four specifications.

Approximately 90% of all custom carbon steel pressure vessels manufactured for the oil and gas industry in the world today are made from SA-516-70 or its UNS (Unified Numbering System) equivalent. Figure 3 presents an example of a vertical drum made of SA-516-70.

During the 1960’s SA-106 pipe replaced SA-53 as the pipe of choice. Unlike SA-53B, SA-106B is seamless, killed, fine grain steel. It has a 60,000 psi (413 MPa) psi tensile.

In 1978, SA-105 forgings replaced the SA-181 as the forging material of choice. SA-105 has a tensile of 70,000 psi (482 MPa), so the pressure ratings of B16.5 carbon steel flanges increased.

Around the year 2000, the pipe manufactures improved their processes making SA-106 pipe to the point that they are able to meet the chemical and mechanical properties of SA-106B and SA-106C in the same heat.

Since 2003, basically all SA-106 pipe is dual certified to SA-106B and SA-106C. This means that all three major components of a pressure vessel or shell and tube heat exchanger now have the same tensile strength, 70,000 psi (482 MPa). Figure 4 presents pipes made of SA-106.

Austenitic Stainless steels (300 series) fifty years ago were made to straight grade (0.08 carbon) or “L” grade (0.03 carbon). Steel service centers had to maintain stocks of both grades. About 45 years ago, the stainless mills improved their manufacturing techniques to produce dual certified stainless steel, meaning that virtually all stainless in the steel service centers meets the criteria of 0.03 carbon for “L” grade but also meets the mechanical properties of straight grade. Straight grades have a higher tensile allowing for the use of a thinner plate than “L” grade plate.

Figure 5 presents an example of a separator made of stainless vessel. This 316 stainless separator is the first to be used offshore in place of a clad vessel. Since the temperature was low, the higher tensile allowed this item to be thinner, saving weight, and not require PWHT (Post Weld Heat Treatment), impact testing or special paint.

Figure 3. An example of a vertical drum made of SA-516-70

Figure 4. Pipes made of SA-106

Figure 5. This 316 stainless separator is the first to be used offshore in place of a clad vessel

Summary:

In the last half century, the adoption of new technology in the manufacturing of fine grain steel plates, pipes and forgings has vastly improved the quality of the steels used in Oil and Gas Processing Equipment. Along with improvements in the welding processes used to construct Oil and Gas Processing Equipment, vessels, exchangers, piping and storage tanks are safer than ever before.

To learn more about similar cases and how to minimize operational problems, we suggest attending our ME43 **(**Mechanical Specification of Pressure Vessels and Heat Exchanges**)**, **PF49** (Troubleshooting Oil and Gas Facilities),**PF42** (Separation Equipment Selection and Sizing), **G4 (**Gas Conditioning and Processing**),** and**PF4** (Oil Production and Processing Facilities),**courses.**

*PetroSkills*offers consulting expertise on this subject and many others. For more information about these services, visit our website at http://petroskills.com/consulting, or email us at consulting@PetroSkills.com.

John R. Curry

Instructor and Consultant

Source: ASME Boiler and Pressure Vessel Code Section II, Part A.

American Society of Mechanical Engineering, 1968.

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Feature Article

THE BIRTH OF UNFIRED PRESSURE VESSEL CODE

The Administration of the First Code 1915-1918

The first ASME "Rules for the Construction of Stationary Boilers and for Allowable Working Pressures" was adopted in the spring of 1915. The Boiler Code Committee (BCC) was to administer this Code subject to the final approval of the Council of The American Society of Mechanical Engineers (Council), and was to provide interpretations, rulings, revisions, and additions. The BCC established methods of procedure, introduced the formation of subcommittees of experts consisting of some of its members and some nonmembers for advice and guidance, and called for special hearings on disputed questions which required clarification.

Before the first meeting of the BCC, the Council acted on Code matters that were brought to its attention. On April 9, 1915, the Council voted that:

a) BCC be requested to make its own suggestion of changes, omitting the request that the Council sanction any work on laws, and;
b) That the authorization to use the Code symbol be referred to the BCC for recommendations and report to the Council.

First BCC Meeting – June 23, 1915

The first meeting of the Committee after the adoption of the Code was held on June 23, 1915 under the chairmanship of John Stevens. The Committee adopted resolutions to be presented to the Council asking it to approve the statement that the Code symbol applied to a boiler would indicate that the boiler had been built in full compliance with the Code and that the stamp should be applied by the manufacturer. It asked permission to make rulings respecting constructions not covered by the Code and to interpret any part of the Code. It also asked for authority to consider the subject of economizers, pressure vessels, rules for the care of steam boilers, and the section on recommended practice for the future editions. The Council gave assent to these requests at its meeting on the same day and asked that BCC report its actions to the Council.

At the BCC meeting the next day, June 24, 1915, the procedure to be followed in making Interpretations of the Code was formulated. It was ordered that any opinion or reply to correspondence which might be considered a decision was to be given a case number as it would establish a precedent or guide for future similar action. Cases were to be held separate from general correspondence. All case matters together with the final decision were to be sent to each member of the BCC with a reasonable time allowance for examination, criticism, and approval before the ruling was sent to the inquirer.

The Committee also considered Cases 1 to 10 at this meeting:

> **Case 1** was an inquiry regarding the stresses and staying of a special form of portable vertical boiler, the Tudor boiler. BCC stated that the strains in the Tudor boiler cannot be calculated. They would like to have the boiler of a particular size tested to destruction, and review the results of this test before giving an empirical formula for the calculation of the safe working pressure of the boiler.
>
> **Case 2** was a request for a ruling as to the method of supporting watertube boilers by head supports attached directly to the drums. The reply stated that where additional loads were placed on parts of a boiler these must be considered, and additional strength provided, using a factor of safety not less than that given in the Code.

Case 3 asked if flange steel could be used in shells of certain boilers under the ASME Code. The reply stated in accordance with paragraphs 2 and 3, flange steel may be used in shells of such boilers.

In **Case 4** the Committee replied that although the Code did not mention or provide for the return products of combustion passing over the tops of horizontal-return-tubular boilers, nevertheless when such is the case, fire-box steel must be used as required by paragraphs 2 and 3 of the Code.

Case 5 referred to the use of a particular design of a quadruple-riveted butt and double strap joint under Code rules. The reply stated that there was nothing in the Code to prohibit the use of such arrangement providing rules of Code with respect to joints were complied with.

Case 6 referred to the upper cut on page 103 of the Code, and called such a joint as illustrated impossible for boiler construction. The reply stated that the criticism was justified only when butt straps were thin. The type shown on page 103 was in common use in this country and abroad with heavy plates.

Case 7 referred to the use of bushings specified in paragraph 307 and 315 and asked if these were considered necessary to more securely hold the pipe to the head, and if so, did not a lip pressed outwardly around the feed pipe perform the same function and could it not be included under the same specification. The reply stated: "the flat part for the bushing would be better construction, but the bushing is required to allow the pipe to be threaded in tightly from each side.

Case 8criticized the title of the Code. Since the Code referred to portable, semi portable, and traction boilers, the expression "Construction of Stationary Boilers" was incorrect. The Committee replied that the word Stationary had been used to distinguish between land boilers and marine boilers and also it referred to boilers not used for propulsion.

Case 9 covered a request to publish extracts from the Code in a textbook, and in reply the Committee stated that this was not allowable.

Case 10 asked where the stamp specified in paragraph 332 of the Code might be obtained. The reply stated that these stamps could be obtained through ASME at a price of $3 each.

The first ten rulings were reported to the Council at its meeting on October 8, 1915. The Council voted to rescind its action of June which granted authority to BCC to make final decisions as to Interpretations of the Code. It voted that the BCC be empowered to make rulings when inquiries were made respecting construction not covered by the Code and to interpret any part of the Code, but actions on all rulings made by the Committee were to be reported to the Council and approved by the Council before being released. Approval of the Interpretations by the Council made them official, and later, when revisions or additions of certain paragraphs were made between editions of the Code, the Council added to their approval an order to print the words "and are adopted as Standard Practice."

Autogenous Welding

The matter of gas and electric-arc welding in use for building steel structures and ships was brought before the Committee at its first meeting on June 23, 1915. Robert Cramer presented many samples of the work of his company using oxyacetylene welding. He stated that the art was new and that his organization was proceeding with speed to develop the process before approaching the BCC for any decision.

First Subcommittee Appointed

On September 27, 1915 the Committee considered a second printing of the Code with Index and the correction of typographical errors but without any changes. This was followed by consideration of Cases 11 to 32; and for one of them, a subcommittee was formed to consider locomotive boilers not under federal control. Thus began the practice of the BCC to secure Council approval of subcommittees for definite purposes and composed of members and nonmembers of the BCC who were specifically qualified for the work by their training and experience.

Communications

At the Committee meeting of October 27, 1915, a communication from the Bigelow Company was considered. This communication did not warrant a case number because a reply by letter would give the necessary information. This was one of the earliest examples of the so-called “Communications” to be found in the minutes of the BCC.

BCC Meeting on January 14, 1916

This meeting considered two new cases, two reopened cases, and two communications. One of these communications was a protest from the American Society of Testing Materials (ASTM) relative to the reference in the Code to their material specifications and the changes which had made in their printing in the Code. It was pointed out that the Code must use a definite specification and could not refer to any new one not yet included in the published Code. It was shown also that automatic reference was not possible and that only after approval by the Council could changes be made.

BCC Meeting on March 10, 1916

This meeting was attended by nine members. Another objection was received from John C. Parker regarding the limit of 160 psi pressures on boilers equipped with malleable iron headers. They could offer no change, although at a later meeting this subject was submitted to a subcommittee for investigation and report.

BCC Meeting on May 12, 1916

This meeting was attended by 12 members and Paul Talbot, a guest. Eight cases were considered. Mr. Talbot had sent in drawings of his flash boiler, and in appearing before the Committee he reported his experience in the use of boilers which differ from those carrying a definite water level. He explained the operation of his boiler but the Committee could not reach a decision or formulate rules for such a boiler.

As some of the cases before the Committee were delayed by the need for drawings, it was decided that all inquiries made to the BCC should be submitted with necessary drawings for all members of the Committee or members of the Council.

In this meeting, the Committee also decided that when a case was withdrawn or dropped, the numbers of succeeding cases would not be changed, but the case in question would be marked annulled.

BCC Meeting on June 16, 1916

In this meeting, seven new and six earlier cases were considered. Case 80, from the Union Iron Works of California, asked if the Committee had investigated recent methods of welding, as a great deal of time and effort had been put forth by manufacturers of autogenous welding apparatus. The Committee was requested to give this matter further consideration.

The Committee replied that since its inception it had under constant observation all sorts of welding of pressure vessels, and had gone so far as to ask some of the welding experts of the country to write papers for the Society to bring out further information regarding these particular processes. Suggestions for changes would be considered at the public hearing before the Committee, where all interested parties might be heard.

BCC Meeting on August 24, 1916

At this meeting, the Committee agreed to hold public hearings on revision of the Code on December 8 and 9, 1916, and this decision was approved by the Council on September 25 with the understanding that, if necessary, the hearings would be continued during the following week.

Also, an advisory committee of the BCC, to be formed solely of representatives elected or appointed by the states and municipalities that had adopted the Code, was discussed, and was approved by the Council on October 13, 1916 to be called the Conference Committee.

American Uniform Boiler Law Society

At one of the later sessions of the public hearing on the Code of 1914, the question of forming an organization to bring the Code before the legislatures of states and to the attention of municipalities was discussed. The Boiler Manufacturers Association had a Committee on Uniform Boiler Laws, and Thomas Durban, a member of that Committee, realized the need for such uniformity. He had been busy from 1913 to 1916 in visiting many states and provinces to address manufacturers associations, boiler users, and state and city officials on the importance of uniformity. As a result of his strenuous work, the American Uniform Boiler Law Society was formed early in 1916 for the purpose of presenting the ASME Code to governing bodies of all states, provinces, and cities so as to secure, where possible, its legal adoption and to promote uniformity in boiler and pressure vessel inspection regulations. The Society planned to work with manufacturers and users of boilers, chambers of commerce, engineering societies, and others interested in boiler operation to secure the introduction of uniform bills using the ASME Code as the minimum requirement. Mr. Durban became the Chairman of the American Uniform Boiler Law Society in 1916 with a council of twelve representatives of power boiler manufacturers, heating boiler manufacturers, pressure vessel manufacturers, railroads, public utilities, and boiler equipment and appliance manufacturers.

To bring uniform laws before the United States as a whole, Mr. Durban planned a Congress for representatives of government and industry in Washington. The governors of twenty-two states and one province of Canada, the government of District of Columbia, and the mayors of four cities, each appointed from one to five official delegates for the Congress.

The two maxims of the Congress were:

1) Civilization and government are based on human life. Its protection is government's first duty.
2) Standardization is the foreword of business efficiency

The first address on the objects of the Congress by the member of Industrial Commission of Ohio, called attention to the work of ASME Boiler Code and the willingness of his Commission to accept it. The address by chief inspector of the City of Detroit cited an instance of a boiler which bore four state stamps, one city stamp and one manufacturer's stamp. In discussing the conflict between different states, he appealed for the state adoption of the Code.

Similarly, the states of California, Connecticut, New York, Louisiana, Michigan and Missouri either adopted the Code, were seriously considering adopting the Code, or announced preparation of Code that would meet ASME requirements. One representative even stated that his state should adopt the Code so as to escape the possibility of becoming the dumping ground for secondhand boilers!!

The Congress also adopted the report of the Committee on the Interchangeability of Inspectors' Certificates, and then that of the Legislative Committee which required that inspection bills contain the following points:

1) Pressure vessels be included or exempted.
2) Frequency and character of inspection.
3) Acceptability of inspection other than that by government.
4) Appointment and authority of inspectors.
5) Code of rules to govern inspection.
6) Fees, if any.

The following resolutions were unanimously adopted:

- Recommendation that all states adopt as their standard the ASME Boiler Code, thus bringing in standardization, full interchange of boilers and efficiency together to the end that the manufacturers, users and inspectors may profit by the advantages of uniformity.
- The human factor enters into the work of boiler inspection so that experience and training should be required of boiler inspectors.

Public Hearing, December 8 and 9, 2016

The hearing was attended by a large representation of builders, manufacturers, designers, and users in response to about 1500 invitations issued. Few comments were offered in connection with the material specifications – indicating that this part of the Code had received acceptance. Most of the discussion dealt with the paragraphs of boiler construction. There was a growing demand for recognition of welding by other means than forging methods, and this was the subject of greatest amount of discussion.

BCC Meeting on January 22, 1917

At this meeting the subject of Interpretations of the Code for states which had adopted the Code was discussed. The advisability of appointing additional subcommittees on safety code for pressure vessels other than for steam, on rules for the operation of boilers, and on recommendation distinct from the rules was discussed. But after due consideration, the appointments of such subcommittees appeared inadvisable until after the revision of the Code had been completed. This action was reported to the Council. The ASME Council minutes of February 1917 record that the Compressed Air Society requested the consideration of rules to cover pressure vessels other than those for steam. The Council suggested that the Compressed Air Society submit a brief to the BCC covering changes or additions to the present Code with scientific facts on which to base them.

BCC Meeting on September 20, 1917

At this meeting, Professor Greene, Chairman of the Subcommittee, reported that he had consulted Professor Enrique Touceda, consulting engineer of the American Malleable Casting Association, on the advances in the production of malleable iron since the issuance of the 1914 edition of the Code. During the previous ten years, it was reported, the quality, uniformity, strength, elastic limit and dependability of the malleable castings had been greatly improved. The principal drawback was the possible lack of the care in production.

This report was approved by the members of the subcommittee and accepted by the BCC with a vote of thanks. At its meeting on November 9, 1917, the Committee took no further action regarding the revision but increased the allowable working pressure with malleable iron boxes from 160 psi to 200 psi.

First Revision of the Code

Beginning with the six day sessions of the BCC from January 22 to 27, work on the revision of the Code was continued at the Committee meetings until December 3, 1918, at which time the Council authorized the printing of the so-called 1918 edition of the Code. The new edition had the same arrangement and paragraph numbering as were used in the 1914 edition:

Part I	Section I	New Installations of Power Boilers
	Section II	Low Pressure Heating Boilers
Part II		Existing Installations

Although the arrangement of subjects and the paragraph numbering were the same as in the first Code, the wording was changed to meet the Interpretations, suggestions, reports, and results of investigations by members of the BCC or by subcommittees. Some notable changes are listed below:

- Many specifications for Materials of the 1914 Code were brought into agreement with those of ASTM.
- A number of changes were made in paragraphs of boiler joints as a result of Interpretations, and to allow autogenous welding “where the stress or load is carried by other construction which conforms to the

requirements of the Code and where the safety of the structure is not dependent upon the strength of the weld."

- The paragraph on determination of the efficiencies of the longitudinal and diagonal ligaments of shells or drums was entirely new and required the use of a new chart for its application.
- Changes were made in the paragraphs referring to domes, heads, braced and stayed surfaces, as well as stays, staybolts, braces and connections.
- The allowable working pressure with malleable iron headers was increased from 160 psi to 20 psi. The test pressure at destruction on structures of this material was increased from 1200 psi to 1500 psi.
- The requirements for stamping and data reports were changed to meet the experiences which came from the administration of the 1914 Code.
- A new paragraph was added in Part II requiring consultation with a state inspector, municipal inspector, or inspector of a boiler insurance company when repairs affecting the working pressure or safety of the boiler were needed.
- A complete index of 15 pages was added at the end of the 1918 Code.
- An introduction to the Code, which outlined a statement of its objective, methods of administration, described the changes that were made in the 1914 Code, and the reasons for these changes was signed by the 24 members of BCC and 13 members of the Conference Committee. The business connection of each member of BCC, and the state or municipality represented by each member of Conference Committee appeared with each name.

Autogenous Welding (Continued..)

At the meeting of September 20, 1917, the BCC heard Llewellyn Williams of the American Society of Refrigerating Engineers (ASRE) and C.H. Bryce of the National Acetylene Association in presentations on the state of welding specifications. The autogenous welders were also heard, but the statements proved to be of little value because the different interests were in conflict and could not agree on anything. The Committee pointed out that when there should be agreement among all welding interests, they could then present their recommendations to the ASRE and the BCC.

The National Welding Council, which had been formed during World War 1, invited the Society to become affiliated with it in an investigation and standardization of welding procedure. It suggested the formation of a new organization known as American Welding Society (AWS) representing the entire industry. AWS would eliminate commercial aspects, undertake research and standardization, and act as a judicial body providing a medium for advancing the science and art of welding. AWS was invited to appoint a committee to confer with BCC on welding the joints of pressure vessels.

At the BCC meeting on June 23, 1921, the Chairman of the Subcommittee on Air Tanks and Pressure Vessels stated that specific provisions for welding were needed by his committee and for this reason the Unfired Pressure Vessel Code could not be issued. The Subcommittee on Welding in turn stated that it was almost ready to report, but the report was being withheld out of courtesy to the AWS and ASRE. A conference of the Subcommittee, AWS and ASRE was held later at which it was decided that the AWS and ASRE would obtain data on autogenous welding and the Subcommittee would obtain data on forge welding.

At the October 1921 meeting, it was very clear that the abovementioned conference had failed to give the necessary assistance in formulating a Code on Autogenous Welding. BCC suggested that the Subcommittee should prepare a Code on Welding and submit it to the cooperating bodies with ample notice of the reason for independent action. Subcommittee reported the findings of AWS that autogenous welding might be applied to pulp digesters, rendering tanks, oil stills, pressure tanks for distilling oils, autoclaves, brick drying and creosoting cylinders, steam receivers and separators. Longitudinal seams of pressure vessels for noxious or explosive gases or liquids and longitudinal seams of vessels over 5/8 in. thick should not be included. It was decided that the Subcommittee should stand on its position if it could be shown that the field had been sufficiently investigated and its position was sound.

S.W. Miller of the Subcommittee on Welding submitted a report based on tests made on 48 tanks of different types and construction. His paper on fusion welding dealt with strength and structure of welds, the effect of welding on the base metal, and impact bending tests showing the advantage in low carbon steel. His paper on the construction of unfired vessels reported tests on longitudinally double V-welded seams of 24 in. tanks of ½ in. metal. There were leaks in small pinholes when tested to practically the ultimate stress in the shell and at 800 psi there were no failures on the hammer test. Mr. Miller defended fusion welding on the basis of his own experience and the testing of his own product as well as tests on structures built by others. His letter to the BCC made clear the success of autogenous welding and the requirements for welds which were reliable.

Section VIII – Unfired Pressure Vessel Code

The question of the needed safety code for Pressure Vessels other than steam was considered by the BCC at its meeting of December 22, 1916, but because revision of the 1918 code was under way, these matters could not be given due consideration at that time. The minutes of the Council for February 16, 1917 record a communication from the Compressed Air Society which requested consideration of rules to cover pressure vessels other than steam which had been omitted in the first code of 1914. That society was asked to submit to the BCC a brief covering the changes in or additions to the Code, with supporting documents, as a basis for rules which it would regard as being equitable with scientific facts.

The BCC appointed a subcommittee on the Code for Air Tanks and Pressure Vessels which, in October of 1919, prepared a preliminary report containing discussion of formulas for stress based on elastic limit and maximum elongations for use for substances other than steel. The formulas for stress were given as:

For Class A, $S = 0.0125\ E\ [e + 8]$ not more than $0.4\ E$
For Class B, $S = 0.0125\ E\ [e + 16]$ not more than $0.65\ E$

in which E = elastic limit, psi, and e = elongation, percent in 8 in.

A public hearing on what was now called the "Code for Unfired Pressure Vessels (Third Draft)" was held on December 5, 1921. This Code was a 24-page pamphlet entitled "Preliminary Report". There were 200 persons present in the morning and afternoon sessions and the preliminary report was discussed by paragraphs.

The next public hearing on the Unfired Pressure Vessel Code (Fourth Printing) was held on December 4, 1922. At the meeting of December 10, 1922, the Chairman of the Subcommittee on Unfired Pressure Vessels called on Scaife Co., Electric Railway Association, and Pressed Steel Tank Co. to present their views on a minimum thickness of 1/8 in. for plates for air tanks. At this meeting, they were asked to submit written statements at a later date.

A conference of the Subcommittees of Unfired Pressure Vessels and on Welding, and representatives of ASRE, AWS, The American Electric Railway Association, and certain individuals was held on June 17, 1924. Revisions of several paragraphs of the Code for Unfired Pressure Vessels were discussed. S.W. Miller submitted a report of 19 pages – this report is discussed earlier under Autogenous Welding but it also contained criticism of Unfired Pressure Vessel Code. He pointed out that the classifications were faulty and that the Code had one paragraph U-2, on safety appliances, while the Power Boiler section had a much greater number. The Subcommittee assured the conference that the opinions of participants would be considered by the BCC.

At the meeting of the BCC on September 15, 1924, a redraft of the Code was submitted to the Subcommittees on Unfired Pressure Vessels and on Welding, and then to the Executive Committee for publication. **This sixth draft of the Code was published in MECHANICAL ENGINEERING for December 1924, and the Code for Unfired Pressure Vessels was adopted by the ASME Council on January 15, 1925, as the Section VIII of the ASME Boiler Code.**

Source: HISTORY of the ASME BOILER CODE - Arthur Maurice Greene

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CERTIFICATE OF AUTHORIZATION AND CERTIFICATION MARKS

The Certificate of Authorization to use the Certification Mark with the U, UM, UV and UD Designators is granted by the ASME. An organization that desires a Certificate of Authorization is required to apply to the Boiler and Pressure Vessel Committee of the ASME. The application must specify the Certification Designation desired and the scope of activities that will be performed. The Certificate of Authorization is granted for a plant. Therefore, if an organization intends to build ASME Code pressure vessels at plants in more than one location, a separate Certificate of Authorization is prepared for each plant. In such a case, either separate application for each plant may be submitted, or a single application listing addresses of all such plants may be submitted. Each application must identify the Authorized Inspector Agency at each plant. Applicant for a UM Certificate of Authorization must already hold a 'U' certificate.

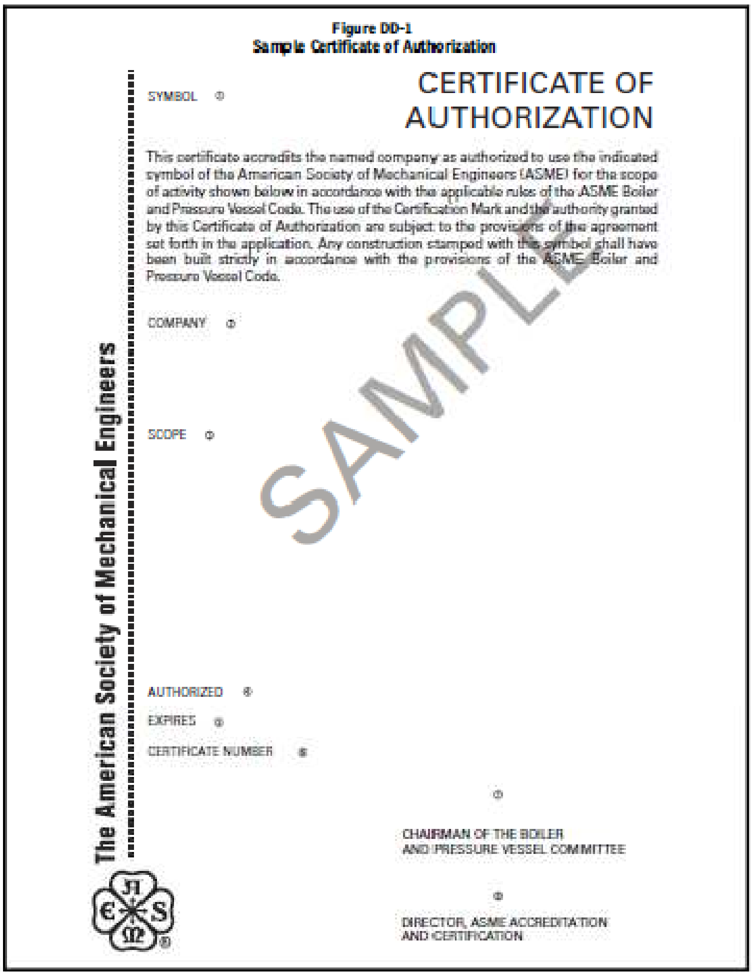
Figure DD-1
Sample Certificate of Authorization

The American Society of Mechanical Engineers

SYMBOL ①

CERTIFICATE OF AUTHORIZATION

This certificate accredits the named company as authorized to use the indicated symbol of the American Society of Mechanical Engineers (ASME) for the scope of activity shown below in accordance with the applicable rules of the ASME Boiler and Pressure Vessel Code. The use of the Certification Mark and the authority granted by this Certificate of Authorization are subject to the provisions of the agreement set forth in the application. Any construction stamped with this symbol shall have been built strictly in accordance with the provisions of the ASME Boiler and Pressure Vessel Code.

COMPANY ②

SCOPE ③

AUTHORIZED ④

EXPIRES ⑤

CERTIFICATE NUMBER ⑥

⑦

CHAIRMAN OF THE BOILER AND PRESSURE VESSEL COMMITTEE

⑧

DIRECTOR, ASME ACCREDITATION AND CERTIFICATION

Certificates of Authorization for the use of U, UV and UD Designators are valid for three years; those for the use of UM Designator are valid for one year. Six months prior to the date of expiration of any such Certificate, the applicant must apply for a renewal of such authorization and the issuance of a new certificate. The Certificate of Authorization and the Certification Mark stamp are at all times the property of the ASME, and must be promptly returned to ASME upon demand, or when the applicant discontinues the Code activities, or when the Certificate of Authorization has expired and no new Certificate has been issued.

The Manufacturer is required to have in force an agreement with an Authorized Inspection Agency to provide inspection services. This is a written agreement between the Manufacturer and the Inspection Agency which specifies the terms and conditions under which the inspection services are to be furnished and which states the mutual responsibilities of the Manufacturer and the Authorized Inspectors. Whenever this agreement is cancelled or changed to another Authorized Inspection Agency, the Certificate holder must notify ASME.

Any Manufacturer holding or applying for a Certificate of Authorization to use the Certification Mark with U, UM, UV or UD Designators must have, and demonstrate, a Quality Control System. The Quality Control System must establish that all Code requirements with respect to material, design, fabrication, examination by Manufacturer, inspection by the Authorized Inspector, pressure testing, and certification will be met. The Quality Control System of Certificate holders with UM, UV or UD Designators must also include duties of a Certified Individual (CI). The CI must meet the following requirements:

a) CI must be an employee of the Manufacturer.

b) CI must be qualified and certified by the Manufacturer. These qualifications must include as a minimum

    1) Knowledge of Code requirements for the application of the Certification Mark with the appropriate designator.

    2) Knowledge of the Manufacturer’s quality program.

c) Training that is commensurate with the scope, complexity or special nature of the activities to which oversight is to be provided.CI must have a record, maintained and certified by the Manufacturer, containing objective evidence of the qualifications of the CI and the training provided.

The duties of the CI are as follows:

a) Verify that each item to which Certificate mark is applied meets all applicable Code requirements and has a current capacity certification for the UV or UD Designators.

b) For the UV or UD Designators, review documentation for each lot of items to be stamped to verify, for that lot, that Code requirements have been completed.

c) Sign the appropriate Certificate of Compliance/ Conformance Form U-3, U-3A, UV-1, or VD-1 as appropriate prior to release of control of the item.

The appropriate Certificate of Conformance is filled out by the Manufacturer, and signed by the CI. Mass produced pressure relief devices are often recorded on a single entry as long as devices are identical and produced in the same lot. Manufacturer’s written Quality Control System must include requirement for completing Certificate of Conformance forms and retention by the Manufacturer for a minimum of five years.

Source: ASME Boiler and Pressure Vessel Code, Section VIII, Division 1 – 2015 Edition

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BUILDING A BETTER TOMMORROW

It is becoming less practical for many companies to maintain in-house engineering staff. That is where we come in – whenever you need us, either for one-time projects, or for recurring engineering services. We understand the codes and standards, and can offer a range of services related to pressure vessels, tanks and heat exchangers.

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Oil & Gas ● Power ● Chemical ● Petrochemical ● Fertilizer