ASME Section III Executive Summary

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ASME Section III Division 4 Fusion Energy Devices

The Rules for Construction of Nuclear Facility Components, specifically Division 4, have been newly published to address fusion energy devices. These rules provide guidelines and requirements for various components used in fusion energy systems, including vacuum vessels, cryostats, magnet structures, and their interactions.

Furthermore, the rules cover related support structures, such as metallic and nonmetallic materials, containment or confinement structures, and various in-vessel components like blankets, divertors, shields, fusion-system piping, vessels, valves, pumps, and supports.

The publication includes comprehensive requirements for materials, design, fabrication, testing, examination, inspection, certification, and stamping. These guidelines aim to ensure the safe and reliable construction and operation of fusion energy devices.

Initially, the BPV III Division 4 Fusion Energy Devices Code was released as a Draft Standard for *trial use* in 2018. Since then, the Standard Group (SG) on Fusion has gathered and considered feedback and comments from stakeholders, incorporating necessary revisions into the document.

It is important to note that this standard primarily focuses on magnetic fusion energy systems found in tokamak designs, which are confinement-based fusion systems. It does not encompass the inertial confinement method at this time.

Alternative Treatments

Historically, regulations governing the design and operation of nuclear plants in the United States were primarily based on deterministic requirements. These requirements outlined a specific set of design events that the plants had to be able to withstand.

Over time, as more data became available on actual transients, accidents, and the performance of plant equipment, the industry recognized the need to incorporate this information into the regulatory framework. The data collected were used in modeling accident scenarios to estimate the overall risk associated with plant operation. To analyze this risk, US nuclear plants began utilizing a probabilistic risk analysis (PRA) approach.

The insights gained from PRAs highlighted that certain plant equipment, which was deemed important to safety according to the deterministic regulatory requirements, had low safety significance when it came to ensuring safety. This realization prompted the Nuclear Regulatory Commission (NRC) to develop technical requirements that specifically defined the scope of structures, systems, and components (SSCs) governed by NRC alternative special treatment requirements. This initiative resulted in the establishment of a final rule, known as 10 CFR 50.69.

In line with its strategic initiatives, the American Society of Mechanical Engineers (ASME) Section III formed a special task group to propose alternate requirements for the construction of ASME Section III nuclear items. The aim was to align the construction process with the safety or risk contribution of each item, moving away from the traditional categorization of components based solely on deterministic processes. Instead, a risk-based safety classification system consistent with 10CFR50.69 and NEI 18-04 was considered, with the intention of enhancing the value of construction and meeting the design needs of advanced reactors.

The Task Group responsible for alternative treatments has presented a code update for the 2023 edition of ASME Section III Divisions 1 and 5. This update includes alternative material procurement requirements that expand the existing small products exclusions already outlined in paragraph NX-2610 of the code.

The revised code paragraph now allows for the integration of risk-based approaches into the construction of nuclear items when procuring materials. This means that the selection and acquisition of materials for nuclear item construction can take into account risk considerations, enhancing the overall safety and performance of the items.

However, it is important to note that the use of this code provision is subject to the approval of proposed alternative treatments by the Nuclear Regulatory Commission (NRC) or relevant regulatory authority. In the United States, the owner or their designee (Licensee) will need to seek approval from the NRC for any proposed modifications to design, construction, testing, inspection, and maintenance practices that involve the use of alternative treatments. This ensures that the changes comply with regulatory requirements and maintain the necessary safety standards.

It is crucial to understand that different countries may have different nuclear regulatory authorities with their own licensing processes. These authorities may have their specific requirements and may or may not allow for alternative treatments similar to those found in 10CFR50.69. International users should be aware of the specific regulations and licensing processes in their respective countries.

In the future, further efforts will be made to explore alternative treatments in areas such as non-destructive examination (NDE), testing, and quality requirements. These updates will likely take place in subsequent editions of the code or through the development of code cases.

ANSI/ASNT CP-189 Standard for Qualification and Certification of Nondestructive Testing Personnel

The 2023 Edition of Section III now includes a provision to utilize CP-189 in accordance with Section XI. Code users now have the flexibility to choose between SNT-TC-1a or CP-189, but it's important to note significant differences between the two.

Here are some key distinctions:

1. Certification Approach: SNT-TC-1A follows a recommended practice approach, providing guidelines for the qualification and certification of nondestructive testing personnel. CP-189, on the other hand, is a national standard that specifies mandatory requirements for the qualification and certification of NDT personnel.

2. Written Practice vs. Certification Procedure: SNT-TC-1A requires the implementation of a "Written Practice" that outlines the procedures for personnel qualification. In CP-189, a "Certification Procedure" is required instead. The Certification Procedure in CP-189 cannot be modified to suit company-specific requirements and must be approved by the Level III personnel.

3. Vision Requirements: CP-189 has more stringent vision requirements compared to SNT-TC-1A. For near vision acuity, CP-189 mandates the ability to read Jaeger #1, while SNT-TC-1A specifies Jaeger #2. The Jaeger notation signifies different levels of visual acuity.

4. Levels of Qualification: SNT-TC-1A has three levels of qualification: Level I, Level II, and Level III. CP-189 introduces two additional levels: "Instructor" and "Trainee," resulting in a total of five qualification levels.

5. Minimum Training Hours: CP-189 sets different minimum training hour requirements compared to SNT-TC-1A. For example, CP-189 does not reduce the minimum training hours for individuals holding a two-year degree in certain methods, as SNT-TC-1A does. CP-189 may have more or less stringent training hour requirements depending on the method and level of qualification.

6. Certification Prerequisites: In CP-189, Level III certification requires holding an ASNT Level III certificate in the specific method as a prerequisite. However, SNT-TC-1A does not have this specific prerequisite.
7. Terminology and Verbs: CP-189 emphasizes mandatory requirements by using the term "shall" throughout the document. In contrast, SNT-TC-1A uses the verb "should" to indicate recommendations rather than strict mandates.

Consolidated NCA-3800 through NCA-3900 into NCA-3300

In the 2023 Edition of Section III, the consolidation efforts for the duties and responsibilities of owners and certificate holders continued from the previous 2021 Edition. In particular, the requirements from the metallic and non-metallic materials organizations, previously found in NCA-3800-3900, have been consolidated into the new NCA-3300. Here are the major updates:

1. Merging and Alignment: The responsibilities outlined in NCA-3800/NCA-3900 have been merged and aligned into the new content numbering system of NCA-3300. This consolidation ensures that the requirements are organized and presented in a cohesive manner.
2. Transfer of Requirements: The requirements previously found in NCA-3862 have been moved to NCA-1225, providing a more logical placement of the content.
3. Consolidated Content Title: The content title has been modified to accurately reflect the paragraph numbering system and ensure consistency throughout the section.
4. Introduction of Table NCA-3300-1: A new table, Table NCA-3300-1, has been created to clearly outline the assigned responsibilities for each type of Material Organization. This table enhances clarity and makes it easier to understand the specific responsibilities.
5. Updates to Reflect 2021 Edition: The merged content of NCA-33xx and Table NCA-3300-1 have been updated to align with the requirements specified in the 2021 edition of the code. This ensures that the consolidated content is up-to-date and compliant with the latest standards.
6. Re-alignment of Reference Numbers: The reference numbers within the body of the respective NCA-33xx have been adjusted to reflect the current numbering format. This helps maintain consistency and clarity within the section.
7. Explicit Requirement Statements: Where there were previously implied requirements without explicit statements, explicit requirement statements have been added. This ensures that all necessary requirements are explicitly stated, leaving no room for ambiguity.

Digital Pressure Gauges

In NB-6412(b), there is a restriction on the combined error resulting from calibration and readability, which should not exceed 1% of the test pressure. However, it is worth noting that the term "readability" in this specific context has not been defined in NCA-9200 or provided as a footnote to NB-6412(b).

In the context of analog gauges, readability refers to the ability to accurately read and interpret the measurement based on the scale and marks on the gauge. For example, if the scale on an analog gauge is marked in 5 psig increments, the readability of the gauge would be 5 psig. It signifies the level of precision in reading the gauge.

Similarly, in the case of digital gauges, readability is often synonymous with resolution. Resolution refers to the smallest increment or change in pressure that the gauge can detect and display. For instance, a digital gauge with a resolution of

0.001 would display pressure values with three decimal places. However, if the third decimal place fluctuates rapidly or doesn't provide a stable reading, then the effective readability of the gauge would be limited to two decimal places.

Most gauges are designed to have stable resolution, matching their readability. The readability represents the value displayed on the gauge output and the increments at which changes in pressure are detected. This value is typically around 1 or 5 psig, depending on the specific gauge.

The new code update removes readability from the combined error resulting from calibration and only address accuracy provided the digits are “legible.” Note that with legibility, the digits on the digital gauge should be clearly visible and easily readable. This ensures that the pressure measurement can be accurately observed and interpreted.

If the accuracy exceeds the legibility, it may be necessary to consider using a gauge with larger, more easily readable digits to ensure accurate interpretation of the pressure measurement. This way, the accuracy of the gauge can be effectively utilized and the pressure readings can be accurately read and understood.

Alternate Methods for Applying the ASME Certification Mark

Paragraph NCA-8212, which pertains to "Stamping With Certification Mark," has been revised to allow for an alternative marking method using laser etching. The revised paragraph now includes provisions that permit the use of laser etching to apply the "Code Symbol" and the markings required by NCA-8210.

Additionally, the title of NCA-8200 has been modified to better reflect the subject matter covered in that section. The specific new title is not provided.

These changes align with Interpretation III-1-92-47, which states that laser etching is an acceptable method for applying the "Code Symbol" and the required markings outlined in NCA-8210. This interpretation clarifies that laser etching can be used as an alternative to traditional stamping for these specific markings.

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Paul Coco, P.E. Sr. Engineer, Codes and Standards paul_coco@hsb.com Paul joined HSB in January 2014. Paul is a graduate of the United States Naval Academy where he earned a Bachelor of Science degree in aeronautical engineering. Paul also holds a Master’s degree of Engineering Management and a Master of Science degree in Mechanical Engineering. Paul served in the U.S. Navy from 2002 through 2010. During this time, one of his many responsibilities included, the role of Reactor Mechanical Division Officer and Training Officer where Paul was responsible for the safe operation of a nuclear power plant onboard a Nuclear Powered Aircraft Carrier. From 2007 through 2010, Paul joined the Mechanical Engineering Department at the U.S. Naval Academy where he taught Applied Engineering Thermodynamics for Naval Applications as a Military Professor. After Military Service, Paul then joined the US Nuclear Regulatory Commission (NRC) as a Reactor Operations Engineer where he conducted detailed technical reviews of nuclear licenses in accordance with federal codes and standards and performed quality assurance inspections on domestic and international nuclear vendors for nuclear safety related components. Within the HSB Codes and Standards group, Paul is responsible for providing code technical support to internal and external clients with a focus on nuclear construction to ASME Section III and the associated nuclear conformity assessment programs. He is responsible for the development, maintenance, and delivery of technical training related to nuclear construction, as well as supporting the HSB NQA Services Program. Paul is also responsible for the development of HSB’s remote inspection program and is the technical lead on emerging renewable technologies. He holds a Professional Engineer License in the state of Maryland, National Board Endorsements as an AI and ANI, and is a member of various ASME Section III committees.