



PV Newsletter

Monthly Publication from CoDesign Engineering Skills Academy

This is the last issue for the year 2012. We will compile all the newsletter articles into a 2012 Annual Pressure Vessel Compendium that will be available for ready reference and/ or free download from our website www.codesignengg.com. Hard copy in a book form will be available on request upon payment of a nominal fee to cover the printing and mailing costs.

For the year 2013, we have planned a full coverage of shell-and-tube heat exchanger topics in 12 issues. The first issue will be available on January 15; this issue will also contain a listing of all the heat exchanger topics that will be covered in the subsequent issues for year 2013.

ASME Boiler and Pressure Vessel Codes

ASME Boiler and Pressure Vessel Code establishes rules of safety governing the design, fabrication and inspection of boilers and pressure vessels, and nuclear power plant components during construction. The objective of the rules is to provide a margin for deterioration in service. Advancements in design and material, and the evidence of experience are constantly being added.

Important information regarding the upcoming 2013 editions of the Code is included at the end of this article.

Section I - Power Boilers

This Section provides requirements for all methods of construction of power, electric and miniature boilers; high temperature water boilers used in stationary service; and power boilers used in locomotive, portable and traction service.

Rules pertaining to use of the V, A, M, PP, S and E Code symbols are included. The rules are applicable to:

- 1) Boilers in which steam or other vapor is generated at a pressure exceeding 15 psig, and
- 2) High temperature water boilers intended for operation at pressures exceeding 160 psig and/or temperatures exceeding 250°F.

Superheaters, economizers, and other pressure parts connected directly to the boiler without intervening valves are considered as part of the scope of Section I.

Contents:

Requirements for boiler fabricated by welding; Boilers fabricated by riveting (by reference only); Watertube boilers; Firetube boilers; Miniature boilers; Electric boilers; Feedwater heaters; and Organic fluid vaporizer generators.

Section II - Materials

This Section is a service book to other Code Sections and consists of four parts.

Part A: Ferrous Material Specifications

This Part provides material specifications for ferrous materials adequate for safety in the field of pressure equipment. These specifications contain requirements and mechanical properties, test specimens, and methods of testing. They are designated by SA numbers and are derived from ASTM "A" specifications.

Contents:

Requirements for: Steel pipe; Steel tubes; Steel flanges, fittings, valves & parts; Steel plates, sheets and strips for pressure vessels; Structural steels; Steel bars; Steel bolting materials; Steel billets & forgings; Steel castings; Corrosion resisting & heat resisting steels; Wrought irons, Cast iron and malleable irons; Methods.

Part B: Nonferrous Material Specifications

This Part provides material specifications for nonferrous materials adequate for safety in the field of pressure equipment. These specifications contain requirements for heat treatment, manufacture, chemical composition, heat and product analyses, mechanical test requirements and mechanical properties, test specimens and methods of testing. They are designated by SB numbers and are derived from ASTM "B" specifications.

Contents:

Requirements for: Aluminum & aluminum alloys; Copper & copper alloys plate, Sheet & strip, and rolled bar; Copper & copper alloy rod bar & shapes; Copper & copper alloy pipe and tubes; Copper alloy castings; Nickel & nickel alloy plate, sheet and strip; Nickel and nickel alloy rod, bar and wire; Nickel and nickel alloy pipe and tubes; Nickel alloy castings; Nickel and nickel alloy fittings; Titanium and titanium alloys; Zirconium and zirconium alloys

Part C: Specs for Welding Rods Electrodes and Filler Metals

This Part provides material specifications for the manufacture, acceptability, composition, mechanical usability, surfacing, testing requirements and procedures, operating characteristics, and intended uses for welding rods, electrodes and filler metals.

Contents:

Requirements for: Steel & steel alloy rods and electrodes; Low alloy electrodes rods & filler metals; Aluminum & aluminum base alloy rods & electrodes; Copper & copper base alloy rods & electrodes; Nickel & nickel base alloy rods & electrodes; Titanium & titanium alloy rods & electrodes; Zirconium & zirconium base alloy rods & electrodes; Consumable inserts; Brazing filler metals; Surfacing rods & electrodes; Filler metal procurement guidelines

Part D: Properties (Customary/ Metric)

This Part provides tables of design stress values, tensile and yield strength values, and tables and charts of material properties. It facilitates ready identification of specific materials to specific Sections of the Boiler and Pressure Vessel Code. It also contains appendices which contain criteria for establishing allowable stress, the bases for establishing external pressure charts, and information required for approval of new materials.

Section III - Rules for Construction of Nuclear Power Plant Components

This Section provides requirements for the materials, design, fabrication, examination, testing, inspection, installation, certification, stamping and overpressure protection of nuclear power plant components, and components and piping supports. Components include metal vessels and systems, pumps, valves and core support structures. The components and supports covered by this Section are intended to be installed in a nuclear power system which serves the purpose of producing and controlling the output of thermal energy from nuclear fuel and those associated systems essential to the functions and overall safety of the nuclear power system.

This Section also provides requirements for:

- 1) Containment systems and transport packagings for spent fuel and high-level radioactive waste, and
- 2) Concrete reactor vessels and containments.

In addition, this Section provides requirements for new construction and includes consideration of mechanical and thermal stresses due to cyclic operation. Deterioration that may occur in service as a result of radiation effects, corrosion, erosion, or instability of the material is not covered. Rules pertaining to the use of N, NPT, NA and NV Code symbol stamps are also included.

The basic coverage contains the following subsections and appendices:

Subsection NCA: General Requirements for Division 1 & Division 2

This Subsection covers general requirements for manufacturers, fabricators, installers, designers, material manufacturers, material suppliers, and owners of nuclear power plants. It is referenced by and is an integral part of Division 1, Subsections NB through NG, and Division II of Section III, covers quality assurance requirements, Code Symbol stamping and authorized inspection for Class 1, 2, 3, MC, CS, CB and CC construction.

Selective reference of ASME standard NQA-1, Quality Assurance Program Requirements for Nuclear Facilities, is made in this Subsection. NQA-1 provides the programmatic quality assurance requirements for the establishment and execution of a quality assurance program.

Subsection NB: Class 1 Components

This Subsection contains requirements for the material, design, fabrication, examination, testing, and overpressure protection of items which are intended to conform to the requirements for Class 1 construction. These rules cover the requirements for assuring the structural integrity of items.

Subsection NC: Class 2 Components

This Subsection contains requirements for the material, design, fabrication, examination, testing, and overpressure protection of items which are intended to conform to the requirements for Class 2 construction. These rules cover the requirements for assuring the structural integrity of items.

Subsection ND: Class 3 Components

This Subsection contains requirements for the material, design, fabrication, examination, testing, and overpressure protection of items which are intended to conform to the requirements for Class 3 construction. These rules cover the requirements for assuring the structural integrity of the metal containment vessel.

Subsection NE: Class MC Components

This Subsection contains requirements for the material, design, fabrication, examination, testing, and overpressure protection of metal containment vessels which are intended to conform to the requirements for Class MC construction. These rules cover the requirements for assuring the structural integrity of items.

Subsection NF: Supports

This Subsection contains requirements for the material, design, fabrication, and examination of supports which are intended to conform to the requirements for Class 1, 2, 3, and MC construction. Nuclear power plant supports for which rules are specified in this Subsection are those metal supports which are design to transmit loads from the pressure retaining barrier of the component to the load carrying building structure. In some cases, there may be intervening elements in the component support load path which are not constructed to the rules of this Section, such as diesel engines, electric motors, valve operators, coolers and access structures.

Subsection NG: Core Support Structures

This Subsection contains requirements for the material, design, fabrication, and examination of supports required in the manufacture. Core support structures are those structures or part of structures which are designed to provide direct support or restraint of the core (fuel and blanket assemblies) within the reactor pressure vessel.

Subsection NH: Class 1 Components in Elevated Temperature Service

This Subsection contains requirements for materials, design, fabrication, examination, testing, and overpressure relief of Class 1 components, parts and appurtenances which are expected to function even when metal temperatures exceed those covered by the rules and stress limits of Subsection NB and Tables 2A, 2B, and 4 of Section II, Part D, Subpart 1.

Appendices:

This Subsection contains appendices, both mandatory and nonmandatory for Section III, Division 1 (Subsections NCA through NG) and Division 2, including a listing of design and design analysis methods and information, and Data Report Forms. These appendices are referenced by and are integral part of Subsections NCA through NG and Division 2.

Division 2: Code for Concrete Reactor Vessels and Containments

This Division contains requirements for the material, design, construction, fabrication, testing, examination, and overpressure protection of concrete containment structure, prestressed or reinforced. These requirements are applicable only to those components that are designed to provide a pressure retaining or containing barrier. They are not applicable to other support structures, except as they directly affect the components of the systems. This Section contains appendices, both mandatory and nonmandatory, for Division 2 construction.

Division 3: Containment Systems and Transport Packings for Spent Fuel and High Level Radioactive Waste

The rules of Division 3 constitute requirements for the design and construction of the containment system of a nuclear spent fuel or high level radioactive waste transport packaging.

Section IV - Heating Boilers

This Section provides requirements for design, fabrication, installation and inspection of steam generating boilers, and hot water boilers intended for low pressure service that are directly fired by oil, gas, electricity, or coal. It contains appendices which cover approval of new material, methods of checking safety valve and safety relief valve capacity, examples of methods of calculation and computation, definitions relating to boiler design and welding, and quality control systems. Rules pertaining to use of the H, HV, and HLW Code symbol stamps are also included.

Contents:

Requirements for: Scope and service restrictions; Boilers constructed of wrought materials; Boilers constructed of cast iron; Lined potable water heaters.

Section V - Nondestructive Examination

This Section contains requirements and methods for nondestructive examination which are referenced and required by other code Sections. It also includes manufacturer's examination responsibilities, duties of authorized inspectors and requirements for qualification of personnel, inspection and examination. Examination methods are intended to detect surface and internal discontinuities in materials, welds and fabricated parts and components.

Contents:

Requirements for: Radiographic examination; Ultrasonic examination; Liquid penetrant examination; Magnetic particle examination; Eddy current examination of tubular products; Visual examination; Leak testing; and acoustic examination of fiber-reinforced plastic pressure vessels.

Section VI - Recommended Rules for the Care and Operation of Heating Boilers

This Section covers general descriptions, terminology, and operation guidelines, applicable to steel and cast iron boilers limited to the operating ranges of Section IV Heating Boilers. It includes guidelines for associated controls and automatic fuel burning equipment. Illustrations show typical examples of available equipment. Also included is a glossary of terms commonly associated with boilers, controls and fuel burning equipment.

Contents:

Types of boilers; Boiler & boiler room accessories; Fuels, fuel burning equipment and burning controls; Boiler room facilities; Operation, maintenance and repair of hot water boilers & hot water heating boilers; and Water treatment.

Section VII - Recommended Guidelines for the Care of Power Boilers

This Section covers guidelines to assist operators of power boilers in maintaining their plants. These guidelines are intended to promote safety in the use of stationary, portable and traction type heating boilers. Emphasis has been placed on industrial type boilers because of their extensive use.

Contents:

Fuels for routine operation; Operating and maintaining boiler appliances; Inspection; Prevention of direct causes of boiler failure; Design of installation; Operation of boiler auxiliaries; Control of internal chemical conditions.

Section VIII - Pressure Vessels

Division 1

This Division of Section VIII provides requirements applicable to the design, fabrication, inspection, testing, and certification of pressure vessels operating at either internal or external pressures exceeding 15 psig. Such pressure vessels may be either fired or unfired. Specific requirements apply to several classes of material used in pressure vessel construction, and also to fabrication methods such as welding, forging and brazing.

It contains mandatory and nonmandatory appendices detailing supplementary design criteria, nondestructive examination and inspection acceptance standards. Rules pertaining to the use of U, UM, and UV code symbols are also included.

Contents:

Scope and service restrictions; General requirements; Requirements for fabrication by welding, forging, or brazing; Requirements pertaining to classes of materials for carbon and low alloy steels, nonferrous materials, high alloy steel, cast iron, cast ductile iron, clad & lined vessels, ferritic steels with tensile properties enhanced by heat treatment, layered construction, and high stresses at low temperatures.

Division 2: Alternative Rules

These rules provide an alternative to the minimum requirements for pressure vessels under Division 1 rules. In comparison to the Division 1, the Division 2 requirements on materials, design and nondestructive examination are more rigorous; however, higher design stress intensity values are permitted. Division 2 rules cover only vessels to be installed in a fixed location for a specific service where operation and maintenance control is retained during the useful life of the vessel by the user who prepares or causes to be prepared the design specifications.

Contents:

General requirements; Material requirements, Design requirements; Fabrication requirements; Pressure relief devices; Inspection in radiography; Testing; Marking; Stamping; Reports and Records.

Division 3: High Pressure Vessels

This Division provides requirements applicable to the design, fabrication, inspection, testing, and certification of pressure vessels operating at either internal or external pressures generally over 10,000 psi. It covers vessels for specific service and installed in a fixed location or relocated from worksite to worksite between pressurizations. The operation and maintenance control is retained during the useful life of the vessel by the user who prepares or causes to be prepared the design specifications. Division 3 does not establish maximum pressure limits for either Section VIII Division 1, or Division 2. It also does not set minimum pressure limits for this Division. Rules pertaining to the UV3 code Symbol stamps are also included.

Contents:

General requirements; Material requirements, Design requirements; Fabrication requirements; Pressure relief devices; Examination requirements; Testing; Marking; Stamping; Reports and Records.

Section IX - Welding and Brazing Qualifications

This This Section contains rules relating to the qualification of welding and brazing procedures as required by other Code Sections for component manufacture. It also covers rules relating to the qualification and requalification of welders, brazers, and welding and brazing operators in order that they may perform welding or brazing as required by other Code Sections in the manufacture of components. Welding and brazing data cover essential and nonessential variables specific to the welding or brazing procedure used.

Contents:

General welding requirements; Welding procedure qualifications; Welding performance qualifications; Welding data; Welding forms; General brazing requirements; Brazing procedure qualifications; Brazing performance qualifications; Brazing data; Brazing forms.

Section X - Fiber Reinforced Plastic Pressure Vessels

This Section provides requirements for construction of an FRP pressure vessel in conformance with a manufacturer's design report. It includes fabrication, processing, fabrication, inspection, and testing methods required for the vessel. The Section includes two classes of vessel design: Class 1, a qualification through the destructive test of prototype, and Class 2, mandatory design rules and acceptance testing by nondestructive methods.

These vessels are not permitted to store, handle or process lethal fluids. Vessel fabrication is limited to the following processes: bag molding, centrifugal casting, and filament winding and contact molding. General specifications for the glass and resin materials and minimum physical properties for the composite materials are given.

Contents:

General requirements; Material requirements; Design requirements; Fabrication requirements; Rules for qualifying design and procedures; Pressure relief devices; Rules governing testing, inspection & stamping requirements.

Section XI - Rules for Inservice Inspection of Nuclear Power Plant Components

This Section contains Division 1 and Division 3, in one volume and provides rules for the examination, inservice testing and inspection, and repair and replacement of components and systems in light-water cooled and liquid-metal cooled nuclear power plants.

The Division 2 rules for inspection and testing of components of gas-cooled nuclear power plants are no longer in use. With the decommissioning of the only gas-cooled reactor to which these rules apply in mid-1990s, there is no apparent need to continue publication of Division 2.

Application of this Section of the Code begins when the requirements of the construction Code have been satisfied. The rules of this Section constitutes requirements to maintain the nuclear power plant while in operation and return the plant to service, following plant outages, and repair or replacement activities. The rules require a mandatory program of scheduled examinations, testing, and inspections to evidence adequate safety. The method of nondestructive examination to be used, and flaw size characterization are also contained within this Section.

Contents:

Divisions 1

Rules for light-water cooled nuclear power plant components; General requirements; Inspection schedules; NDE personnel requirements; Inservice inspection & testing; Requirements for Class 1, 2 and 3 components and their supports and Class MC and CC components in light-water cooled power plants; Repair and replacement of components; System pressure test requirements; Flaw detection and evaluation; Inservice testing pumps and valves; Duties and responsibilities of the Owner and the authorized nuclear inservice inspector.

Division 3

Rules for liquid-metal cooled nuclear power plant components; General requirements; Inspection schedules; Personnel requirements; Inservice inspection & testing; Requirements for Class 1, 2 and 3 components (containing liquid metal or cover gas) and their supports; Flaw detection and evaluation; Repair and replacement requirements; Duties and responsibilities of the Owner and the authorized nuclear inservice inspector.

Section XII - Rules for Construction & Continued Service of Transport Tanks

This Section contains requirements for construction and continued service of pressure vessels for the transportation of dangerous goods via highway, rail, air or water at pressures from full vacuum to 3,000 psig and volumes greater than 120 gallons. "Construction" is an all-inclusive term comprising materials, design, fabrication, examination, inspection, testing, certification and overpressure protection. "Continued Service" is an all-inclusive term referring to inspection, testing, repair, alteration and recertification of a transport tank that has been in service. This Section also contains appendices containing requirements for vessels used in specific transport modes and service applications. Rules pertaining to the use of T Code symbol stamp are also included.

Contents:

General requirements; Material requirements; Design requirements; Requirements for welded construction; Fabrication requirements; Nondestructive examination requirements; Testing requirements; Requirements for pressure relief devices; Requirements for marking, stamping, reports and records; Requirements for continued service, repair and alterations.

Code Cases: Boilers and Pressure Vessels

This volume contains provisions that have been adopted by the Boiler and Pressure Vessel Committee that cover Section III, Divisions 1, 2 and 3 and Section XI to provide, when the need is urgent, rules for materials of constructions not covered by existing code rules.

Code Cases: Nuclear Components

This volume contains provisions that have been adopted by the Boiler and Pressure Vessel Committee that cover all Sections of the Code other than Section III, Divisions 1, 2 and 3 and Section XI to provide, when the need is urgent, rules for materials of constructions not covered by existing code rules.

2013 Edition of Boiler and Pressure Vessel Code

The 2013 of the Code is due for release in August of 2013. With this release, the Code will be moving from three-year to a two-year cycle. The change to a two-year cycle, made at the request of the industry, will considerably enhance the ability of certificate-holders to comply with the Code, with the elimination of the Addenda and a reduction in changes that will be required in manuals between updates. The Errata, Interpretations and Code cases will continue to be updates regularly, in between new releases of the Code.

Sources:

1. <http://www.asme.org/kb/standards/bpvc-resources/boiler-and-pressure-vessel-code---2010-edition>

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About CoDesign Engineering:

CoDesign Engineering specializes in the core business of providing training and consultancy for design and fabrication of ASME code pressure vessels, and the ecosystem that includes piping, welding, valves, geometric dimensioning and tolerancing, process improvement, and engineering management. Some of the training courses (lasting from two days to five days) that we provide include,

- Design and Fabrication of ASME Section VIII, Div. 1 Pressure Vessels
- Design and Fabrication of ASME Section VIII, Div. 2 Pressure Vessels
- Shell & Tube Heat Exchangers - Thermal and Mechanical Design
- ASME Section IX - Welding Technology
- Engineering Management

We also provide several one-day workshops:

- Know Your Power Piping
- Know Your Process Piping
- Know Your ASME Section VIII Pressure Vessel Code
- Know Your Shell & Tube Heat Exchangers
- A to Z of Pressure Vessels
- Transitioning to ASME Section VIII, Div. 2

Our trainings can be offered at most cities in India and in US.

Please contact info@codesignengg.com for the training calendar and rates.

Visit our website www.codesignengg.com for contents of the courses.

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Ramesh Tiwari holds a Master's degree in Mechanical Engineering from Clemson University in South Carolina, and is a registered Professional Engineer from the state of Maryland in the United States. He has over 22 years of experience designing pressure vessels, heat exchangers and tanks. Ramesh is a member of ASME Section VIII Subgroup on Heat Transfer Equipment, and member of ASME B31.1 IWG for Power Piping. He is also an approved pressure vessel instructor at National Thermal Power Corporation (NTPC), a premier thermal power generating company in India.

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