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Japanese Codes and Standards System for Boilers and Pressure Vessels – An Overview

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The current Japanese situation on boilers and pressure vessels codes and standards and their relation to regulation is briefly but frankly described. The situation of the Japan Industrial Standard is also described. These contain some problems for national and international trade of boilers and pressure vessels. In future development of Japanese codes and standards on boilers and pressure vessels, new trends intending deregulation and globalization are introduced which are generalization of national C/S with those of other countries. At the same time voluntary action has been initiated within some private groups. Japan strongly supports the international cooperation for globalization and international development of codes and standards.

After the 1994 WTO/TBT Agreement was approved, the Japanese government intended to change its national regulation codes and standards system to meet the Agreement. The pressure equipment codes and standards were also being subjected to change to accept international free trade.

From a historical viewpoint, Japanese standardization activity has been subject to leadership and authorization by the Japanese government over the last fifty years. In order to encourage a development of technical and industrial activity, the Japanese government has introduced national codes and standards using western systems to maintain the public safety from industrial hazard and to give a universal guideline of quality assurance for industrial development. The Japanese Industrial Standard (JIS) has been prepared to give a base for the unification of technical direction of industrial products and research and development activity. These activities have been developed under the leadership and authorization of the government with a nationwide participation of voluntary technical groups from industries and institutions.

As far as boilers and pressure vessels are concerned, Japanese codes and standards were established based mainly on ASME Boiler and Pressure Vessel Codes. The technical aspect of Japanese boiler and pressure vessel codes and standards gives almost the same items as those of Section I, Section III Division 1 or Section VIII Division 1 of the ASME Boiler and Pressure Vessel Codes. The administrative aspects of those Japanese codes and standards have been changed from those of ASME Codes to meet the Japanese national situation and social environment. Those codes and standards for boilers and pressure vessels were adopted to regulate national concerns on public safety. At the same time they gave a common base for establishing a quality assurance system composed of all related technical items of material, design, welding, inspection and testing.

The preparation of codes and standards on boilers and pressure vessels in Japan has started during 1960's and 1970's. Since then established codes and standards have been subject to several revisions . These revisions were only made as and when a tremendous difference was recognized between Japanese codes and updated ASME codes. As a result, Japanese codes and standards for boilers and pressure vessels are now rather old fashioned compared to the newest versions of ASME Boiler and Pressure Vessel Codes or other codes and standards such as BS and DIN. This delay of updating codes and standards in Japan was a result of Japanese practice that boiler and pressure vessel codes and standards belong to a part of regulatory documents, administrated by national industrial laws.

The following is an abridged version of the presentation made at the ASME seminar "Doing Business Globally Using the ASME Boiler & Pressure Vessel Code" held in San Francisco on February 12-13, 2001. The full text of the presentation can be downloaded from the asme.org

CODES AND STANDARDS SYSTEM FOR BOILERS AND PRESSURE VESSELS

Codes and standards on boilers and pressure vessels in Japan are substantially regulatory tools to maintain public safety from industrial hazard. The related codes and standards are classified in accordance with industrial application branches governed by different laws. The laws themselves give general administrative rules to control

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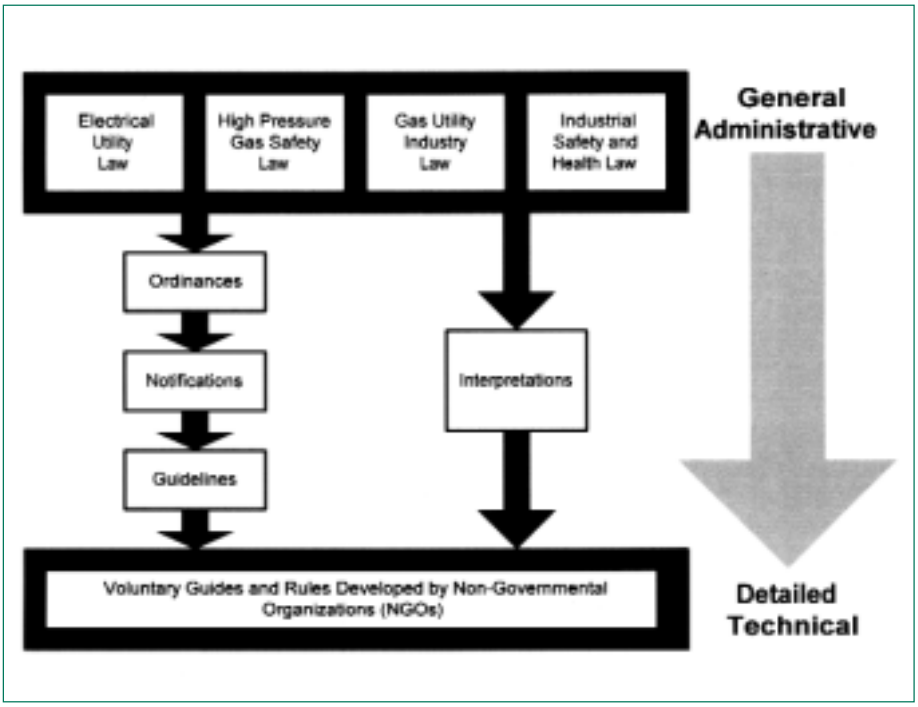
related industrial activity and are composed of Ordinances that give more detailed rules than the laws. However, Ordinances are still generally administrative and are composed of Notifications that give technically detailed rules on construction and operation/maintenance corresponding to codes and standards such as those developed by ASME, BS, EN or DIN.

In recent cases, "Interpretation" is referenced in Laws or Ordinances to give technical detailed requirements instead of Notifications or Guidelines in the Laws which have been revised to performance-based criteria.

Generally speaking, Japanese regulatory codes and standards system takes a framework as shown in the figure to the right.



JAPANESE REGULATORY CODES AND STANDARDS SYSTEM

A situation of Interpretation in regulatory framework is rather ambiguous. It is said that Interpretation is a base of judgment by government but one of examples of technical detailed codes and standards satisfying necessary level of conservatisms required by Laws or Ordinances. It is said that any detailed technical code or standard, even if it is voluntary base, can be applied as far as it has sufficient level of conservatisms required by Laws or Ordinances, however, process of harmonization to Laws or Ordinances is not identified. JIS Standards are classified into voluntary base standards and have regal meanings by being referred in governmental codes and standards system.

The following four Laws give a fundamental base on technical detailed codes and standards for boilers and pressure vessels in Japan: Electric Utility Industry Law; High Pressure Gas Safety Law; Gas Utility Industry Law; Industrial Safety and Health Law.

In Japanese industrial law system, the law regulates industry, its activity and any technical items including equipments. The above four laws also include rules on boilers and pressure vessels used in industries governed by the laws. Therefore, these four Laws include rules on boilers and pressure vessels, respectively. Special features of boilers and pressure vessels governed by each Law are summarized below.

Electric Utility Industry Law. Boilers and pressure vessels used in the electric power industry are regulated by this Law. The main objective equipments regulated by the law are pressure equipment used in thermal power plants and nuclear power plants.

The rules for thermal power boilers are given by METI[1] Ordinance No. 51 which were revised to a performance base standard in March 1997 in accordance with the 1994 WTO/TBT Agreement. Technically detailed rules for construction and maintenance of power boilers are given by the Interpretation for Ordinance No. 51. This Interpretation is very similar to the guidelines found in 1970's edition of ASME Code Section I and Section VIII Div. 1. In addition to rules for boilers, the Interpretation includes rules for turbines and fuel battery.

General rules for nuclear power plant components are given by METI Ordinance No. 62. Details of construction and maintenance of nuclear power plant equipments are given in METI Notification No. 501 which again gives similar items and descriptions found in the 1995 edition of the ASME Section III Division 1 Code.

High Pressure Gas Safety Law. Pressure vessels and related equipments used in chemical and petrochemical industries are regulated by this law. The law was revised as performance-based criteria in April 2000, but some technical detailed requirements still remained in the law as in the PED. The technical requirements for pressure vessels in this Law and Interpretation were developed using the ASME Section VIII Division 1 Code in 1970's.

Gas Utility Industry Law. Pressure equipments such as boilers and pressure vessels used in the gas supply industry are regulated under a control of this Law. It was revised to performance-based criteria in September 2000. Technical detailed requirements are defined in Interpretations which describes technically detailed rules on material, design, welding, inspection and testing of pressure equipments used in the gas supply industry and gas generating plants. The Interpretation refers to JIS B 8265 for technical detailed criteria. Technical requirements for pressure equipments in this Law and Interpretation were developed using ASME Section VIII Division 1 Code in 1960's to 1970's.

Industrial Safety and Health Law. This law regulates small boilers such as a heating boiler and other related pressure equipments. This law gives directly the technically detailed rules on material, design, welding, inspection and testing of the regulated equipments. The technical requirements were established based on an old edition of ASME Section VIII Division 1 Code in 1960-'s to 1970's.

JAPAN INDUSTRIAL STANDARDS

As easily supposed from above the summary of Japanese pressure equipment codes and standards, there is some confusion and differences among technical requirements issued in the four laws despite the fact that they have been issued based on ASME Section I or Section VIII. The differences are mainly caused from a difference in the year of the edition of the Section I or VIII Code referred to by each law.

In 1998, efforts were started to issue a new Japan Industrial Standard (JIS) to give common technical requirements for boilers and

[1] Japanese ministries and agencies were reorganized on January 6, 2001. METI (Ministry of Economy, Trade and Industry) assumed the responsibilities of MITI (Ministry of International Trade and Industry)

pressure vessels regulated under the four laws. The product of the effort was the new JIS B 8265 published in June 2000. As a consensus among regulatory authorities and agencies administrating the four Laws, JIS B 8265 issues only the common articles of technical requirements of the four laws.

The Standard Department of METI, the responsible organization for JIS, has been requesting the regulatory authorities and agencies administrating the four laws to adopt JIS B 8265 by referencing its technical articles. Other technical requirements than those issued in JIS B 8265 are still to be remained in the four laws.

With respect to technical requirements for pressure vessels, JIS B 8270 General Requirements on Pressure Vessels was established several years ago. JIS B 8270 intends to introduce the Design-by-Analysis rules into construction of non-nuclear pressure vessels. JIS B8270 is issued based on mainly ASME Section VIII Division 2 Code by partly introducing new approaches defined in the PED. However, JIS B8270 is not in use or even referred to in any of the laws and is too complicated for commercial use in the construction process of pressure vessels.

In conclusion, there is still no unified standard on boilers and pressure vessels in Japan. This situation means that it is difficult to promote the deregulation of codes and standards on construction and operation of boilers and pressure vessels to meet the 1994 WTO/TBT Agreement.

FUTURE DEVELOPMENT OF JAPANESE CODES AND STANDARDS

As described previously, it is of the utmost importance to Japanese action on future development of codes and standards for boilers and pressure vessels to attain:

* unification of technical criteria
* deregulation
* globalization of national codes & standards

Unification. With respect to unification, the new JIS B 8265 has been issued and some laws refer to it. There remain some technical criteria of the four laws not issued in JIS B 8265. Further effort is necessary to upgrade JIS B 8265 to give it a higher common technical basis for the laws and their Ordinances or Interpretations. The effort is still on-going.

Deregulation. The second item to be considered in this procedure is to update the values of the design allowable stress.

Current values of the design allowable stress in Japanese boiler and pressure vessel codes and standards are defined using previous versions of ASME Section I or VIII Division 1 Codes, that is, a safety factor of 4 for the design minimum tensile strength. Japanese industries as well as government consider that higher values of the design allowable stress are very effective to increase the economical efficiency of high pressure facilities and components without decreasing their integrity due to unanticipated failure during their operation.

Dialogue continues between industries and regulatory authorities to promote the deregulation of technical codes and standards, particularly, on high pressure components and facilities to attain a high economical efficiency of construction and operation of related plants. For this purpose, it is necessary to revise and update Japanese codes and standards by reflecting recent developments in research and technology. In construction or modification of high pressure facilities, it is necessary to obtain a construction permit from the regulatory authority and this process is carried out under an inspection based on government authorized codes and standards.

It is preferable that these industrial activities are to be made based on codes and standards developed by voluntary activity other than governmental authority. In 1997 a committee was established in JSME to develop technical detailed codes and standards for power plants and components.

The committee published a new code, Rules for Thermal Power Generation Facilities (TA1-1999) in January, 2000. This new code is equivalent to the ASME Code Section I and Section VIII Div. 1 (1995 Edition). The code contains the same figures, tables, equations and descriptions to those of ASME Section I Code under a copyright agreement with ASME. JSME is now proposing that the regulatory authority (METI) accept this new code as the harmonized code to the Electric Utility Industry Law and its Ordinance No. 51. The negotiation is still on-going.

Succeeding a publication of the Rules on Thermal Power Generation Facilities, JSME published Rules on Fitness-for-Service of Codes for Nuclear Power Generation Facilities (NA1-2000) in May 2000. This code currently includes similar descriptions on flaw evaluation to those of the ASME Section XI Code, however, the scope of the code is to be expanded to include technical items of testing, inspection and repair/replacement of nuclear plant components such as replacement of BWR core shroud.

In addition, the JSME Code Committee approved a draft of Rules on Design and Construction for Nuclear Power Plants and a draft of Rules on Transportation/Storage Packaging for Spent Nuclear Fuel in November 2000. Those are equivalent to ASME Section III, Division 1 and Division3. These drafts include some differences from ASME, for example, rules for piping seismic evaluation methodology in JSME Rules on Nuclear Design and Construction and the scope of Rules in JSME Rules on Transportation and Storage Packagings for Spent Nuclear Fuel that includes rules for both transportation and storage casks.

Globalization. With respect to the globalization of national codes and standards, an effort is being continued to adjust technical requirements of current national codes and standards to meet those of other countries or regions that are used worldwide, such as ASME, BS, EN, DIN and others. The PED will be taken into account in a future adjustment activity. At the same time, it is Japanese intention to develop future codes and standards under international cooperation in order to obtain an international harmonization and to reduce the cost of research and development which are necessary in development or revision of codes and standards. In this respect, it is of great concern to Japan that Japanese industry encourages and participates in any international cooperation to develop and update codes and standards.

ISO 9000: 2000 Transition

In December 2000, the new editions of ISO 9000, 9001 and 9004 were issued. Organizations registered (certified) by an accredited registrar such as ASME have three years to update their programs for conformance with the new requirements. Copies of the standards can be obtained from your country's national standards body. For information on ASME's ISO 9000 Registration Program, contact Bill Nothofer (nothoferw@asme.org).

ASME Boiler and Pressure Vessel Committee Approves Code Case 2235-3 for Use of Ultrasonic Examination in Lieu Of Radiography

For many years, radiography (RT) was the only acceptable means of full volumetric NDE under Sections I and VIII, Divisions 1 and 2 of the ASME Boiler and Pressure Vessel Code. Ultrasonic examination (UT) was only permitted when the geometric unsharpness of a radiograph exceeded prescribed limits, or when UT was used in combination with RT in instances such as welds made with the inertia and continuous drive friction welding processes. Considering the state of the art of both of these techniques, it is difficult to understand why they never enjoyed equal acceptance under the ASME Boiler and Pressure Vessel Code. To do that, it is necessary to review the history of RT and UT.

RT was first accepted for volumetric examination of welds under the ASME Boiler and Pressure Vessel Code in the 1930's. It was originally limited to welded construction of less than 4.5 inches, but problems with poor resolution prevented location of defects such as slag and lack of penetration. With the introduction of high-energy sources of radiation in the late 1940's, the quality of RT reached a level that made it the single method permitted by the Boiler and Pressure Vessel Code for verification of weld and casting quality. Being the first technique on the scene, it was very difficult to supplant RT with alternative techniques.

UT was developed in laboratory experiments in the 1940's, but had no real application until the angle beam probe was developed in 1947. The important feature of angle beam inspection is that it is capable of finding the depth of a defect and also of determining component wall thickness. Over the years, UT came to be used not only to complement RT in new construction, but its greater sensitivity over RT made it a versatile tool in the field to determine material quality, degradation in service and other phenomena when access to perform radiography was not practicable.

Despite the fact that the art of ultrasonic examination improved greatly over the decades since its invention, for fifty years it was not accepted as the primary means of volumetric examination under the ASME Boiler and Pressure Vessel Code. However, pressure equipment manufacturers about the world build their products to several construction standards, including the ASME Boiler and Pressure Vessel Code. Gaining experience with their work outside the ASME Code, manufacturers made great strides in the areas of UT equipment, operator qualification and evaluation of results. It was the experience of those manufacturers, as well as those in the US, that led to an inquiry to the ASME Boiler and Pressure Vessel Committee to consider the use of UT in Lieu of RT for Section VIII, Divisions 1 & 2 construction.

On December 23, 1996 Code Case 2235 was approved, permitting the use of UT in Lieu of RT for Section VIII, Divisions 1 & 2. The Case included acceptance criteria for indications and was considered a breakthrough in the philosophy of NDE in the ASME Boiler and Pressure Vessel Code. Unfortunately, there was one severe limitation on the use of the Case – it was limited to vessel thicknesses over 4 inches. Therefore, as a result of further inquiries to the committee, on September 23, 1999, Code Case 2235-1 was approved, which extended the use of UT to thicknesses over _ inch. In so doing, the Case was revised to provide for three categories of acceptance criteria, based on material thickness. In addition, the rules for single indications were expanded to address multiple planar flaws as well as nonaligned coplanar flaws. Ultimately, on July 10, 2000, Code Case 2235-3 was approved, which expanded the use of this Case to Section I applications.

The ASME Boiler and Pressure Vessel Committee meets regularly to consider requests for Code Cases or revisions to the ASME Code . The story of the use of UT in lieu of RT is an example of how the ASME Code is maintained to reflect the latest state of the art in pressure equipment construction.

It is now possible to view Code Cases of the ASME Boiler and Pressure Vessel Code by visiting the ASME website at http://www.asme.org/codes/ and click on the announcement "Boiler and Pressure Vessel Code Cases in PDF".

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PED Guidance Document

The Guidance Document on using Section VIII, Division 1 of the ASME Boiler and Pressure Vessel Code to meet the essential safety requirements of the European Pressure Equipment Directive (PED) will soon be available. Check the ASME web site for details (www.asme.org/codes).

Containments for Spent Nuclear Fuel and High Level Radioactive Waste

An upcoming revision to the Boiler and Pressure Vessel Code, Section III, Division 3, will create ASME's newest Code Symbol Stamp: the N3 Stamp for containments for spent nuclear fuel and high level radioactive waste.

Article WA, the General Requirements for Division 3, has been rewritten to closely align it with the more familiar General Requirements format of Division 1, and to eliminate inconsistencies and errors. In the rewrite terms that were identical with those used in Division 1 but had different meanings in each division were eliminated as were organizational names that had no meaning in the Code but were used in regulatory and other documents, e.g. Design Owner. Division 2 terms intermingled throughout the General Requirements have also been eliminated. The revised Division 3 will now include more than one type of component in order to allow the incorporation of the new WC Subsection for Storage Containments and other components as new rules come forward. The terms Transport Packaging and Spent Nuclear Fuel (SlXIF) Canisters are now called Transport Containments and Storage Containments.

The primary difference between the General Requirements of Divisions 1 and 3 are that Division 3 places very few requirements on the Owner. It shifts nearly all the requirements normally associated with the Owner in Division 1 to the N3 Certificate Holder in Division 3. The N3 Certificate Holder of Division 3 somewhat parallels the N Certificate Holder in Division 1 and additionally with some of the requirements of the Division 1 Owner. Division 3 also requires the N3 Certificate Holder to provide a Fabrication Specification to the fabricator of a part, component, or appurtenance, in addition to the required Design Specification and other Design Output Documents. The Fabrication Specification is a mechanism to convey the required information from the design output documents to the "build to print" fabricator. The Fabrication Specification is to contain all the information necessary to fabricate the item to the Code. In the case of Storage Containments it also has a long range mission, and that is to provide a Certificate Holder who is making the final closure welds the information necessary to make the welds. These closure welds may be made several years after the shop fabrication has been completed and by a Certificate Holder other than the shop fabricator.

Keep in mind that in Division 3 the typical work flow is as follows. The containment designer is the licensee of the transport or storage system and is also the N3 Certificate Holder responsible for over-all Code compliance. Shop fabrication of both types of containments is generally a NPT Certificate Holder. Welding the final closure welds (in the field) of Storage Containments is also generally a NPT Certificate Holder. As in Division 1 the N3 Certificate Holder may do all the work of a NPT Certificate Holder if it is in the scope of his certificate.

This revision to Section III, Division 3, is scheduled for publication in the 2001 Edition of the Code on July 1, 2001.

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Director, Accreditation and Certification – Alan Bagner, 1-212-591-8580, bagnera@asme.org

ACCREDITATION PROGRAMS

AIA Qualification of Authorized Inspection Agencies, nuclear and non-nuclear, based on the ASME QAI-1 Standard (formerly N626.1)
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N-type Nuclear component manufacturers and assemblers (vessels, tanks, pressure piping, and pressure relief devices)
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PRD Pressure relief device testing laboratories and authorized observers
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QEI Elevator Inspector certifying organizations
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QSC Nuclear material organization (material manufacturers and suppliers)
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RTP Manufacturers of reinforced thermoset plastic corrosion resistant vessels
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REGISTRATION PROGRAM

ISO Registration of suppliers of mechanical equipment and related materials, items, and services in the industries and sectors associated with the art, science, and practice of mechanical engineering
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