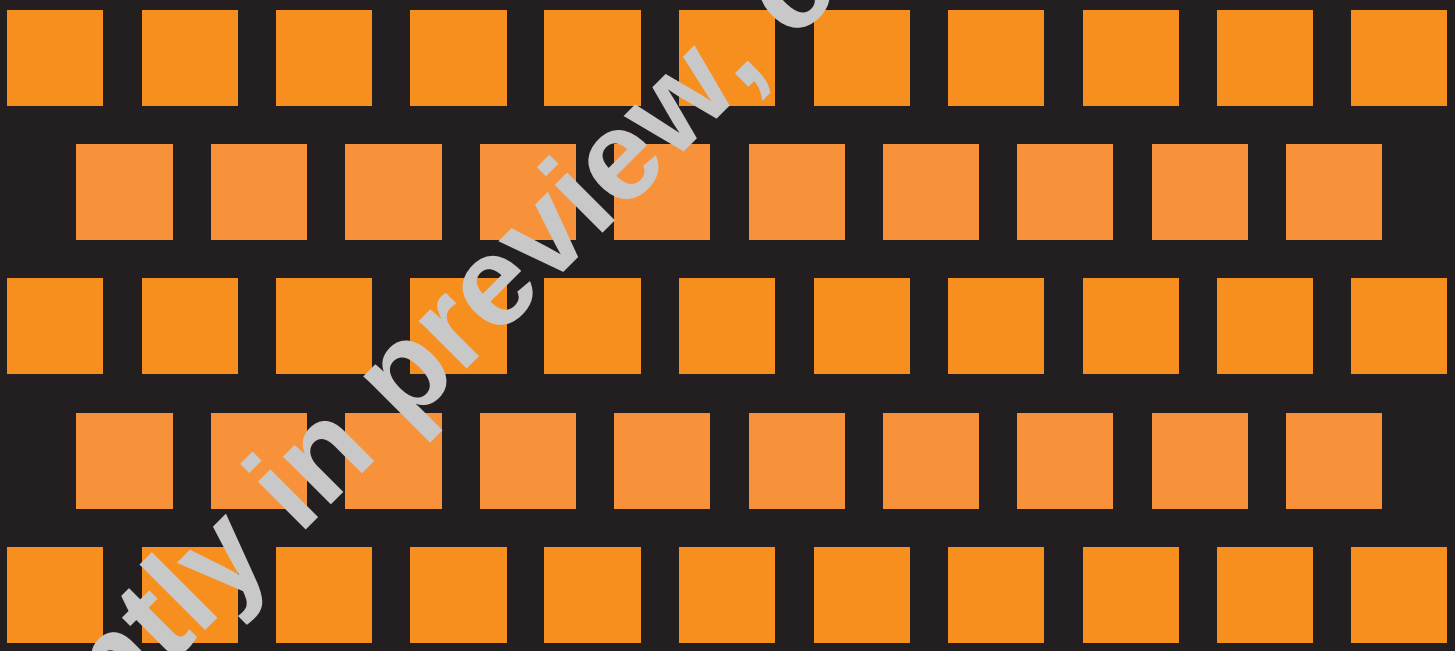
STP-NU-067

ROADMAP FOR THE DEVELOPMENT OF ASME CODE RULES FOR FUSION ENERGY DEVICES



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ASME STANDARDS TECHNOLOGY, LLC

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ROADMAP FOR THE DEVELOPMENT OF ASME CODE RULES FOR FUSION ENERGY DEVICES

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FOREWORD

This Roadmap has been developed as a guide to the Research & Development (R&D) and Code development tasks that could be considered in developing rules for Fusion Energy Devices (FED). The primary focus of the Roadmap is on the development of a complete set of Code rules for the design and operating conditions that are being proposed for the next generation fusion facilities.

The author acknowledges, with deep appreciation, the activities of ASME staff and volunteers who have provided valuable technical input, advice and assistance with review of, commenting on, and editing of, this document.

Established in 1880, the American Society of Mechanical Engineers (ASME) is a professional not-for-profit organization with more than 135,000 members promoting the art, science and practice of mechanical and multidisciplinary engineering and allied sciences. ASME develops codes and standards that enhance public safety, and provides lifelong learning and technical exchange opportunities benefiting the engineering and technology community. Visit www.asme.org for more information.

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ACRONYMS AND ABBREVIATIONS

ASME	American Society of Mechanical Engineers
ASME-LLC	ASME Standards Technology, LLC
BNCS	Board on Nuclear Codes and Standards
BPV	Boiler and Pressure Vessel
DOE	Department of Energy
EFDA	European Fusion Support Organization
EDF	French Utility
FED	Fusion Energy Device
FW	First Wall
IAEA	International Atomic Energy Agency
ISI	In-Service Inspection
ITER	International Fusion Project
JAEA	Japan Atomic Energy Agency
JSME	Japan Society of Mechanical Engineers
KINS	Korean nuclear regulator
O&M	Operation and Maintenance
NDE	Nondestructive Examination
NEI	USA nuclear utilities
PT	Penetrant Testing (dye penetrant)
PWHT	Post Weld Heat Treatment
QA	Quality Assurance
QME	Qualification of Mechanical Equipment
R&D	Research and Development
RP	Recommended Practice
RT	Radiographic Testing
SC	Subcommittee
SCD	Subcommittee on Design
SDO	Standards Developing Organization
SI	International System of Units (from the French Le Système International d' Unités)
SWG	Special Working Group
UT	Ultrasonic Testing
VV	Vacuum Vessels
WG	Working Group

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1 VISION STATEMENT AND OVERVIEW

The ASME Board on Nuclear Codes and Standards approved an effort to develop rules for the construction of fusion-energy-related components such as the vacuum vessel (vacuum or target chamber), cryostat and superconductor structures and their interaction with each other. These rules will be found in a new Division 4 of Section III entitled "Fusion Energy Devices". The rules shall contain requirements for materials, design, fabrication, testing, examination, inspection, certification, and stamping. The formation of the new Subgroup on Fusion Energy Devices will be responsible for the development of these rules and has begun to develop its membership and future working group support structures.

Current ASME BPVC Section III code rules do not specifically address the construction rules for fusion energy devices that are currently under consideration, nor do they support on-going projects, such as ITER (Tokamak Concept) and other fusion concepts such as Inertial Confinement Fusion (primarily laser fusion; an example is the National Ignition Facility).

While it may be feasible to modify the existing Section III rules to meet future fusion needs, it has been recommended that a complete separate set of rules be developed for these new fusion energy devices to cover design, construction and inspection/testing. In addition, it is anticipated that operation and maintenance requirements for these fusion energy devices may also require a new set of rules or major modifications to the existing ASME Operations and Maintenance (OM) Code. It is necessary that these new rules contain the best available methods and technology in each area.

As such, this *Roadmap for the Development of ASME Code Rules for Fusion Energy Devices* (FED Roadmap) was developed to outline what should be considered when developing these rules. The approach in this FED Roadmap consists of a compilation of suggestions from subject matter experts and organizations interviewed, as well as that of the author. As the project teams, task groups, and committees deliberate, it is anticipated that some of the tasks identified in this FED Roadmap will be revised or eliminated from consideration and others will be added.

The Fusion Energy Device Code rules will be developed by various project teams within the Subgroup Fusion Energy Devices of the BPV Committee on Construction of Nuclear Facility Components (III) and will be coordinated with other impacted groups both inside and outside ASME. A Stakeholder Task Group reporting to the Chairman of the BPV Committee on Construction of Nuclear Facility Components (III) and the Chairman of the Subgroup Fusion Energy Devices has been formed to identify stakeholders and their needs, and develop recommendations and approaches to be incorporated into new FED Code rules.

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