ASME FE.1-2018
Draft Standard for Trial Use

# Rules for Construction of Fusion Energy Devices

This is a Draft Standard for Trial Use and Comment. This Draft Standard is not an approved consensus standard of ASME nor is it an American National Standard. ASME has approved its issuance and publication as a Draft Standard only. Distribution of this Draft Standard for comment shall not continue beyond 3 years from the date of issuance. The content of this Draft Standard for Trial Use and Comment was not approved through ASME's consensus process. Following the 3-year trial and comment period, this Draft Standard, along with comments received, will be submitted to a Consensus Committee or Project Team. The Consensus Committee or Project Team will review and revise this Draft Standard based, in part, upon experience during the trial term and resulting comments. A public review in accordance with established American National Standards Institute (ANSI) procedures is required at the end of the Trial-Use Period and before a Draft Standard for Trial Use is submitted to ANSI for approval as an American National Standard. Thereafter, it is expected that this Draft Standard (including any revisions thereto) will be submitted to ANSI for approval as an American National Standard. Suggestions for revision should be directed to the Chair, Subgroup on Fusion Energy Devices, using the following form: http://go.asme.org/FE1CommentForm.



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This Draft Standard for Trial Use will be revised following the conclusion of the Trial-Use Period. There will be no written interpretations of the requirements of this Draft Standard for Trial Use issued.



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# FOREWORD

There is an ongoing effort within The American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (BPV) Committee on Construction of Nuclear Facility Components (Section III) to develop rules for the construction of fusion energy devices. The Standards Committee of Section III, Division 4 and its Subgroup on Fusion Energy Devices (FED) are developing these new fusion Code rules. These rules cover fusion-energy-related components such as vacuum vessels, cryostats, and superconducting magnet structures and the interactions of these components. Related support structures, including metallic and nonmetallic materials, containment or confinement structures, and in-vessel components such as fusion-system piping, vessels, valves, pumps, and supports, are also covered. The rules contain requirements for materials, design, fabrication, testing, examination, inspection, certification, and stamping

# ASME BOILER AND PRESSURE VESSEL COMMITTEE ON CONSTRUCTION OF NUCLEAR FACILITY COMPONENTS (BPV III)

(The following is the roster of the Committee at the time of approval of this Draft Standard.)

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# SUBSECTION FA
# FUSION ENERGY DEVICE FACILITIES

# SUBPART FAA
# GENERAL REQUIREMENTS

## ARTICLE FAA-1000
## INTRODUCTION

### FAA-1100 GENERAL

### FAA-1110 Scope

The rules of Subsection FA, Subpart FAA constitute the general requirements associated with fusion components used in the construction of fusion devices and their supporting systems. Only those fusion components that are serving a pressure boundary and/or structural integrity function (see FAA-2120) are covered by these rules. Items that are specifically excluded are electrical components and superconducting strand. It is understood that these rules were developed to document rules for construction that are not adequately addressed within existing Divisions of Section III of the ASME Boiler and Pressure Vessel Code (BPVC) or other existing codes and standards used in the nuclear industry.

*(a)* The General Requirements of ASME FE.1 are provided in ASME BPVC, Section III, Subsection NCA except for those paragraphs or subparagraphs (with numbered headers) replaced by corresponding numbered FAA paragraphs or subparagraphs or new numbered FAA paragraphs or subparagraphs.

*(b)* ASME BPVC, Section III, Division 1 terminology may differ from that in ASME FE.1 (e.g., Class 1 and Class 2 versus Class A and Class B), but the application and use of these rules are identical for ASME FE.1 construction except where otherwise noted.

*(c)* References to Appendices are to each respective Subsection of this Draft Standard, unless otherwise stated.

### FAA-1120 Definitions

Definitions of key terms specific to this Draft Standard are included in Article FAA-9000 or noted within the applicable text. The definitions in Article FAA-9000 shall prevail should a conflict exist with definitions found in ASME BPVC, Section III, Subsection NCA or in other documents referenced in this Draft Standard. Unless a term is defined in Article FAA-9000, the definition in ASME BPVC, Section III, Subsection NCA, Article NCA-9000 shall apply.

### FAA-1130 Limits of These Rules

The rules of this Draft Standard for fusion components provide requirements for new construction and include consideration of mechanical and thermal stresses due to cyclic operation and high temperature creep. These rules address the thermal and radiation effects on materials produced during the fusion activity. The rules do not cover deterioration that may occur in service as a result of corrosion, erosion, thermal embrittlement, or instability of material. These effects shall be taken into account with a view to realizing the design or the specified life of the component and support identified.

The rules are not intended to be applicable to valve operators, controllers, position indicators, pump impellers, pump drivers, or other accessories and devices, unless they are pressure-retaining parts or act as support structures or supports. If such items are in a support load path, the provisions of FAA-1100 apply.

The rules of this Draft Standard do not apply to instruments, or permanently sealed fluid-filled tubing systems furnished with instruments, but they do apply to instrument, control, and sampling piping when specified in a Design Specification.

### FAA-1300 FUSION TECHNOLOGIES

Subsection FA provides the rules for construction of nuclear fusion devices and their supporting systems. Nuclear fusion and nuclear fission are two different types of energy-releasing reactions in which energy is released from high-powered atomic bonds between the particles within a nucleus. The main difference between these two processes is that fission is the splitting of an atom into two or more smaller ones, whereas fusion is the fusing of two or more smaller atoms into a larger one.

Nuclear fission is a technology that has been in use since the 1950s. Figure FAA-1300-1 illustrates a typical light water fission system. There is potential for new developments in nuclear energy technology to enhance nuclear energy's role in a sustainable-energy future.