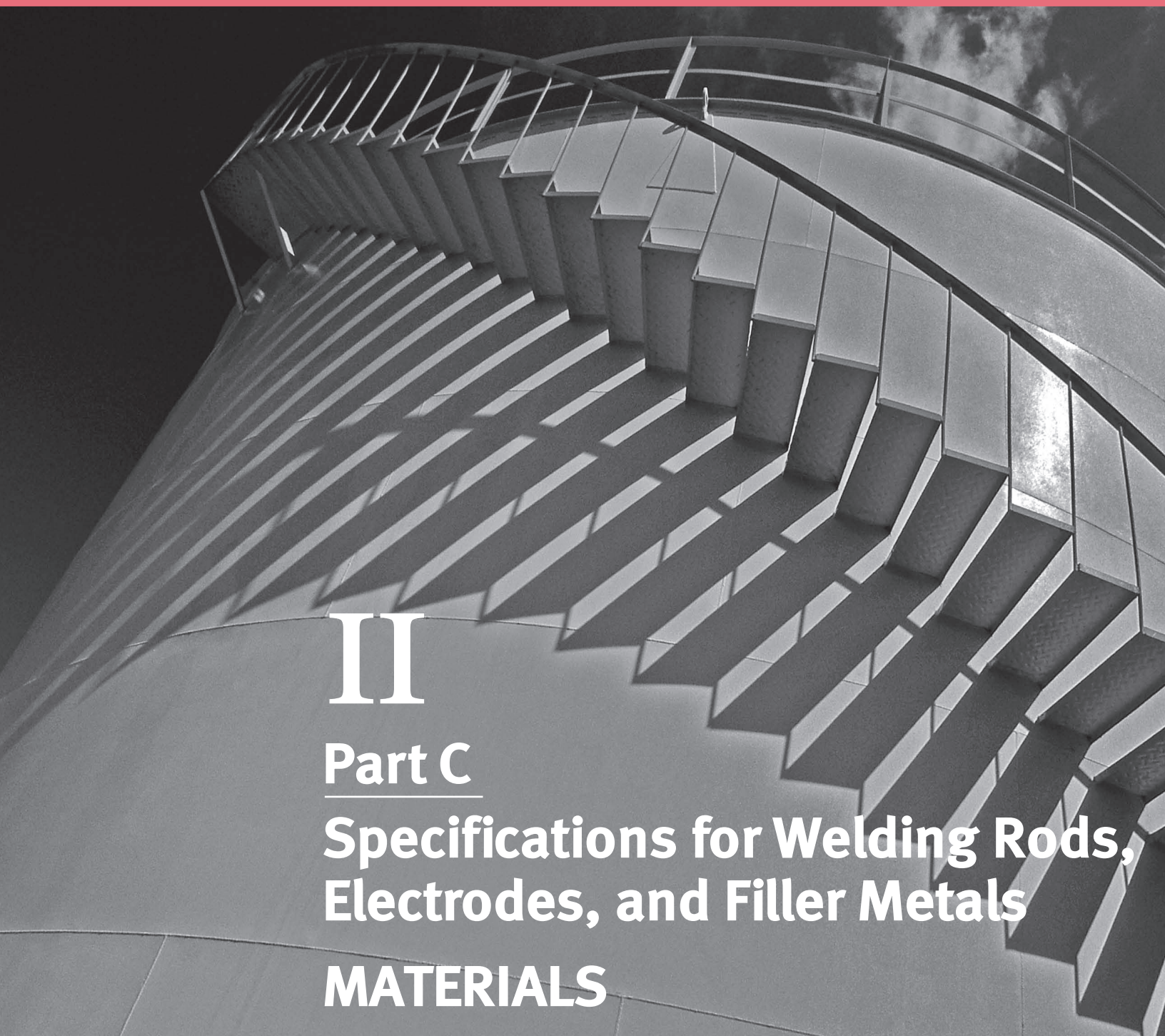
AN INTERNATIONAL CODE

2007 ASME Boiler & Pressure Vessel Code



II

Part C

Specifications for Welding Rods, Electrodes, and Filler Metals

MATERIALS

The American Society of Mechanical Engineers

ASME SETTING THE STANDARD

AN INTERNATIONAL CODE

2007 ASME Boiler & Pressure Vessel Code

2008a Addenda **July 1, 2008**

II

Part C

Specifications for Welding Rods, Electrodes, and Filler Metals

MATERIALS

ASME Boiler and Pressure Vessel Committee
Subcommittee on Materials

The American Society of Mechanical Engineers

ASME SETTING THE STANDARD

U02CW8

Date of Issuance: July 1, 2008

This international code or standard was developed under procedures accredited as meeting the criteria for American National Standards and it is an American National Standard. The Standards Committee that approved the code or standard was balanced to assure that individuals from competent and concerned interests have had an opportunity to participate. The proposed code or standard was made available for public review and comment that provides an opportunity for additional public input from industry, academia, regulatory agencies, and the public-at-large.

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The footnotes in this document are part of this American National Standard.

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2007 ASME
BOILER AND PRESSURE VESSEL CODE

SECTIONS

ADDENDA

Colored-sheet Addenda, which include additions and revisions to individual Sections of the Code, are published annually and will be sent automatically to purchasers of the applicable Sections up to the publication of the 2010 Code. The 2007 Code is available only in the loose-leaf format; accordingly, the Addenda will be issued in the loose-leaf, replacement-page format.

INTERPRETATIONS

ASME issues written replies to inquiries concerning interpretation of technical aspects of the Code. The Interpretations for each individual Section will be published separately and will be included as part of the update service to that Section. Interpretations of Section III, Divisions 1 and 2, will be included with the update service to Subsection NCA.

Interpretations of the Code are distributed annually in July with the issuance of the edition and subsequent addenda. Interpretations posted in January at www.cstools.asme.org/interpretations are included in the July distribution.

CODE CASES

The Boiler and Pressure Vessel Committee meets regularly to consider proposed additions and revisions to the Code and to formulate Cases to clarify the intent of existing requirements or provide, when the need is urgent, rules for materials or constructions not covered by existing Code rules. Those Cases that have been adopted will appear in the appropriate 2007 Code Cases book: “Boilers and Pressure Vessels” and “Nuclear Components.” Supplements will be sent automatically to the purchasers of the Code Cases books up to the publication of the 2010 Code.

SUMMARY OF CHANGES

Addenda to the 2007 Edition of the Code are issued in the form of replacement pages. Revisions, additions, or deletions are incorporated directly into the affected pages. It is advisable, however, that all replaced pages be retained for reference.

Replace or insert the pages listed. Changes given below are identified on the pages by a margin note, **A08**, placed next to the affected area. Revisions to the 2007 Edition are indicated by **07**. For the listing below, the *Page* references the affected area. A margin note, **A08**, placed next to the heading indicates *Location*. Revisions are listed under *Change*.

The Record Numbers listed below are explained in more detail in "List of Changes in Record Number Order" following the Summary of Changes.

Page	*Location*	*Change (Record Number)*
xi–xxi	Roster	Updated to reflect 2008 Addenda
xxiii–xxv	Officers of AWS Committee	Updated to reflect 2008 Addenda
1, 7	SFA-5.01	Subtitle revised *(07-1706)*
10.1–10.10	SFA-5.02/SFA-5.02M	Added *(07-1712)*
51–58.1	SFA-5.2/SFA-5.2M	Revised in its entirety *(07-1713)*
59, 66	SFA-5.3/SFA-5.3M	Subtitle revised *(07-1706)*
75, 76	SFA-5.4/SFA-5.4M	(1) In Table 1, Mo values for E308Mo-XX and E308LMo-XX corrected by errata *(08-304)* (2) In Table 1, Ni values for E410NiMo-XX corrected by errata *(08-304)*
96	SFA-5.4/SFA-5.4M	(1) Fig. A3 title corrected by errata *(07-1966)* (2) Value at left of figure corrected by errata *(07-1966)*
110–112	SFA-5.5/SFA-5.5M	(1) In Table 2, under Chromium-Molybdenum Steel Electrodes, last column for UNS W50425, M50426, and W50428 corrected by errata *(08-726)* (2) In Table 2, under Nickel-Molybdenum Steel Electrodes, last two columns for UNS W21118 corrected by errata *(08-726)* (3) In Table 2, for all entries under General Low-Alloy Steel Electrodes, last column corrected by errata *(08-726)* (4) In Table 2, last column corrected by errata for Weathering Steel Electrodes *(08-726)*
175–184.2	SFA-5.7/SFA-5.7M	Revised in its entirety *(07-1714)*
187	SFA-5.8/SFA-5.8M	In Table 1, Ni and Sn values transposed for BAg-24 by errata *(07-1966)*
216	SFA-5.9/SFA-5.9M	In Table 1, superscript (l) deleted from ER409Nb by errata *(07-1966)*
226	SFA-5.9/SFA-5.9M	Fig. A1 title corrected by errata *(07-1966)*
345, 356	SFA-5.15	Subtitle revised *(07-1706)*
363–376.1	SFA-5.16/SFA-5.16M	Revised in its entirety *(07-1857)*
377, 394	SFA-5.17/SFA-5.17M	Subtitle revised *(07-1706)*

Page	*Location*	*Change (Record Number)*
485, 507	SFA-5.22	Subtitle revised *(07-1706)*
521–554.1	SFA-5.23/SFA-5.23M	Revised in its entirety *(07-1704)*
565, 580	SFA-5.25/SFA-5.25M	Subtitle revised *(07-1706)*
589, 605	SFA-5.26/SFA-5.26M	Subtitle revised *(07-1706)*
615	SFA-5.28/SFA-5.28M	(1) In Table 1, under Chromium-Molybdenum Steel Electrodes and Rods, Cr values for UNS Number S50480 corrected by errata *(08-304)* (2) In Table 1, under Chromium-Molybdenum Steel Electrodes and Rods, Si and Cr values for UNS Number S50482 corrected by errata *(08-304)*
637	SFA-5.28/SFA-5.28M	In Fig. A2, dimensions values to right of figure corrected by errata *(07-1966)*
709, 714	SFA-5.32/SFA-5.32M	Subtitle revised *(07-1706)*
722.1–722.23	SFA-5.34/SFA-5.34M	Added *(07-1703)*

LIST OF CHANGES IN RECORD NUMBER ORDER

Record Number	Change
07-1703	SFA-5.34/SFA-5.34M added.
07-1704	SFA-5.23/SFA-5.23M revised.
07-1706	SFA-5.01: Revised to indicate AWS Reaffirmation (R1999). SFA-5.3: Revised to indicate AWS Reaffirmation (R2007). SFA-5.15: Revised to indicate AWS Reaffirmation (R2006). SFA-5.17: Revised to indicate AWS Reaffirmation (R2007). SFA-5.22: Revised to indicate AWS Reaffirmation (R2005). SFA-5.25: Revised to indicate AWS Reaffirmation (R2003). SFA-5.26: Revised to indicate AWS Reaffirmation (R2003). SFA-5.32: Revised to indicate AWS Reaffirmation (R2007).
07-1712	SFA-5.02/SFA-5.02M added.
07-1713	SFA-5.2/SFA-5.2M revised.
07-1714	SFA-5.7/SFA-5.7M revised.
07-1857	SFA-5.16/SFA-5.16M revised.
07-1966	Errata corrections.
08-304	Errata corrections.
08-726	Errata corrections.

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CONTENTS

FOREWORD

The American Society of Mechanical Engineers set up a committee in 1911 for the purpose of formulating standard rules for the construction of steam boilers and other pressure vessels. This committee is now called the Boiler and Pressure Vessel Committee.

The Committee's function is to establish rules of safety, relating only to pressure integrity, governing the construction[1] of boilers, pressure vessels, transport tanks and nuclear components, and inservice inspection for pressure integrity of nuclear components and transport tanks, and to interpret these rules when questions arise regarding their intent. This code does not address other safety issues relating to the construction of boilers, pressure vessels, transport tanks and nuclear components, and the inservice inspection of nuclear components and transport tanks. The user of the Code should refer to other pertinent codes, standards, laws, regulations, or other relevant documents. With few exceptions, the rules do not, of practical necessity, reflect the likelihood and consequences of deterioration in service related to specific service fluids or external operating environments. Recognizing this, the Committee has approved a wide variety of construction rules in this Section to allow the user or his designee to select those which will provide a pressure vessel having a margin for deterioration in service so as to give a reasonably long, safe period of usefulness. Accordingly, it is not intended that this Section be used as a design handbook; rather, engineering judgment must be employed in the selection of those sets of Code rules suitable to any specific service or need.

This Code contains mandatory requirements, specific prohibitions, and nonmandatory guidance for construction activities. The Code does not address all aspects of these activities and those aspects which are not specifically addressed should not be considered prohibited. The Code is not a handbook and cannot replace education, experience, and the use of engineering judgment. The phrase *engineering judgment* refers to technical judgments made by knowledgeable designers experienced in the application of the Code. Engineering judgments must be consistent with Code philosophy and such judgments must never be used to overrule mandatory requirements or specific prohibitions of the Code.

The Committee recognizes that tools and techniques used for design and analysis change as technology progresses and expects engineers to use good judgment in the application of these tools. The designer is responsible for complying with Code rules and demonstrating compliance with Code equations when such equations are mandatory. The Code neither requires nor prohibits the use of computers for the design or analysis of components constructed to the requirements of the Code. However, designers and engineers using computer programs for design or analysis are cautioned that they are responsible for all technical assumptions inherent in the programs they use and they are responsible for the application of these programs to their design.

The Code does not fully address tolerances. When dimensions, sizes, or other parameters are not specified with tolerances, the values of these parameters are considered nominal and allowable tolerances or local variances may be considered acceptable when based on engineering judgment and standard practices as determined by the designer.

The Boiler and Pressure Vessel Committee deals with the care and inspection of boilers and pressure vessels in service only to the extent of providing suggested rules of good practice as an aid to owners and their inspectors.

The rules established by the Committee are not to be interpreted as approving, recommending, or endorsing any proprietary or specific design or as limiting in any way the manufacturer's freedom to choose any method of design or any form of construction that conforms to the Code rules.

The Boiler and Pressure Vessel Committee meets regularly to consider revisions of the rules, new rules as dictated by technological development, Code Cases, and requests for interpretations. Only the Boiler and Pressure Vessel Committee has the authority to provide official interpretations of this Code. Requests for revisions, new rules, Code Cases, or interpretations shall be addressed to the Secretary in writing and shall give full particulars in order to receive consideration and action (see Mandatory Appendix covering preparation of technical inquiries). Proposed revisions to the Code resulting from inquiries will be presented to the Main Committee for appropriate action. The action of the Main Committee becomes effective only after confirmation by letter ballot of the Committee and approval by ASME.

[1] *Construction*, as used in this Foreword, is an all-inclusive term comprising materials, design, fabrication, examination, inspection, testing, certification, and pressure relief.

Proposed revisions to the Code approved by the Committee are submitted to the American National Standards Institute and published at *http://cstools.asme.org/csconnect/public/index.cfm?PublicReview=Revisions* to invite comments from all interested persons. After the allotted time for public review and final approval by ASME, revisions are published annually in Addenda to the Code.

Code Cases may be used in the construction of components to be stamped with the ASME Code symbol beginning with the date of their approval by ASME.

After Code revisions are approved by ASME, they may be used beginning with the date of issuance shown on the Addenda. Revisions, except for revisions to material specifications in Section II, Parts A and B, become mandatory six months after such date of issuance, except for boilers or pressure vessels contracted for prior to the end of the six-month period. Revisions to material specifications are originated by the American Society for Testing and Materials (ASTM) and other recognized national or international organizations, and are usually adopted by ASME. However, those revisions may or may not have any effect on the suitability of material, produced to earlier editions of specifications, for use in ASME construction. ASME material specifications approved for use in each construction Code are listed in the Guidelines for Acceptable ASTM Editions in Section II, Parts A and B. These Guidelines list, for each specification, the latest edition adopted by ASME, and earlier and later editions considered by ASME to be identical for ASME construction.

The Boiler and Pressure Vessel Committee in the formulation of its rules and in the establishment of maximum design and operating pressures considers materials, construction, methods of fabrication, inspection, and safety devices.

The Code Committee does not rule on whether a component shall or shall not be constructed to the provisions of the Code. The Scope of each Section has been established to identify the components and parameters considered by the Committee in formulating the Code rules.

Questions or issues regarding compliance of a specific component with the Code rules are to be directed to the ASME Certificate Holder (Manufacturer). Inquiries concerning the interpretation of the Code are to be directed to the ASME Boiler and Pressure Vessel Committee. ASME is to be notified should questions arise concerning improper use of an ASME Code symbol.

The specifications for materials given in Section II are identical with or similar to those of specifications published by ASTM, AWS, and other recognized national or international organizations. When reference is made in an ASME material specification to a non-ASME specification for which a companion ASME specification exists, the reference shall be interpreted as applying to the ASME material specification. Not all materials included in the material specifications in Section II have been adopted for Code use. Usage is limited to those materials and grades adopted by at least one of the other Sections of the Code for application under rules of that Section. All materials allowed by these various Sections and used for construction within the scope of their rules shall be furnished in accordance with material specifications contained in Section II or referenced in the Guidelines for Acceptable ASTM Editions in Section II, Parts A and B, except where otherwise provided in Code Cases or in the applicable Section of the Code. Materials covered by these specifications are acceptable for use in items covered by the Code Sections only to the degree indicated in the applicable Section. Materials for Code use should preferably be ordered, produced, and documented on this basis; Guideline for Acceptable ASTM Editions in Section II, Part A and Guideline for Acceptable ASTM Editions in Section II, Part B list editions of ASME and year dates of specifications that meet ASME requirements and which may be used in Code construction. Material produced to an acceptable specification with requirements different from the requirements of the corresponding specifications listed in the Guideline for Acceptable ASTM Editions in Part A or Part B may also be used in accordance with the above, provided the material manufacturer or vessel manufacturer certifies with evidence acceptable to the Authorized Inspector that the corresponding requirements of specifications listed in the Guideline for Acceptable ASTM Editions in Part A or Part B have been met. Material produced to an acceptable material specification is not limited as to country of origin.

When required by context in this Section, the singular shall be interpreted as the plural, and vice-versa; and the feminine, masculine, or neuter gender shall be treated as such other gender as appropriate.

STATEMENT OF POLICY ON THE USE OF CODE SYMBOLS AND CODE AUTHORIZATION IN ADVERTISING

ASME has established procedures to authorize qualified organizations to perform various activities in accordance with the requirements of the ASME Boiler and Pressure Vessel Code. It is the aim of the Society to provide recognition of organizations so authorized. An organization holding authorization to perform various activities in accordance with the requirements of the Code may state this capability in its advertising literature.

Organizations that are authorized to use Code Symbols for marking items or constructions that have been constructed and inspected in compliance with the ASME Boiler and Pressure Vessel Code are issued Certificates of Authorization. It is the aim of the Society to maintain the standing of the Code Symbols for the benefit of the users, the enforcement jurisdictions, and the holders of the symbols who comply with all requirements.

Based on these objectives, the following policy has been established on the usage in advertising of facsimiles of the symbols, Certificates of Authorization, and reference to Code construction. The American Society of Mechanical Engineers does not "approve," "certify," "rate," or "endorse" any item, construction, or activity and there shall be no statements or implications that might so indicate. An organization holding a Code Symbol and/or a Certificate of Authorization may state in advertising literature that items, constructions, or activities "are built (produced or performed) or activities conducted in accordance with the requirements of the ASME Boiler and Pressure Vessel Code," or "meet the requirements of the ASME Boiler and Pressure Vessel Code."

The ASME Symbol shall be used only for stamping and nameplates as specifically provided in the Code. However, facsimiles may be used for the purpose of fostering the use of such construction. Such usage may be by an association or a society, or by a holder of a Code Symbol who may also use the facsimile in advertising to show that clearly specified items will carry the symbol. General usage is permitted only when all of a manufacturer's items are constructed under the rules.

The ASME logo, which is the cloverleaf with the letters ASME within, shall not be used by any organization other than ASME.

STATEMENT OF POLICY ON THE USE OF ASME MARKING TO IDENTIFY MANUFACTURED ITEMS

The ASME Boiler and Pressure Vessel Code provides rules for the construction of boilers, pressure vessels, and nuclear components. This includes requirements for materials, design, fabrication, examination, inspection, and stamping. Items constructed in accordance with all of the applicable rules of the Code are identified with the official Code Symbol Stamp described in the governing Section of the Code.

Markings such as "ASME," "ASME Standard," or any other marking including "ASME" or the various Code Symbols shall not be used on any item that is not constructed in accordance with all of the applicable requirements of the Code.

Items shall not be described on ASME Data Report Forms nor on similar forms referring to ASME that tend to imply that all Code requirements have been met when, in fact, they have not been. Data Report Forms covering items not fully complying with ASME requirements should not refer to ASME or they should clearly identify all exceptions to the ASME requirements.

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SUBMITTAL OF TECHNICAL INQUIRIES TO THE BOILER AND PRESSURE VESSEL COMMITTEE

1 INTRODUCTION

(a) This Section provides guidance to Code users for submitting technical inquiries to the Committee. See Guideline on the Approval of New Materials Under the ASME Boiler and Pressure Vessel Code in Section II, Parts C and D for additional requirements for requests involving adding new materials to the Code. Technical inquiries include requests for revisions or additions to the Code rules, requests for Code Cases, and requests for Code interpretations, as described below.

(1) Code Revisions. Code revisions are considered to accommodate technological developments, address administrative requirements, incorporate Code Cases, or to clarify Code intent.

(2) Code Cases. Code Cases represent alternatives or additions to existing Code rules. Code Cases are written as a question and reply, and are usually intended to be incorporated into the Code at a later date. When used, Code Cases prescribe mandatory requirements in the same sense as the text of the Code. However, users are cautioned that not all jurisdictions or owners automatically accept Code Cases. The most common applications for Code Cases are:

(a) to permit early implementation of an approved Code revision based on an urgent need

(b) to permit the use of a new material for Code construction

(c) to gain experience with new materials or alternative rules prior to incorporation directly into the Code

(3) Code Interpretations. Code Interpretations provide clarification of the meaning of existing rules in the Code, and are also presented in question and reply format. Interpretations do not introduce new requirements. In cases where existing Code text does not fully convey the meaning that was intended, and revision of the rules is required to support an interpretation, an Intent Interpretation will be issued and the Code will be revised.

(b) The Code rules, Code Cases, and Code Interpretations established by the Committee are not to be considered as approving, recommending, certifying, or endorsing any proprietary or specific design, or as limiting in any way the freedom of manufacturers, constructors, or owners to choose any method of design or any form of construction that conforms to the Code rules.

(c) Inquiries that do not comply with the provisions of this Appendix or that do not provide sufficient information for the Committee's full understanding may result in the request being returned to the inquirer with no action.

2 INQUIRY FORMAT

Submittals to the Committee shall include:

(a) Purpose. Specify one of the following:

(1) revision of present Code rules

(2) new or additional Code rules

(3) Code Case

(4) Code Interpretation

(b) Background. Provide the information needed for the Committee's understanding of the inquiry, being sure to include reference to the applicable Code Section, Division, Edition, Addenda, paragraphs, figures, and tables. Preferably, provide a copy of the specific referenced portions of the Code.

(c) Presentations. The inquirer may desire or be asked to attend a meeting of the Committee to make a formal presentation or to answer questions from the Committee members with regard to the inquiry. Attendance at a Committee meeting shall be at the expense of the inquirer. The inquirer's attendance or lack of attendance at a meeting shall not be a basis for acceptance or rejection of the inquiry by the Committee.

3 CODE REVISIONS OR ADDITIONS

Requests for Code revisions or additions shall provide the following:

(a) Proposed Revisions or Additions. For revisions, identify the rules of the Code that require revision and submit a copy of the appropriate rules as they appear in the Code, marked up with the proposed revision. For additions,

provide the recommended wording referenced to the existing Code rules.

(b) Statement of Need. Provide a brief explanation of the need for the revision or addition.

(c) Background Information. Provide background information to support the revision or addition, including any data or changes in technology that form the basis for the request that will allow the Committee to adequately evaluate the proposed revision or addition. Sketches, tables, figures, and graphs should be submitted as appropriate. When applicable, identify any pertinent paragraph in the Code that would be affected by the revision or addition and identify paragraphs in the Code that reference the paragraphs that are to be revised or added.

4 CODE CASES

Requests for Code Cases shall provide a Statement of Need and Background Information similar to that defined in 3(b) and 3(c), respectively, for Code revisions or additions. The urgency of the Code Case (e.g., project underway or imminent, new procedure, etc.) must be defined and it must be confirmed that the request is in connection with equipment that will be ASME stamped, with the exception of Section XI applications. The proposed Code Case should identify the Code Section and Division, and be written as a *Question* and a *Reply* in the same format as existing Code Cases. Requests for Code Cases should also indicate the applicable Code Editions and Addenda to which the proposed Code Case applies.

5 CODE INTERPRETATIONS

(a) Requests for Code Interpretations shall provide the following:

(1) Inquiry. Provide a condensed and precise question, omitting superfluous background information and, when possible, composed in such a way that a "yes" or a "no" *Reply,* with brief provisos if needed, is acceptable. The question should be technically and editorially correct.

(2) Reply. Provide a proposed *Reply* that will clearly and concisely answer the *Inquiry* question. Preferably, the *Reply* should be "yes" or "no," with brief provisos if needed.

(3) Background Information. Provide any background information that will assist the Committee in understanding the proposed *Inquiry* and *Reply*.

(b) Requests for Code Interpretations must be limited to an interpretation of a particular requirement in the Code or a Code Case. The Committee cannot consider consulting type requests such as the following:

(1) a review of calculations, design drawings, welding qualifications, or descriptions of equipment or parts to determine compliance with Code requirements;

(2) a request for assistance in performing any Code-prescribed functions relating to, but not limited to, material selection, designs, calculations, fabrication, inspection, pressure testing, or installation;

(3) a request seeking the rationale for Code requirements.

6 SUBMITTALS

Submittals to and responses from the Committee shall meet the following:

(a) Submittal. Inquiries from Code users shall be in English and preferably be submitted in typewritten form; however, legible handwritten inquiries will also be considered. They shall include the name, address, telephone number, fax number, and e-mail address, if available, of the inquirer and be mailed to the following address:

Secretary
ASME Boiler and Pressure Vessel Committee
Three Park Avenue
New York, NY 10016-5990

As an alternative, inquiries may be submitted via e-mail to: SecretaryBPV@asme.org.

(b) Response. The Secretary of the ASME Boiler and Pressure Vessel Committee or of the appropriate Subcommittee shall acknowledge receipt of each properly prepared inquiry and shall provide a written response to the inquirer upon completion of the requested action by the Code Committee.

GUIDELINE ON THE APPROVAL OF NEW WELDING AND BRAZING MATERIAL CLASSIFICATIONS UNDER THE ASME BOILER AND PRESSURE VESSEL CODE

Code Policy. It is the policy of the ASME Boiler and Pressure Vessel Committee to adopt for inclusion in Section II, Part C, only such specifications as have been adopted by the American Welding Society (AWS), and by other recognized national or international organizations.

It is expected that requests for Code approval will normally be for welding and brazing materials (hereafter termed "consumables") for which there is a recognized national or international specification. For consumables made to a recognized national or international specification other than those of the AWS, the inquirer shall give notice to the standards developing organization that a request has been made to ASME for adoption of their specification under the ASME Code, and shall request that the organization to grant ASME permission to reprint the standard. For other consumables, a request shall be made to the AWS, or a recognized national or international organization, to develop a specification that can be presented to the Code Committee.

It is the policy of the ASME Boiler and Pressure Vessel Committee to consider requests to adopt new consumables for use by boiler, pressure vessel, or nuclear power plant component Manufacturers or end users. Further, such requests should be for consumables for which there is a reasonable expectation of use in a boiler, pressure vessel, or nuclear power plant component constructed to the rules of one of the Sections of this Code.

Application. The inquirer shall identify to the Committee all product forms, size ranges, and specifications for which incorporation is desired, and state whether or not the consumable is covered by patents, whether or not it is licensed, and if licensed, any limitations on its manufacture.

Weldability/Brazability. The inquirer shall furnish complete data on procedure qualification tests made in accordance with the requirements of Section IX. Such tests shall be made over the full range of base metal thickness in which the consumable is to be used. Pertinent information on deposited metal, such as effects from postweld heat treatment, susceptibility to air hardening, effects of joining processes, expected notch toughness values, and the amount of experience in use of the consumable shall be given.

Physical Changes. For new consumables, it is important to know the structural stability characteristics and the degree of retention of properties with exposure at temperature. The influence of welding or brazing and thermal treatment operations on the mechanical properties, ductility, and microstructure of the deposited metal are important, particularly where degradation in properties may occur. Where particular temperature ranges of exposure or heat treatment, cooling rates, combinations of mechanical working and thermal treatments, fabrication practices, exposure to particular environments, etc., cause significant changes in the mechanical properties, microstructure, resistance to brittle fracture, etc., it is of prime importance to call attention to those conditions that should be avoided in service or in manufacture of parts or vessels using the consumable.

Requests for Additional Data. The Committee may request additional data, including data on properties or deposited metal behavior not explicitly treated in the construction Code in which adoption is desired.

Code Case. The Code Committee will consider the issuance of an ASME Code Case, to be effective for a period of three years, permitting the treatment of a new welding or brazing material under an existing ASME Section IX grouping for qualification purposes, provided that the following conditions are met:

(a) The inquirer provides evidence that a request for coverage of the consumable in a specification has been made to the AWS or a recognized national or international organization;

(b) the consumable is commercially available and can be purchased within the proposed specification requirements;

(c) the inquirer shows that there will be a reasonable demand for the consumable by industry and that there exists an urgency for approval by means of a Code Case;

(d) the request for approval of the consumable shall clearly describe it in specification form, including applicable items as scope, process, manufacture, conditions for delivery, heat treatment, chemical and tensile requirements, testing specifications and requirements, workmanship, finish, marking, inspection, and rejection;

(e) all other requirements identified previously under Code Policy and Application apply; and

(f) the inquirer shall furnish the Code Committee with all the data specified in this Guideline.

Requirements for Requests for ASME Acceptance of Welding and Brazing Material Specifications to Recognized National or International Standards Other Than the AWS. The Committee will consider only requests in accordance with the Boiler and Pressure Vessel Committee Operating and Administrative Procedures, OP-8.6 (English language: U.S. or SI/metric units). The Committee will consider accepting specifications of recognized national or international organizations in accordance with OP-8.6 such as, but not limited to, AWS, CSA, CEN, DIN, and JIS. Consumable specifications of other than national or international organizations, such as those of consumable producers and suppliers, will not be considered for acceptance.

Requirements for Recognized National or International Specifications. Acceptable consumable specifications will be identified by date or edition. Approved edition(s) will be stated in the subtitle of the ASME specification. Minimum requirements that must be contained in a consumable specification for which acceptance is being requested include such items as name of national or international organization, scope, reference documents, process, manufacture, conditions for delivery, heat treatment, chemical and tensile requirements, testing specifications and requirements, workmanship, finish, marking, inspection, and rejection.

Publication of Recognized National or International Specifications. Specifications for which ASME has not been given permission to publish by the originating organization will be referenced on a cover sheet in appropriate Appendices in Section II, Part C, along with information on where to obtain a copy of those documents. Documents that are referenced in non-AWS consumable specifications will not be published by ASME. However, information on where to obtain a copy of those documents will be maintained in Section II, Part C. Additions and exceptions to the consumable specification will be noted in the subtitle of the specification.

New Welding and Brazing Materials Checklist. To assist inquirers desiring Code coverage for new consumables, or extending coverage of existing consumables, the Committee has developed the following checklist of items that ought to be addressed by each inquiry. The Committee reserves the right to request additional data and application information when considering new consumables.

(a) Has a qualified inquirer request been provided?

(b) Has a request for either revision to existing Code requirements or for a Code Case been defined?

(c) Has a letter to the AWS been submitted requesting coverage of the new consumable in a specification, and has a copy been submitted to the Committee? Alternatively, is this consumable already covered by a specification issued by a recognized national or international organization, and has an English language version been provided?

(d) Has the Construction Code and Division coverage been identified?

(e) Have mechanical property data been submitted (ultimate tensile strength, yield strength, reduction of area, and elongation) for each intended joining process?

(f) Have toughness considerations required by the Construction Code been defined and has appropriate data been submitted?

(g) Have joining requirements been defined and has procedure qualification test data been submitted?

(h) Has influence of fabrication practices on deposited metal properties been defined?

PREFACE

On January 3, 1919, ASME participated with several other organizations in a meeting to discuss the continuation of wartime research in welding. Out of that meeting, the American Welding Society was established and since that time there has been a constant and interwoven record of development by the American Welding Society and The American Society of Mechanical Engineers of the techniques of welding. Through all of these great years of growth, many of the leaders in the field of engineering had the common interest of pressure equipment design and manufacture and the development of welding as a powerful tool in that manufacture. The evolution of this cooperative effort is contained in Professor A. M. Greene's "History of the ASME Boiler Code," which was published as a series of articles in *Mechanical Engineering* from July 1952 through August 1953 and is now available from ASME in a special bound edition. The following quotation from this history based on the minutes of the Committee notes the cooperative nature of the work done in the area of welding.

"During 1919, a number of cases involving welding were referred by the Boiler Code Committee to the Subcommittee on Welding.

"As the National Welding Council was to be discontinued, a new organization was to be formed to be known as the American Welding Society with which the American Bureau of Welding was to be affiliated. This was to be a body representing the entire industry and would eliminate commercial aspects, undertake research and standardization, and act as a judicial body providing a medium for advancing the science and art of welding."

In 1935 the AWS-ASTM Joint Committee on Filler Metal was organized to provide standard specifications for welding rods, electrodes, filler metals, and fluxes for this developing U.S. industry.

In 1969 these two sponsors agreed to dissolve this joint activity and to permit the American Welding Society to assume sole responsibility for the family of welding rods, electrodes, filler metal, and flux specifications then in being.

In 1992, the ASME Board of Pressure Technology Codes and Standards endorsed the use of materials produced to other than AWS specifications. It is the intent of ASME to follow its procedures and practices curently in use to implement the adoption of material specifications of AWS and other recognized national or international organizations.

Section II, Part C, contains material specifications, most of which are identical to corresponding specifications published by AWS and other recognized national or international organizations. All adopted specifications are either reproduced in the Code, where permission to do so has been obtained from the originating organization, or so referenced, and information about how to obtain them from the originating organization is provided. The ASME Committee reviews all material specifications submitted to it and if it is felt that there is any need to adapt them for Code purposes, revisions are made to them. However, there is constant liaison between ASME and AWS and other recognized national or international organizations, and there will be continuing effort to see that the specifications as produced by AWS and other recognized national or international organizations and those printed in the ASME Code are identical.

To assure that there will be a clear understanding on the part of the users of Section II, ASME publishes both the identical specifications and those amended for Code usage in three parts every three years, in the same page size to match the other Sections of the Code, and Addenda are issued annually to provide the latest changes in Section II specifications.

The ASME Boiler and Pressure Vessel Code has been adopted into law by 48 states and many municipalities in the United States and by all of the Canadian Provinces.

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SUMMARY OF CHANGES

The 2007 Edition of this Code contains revisions in addition to the 2004 Edition with 2005 and 2006 Addenda. The revisions are identified with the designation **07** in the margin and, as described in the Foreword, become mandatory six months after the publication date of the 2007 Edition. To invoke these revisions before their mandatory date, use the designation "2007 Edition" in documentation required by this Code. If you choose not to invoke these revisions before their mandatory date, use the designation "2004 Edition through the 2006 Addenda" in documentation required by this Code.

The BC numbers listed below are explained in more detail in "List of Changes in BC Order" following this Summary of Changes.

Changes given below are identified on the pages by a margin note, **07**, placed next to the affected area.

Page	*Location*	*Change (BC Number)*
73–104	SFA-5.4/5.4M	Revised in its entirety *(BC06-676)*
105–153	SFA-5.5/5.5M	Revised in its entirety *(BC06-943)*
213–235	SFA-5.9/SFA-5.9M	Revised in its entirety *(BC06-944)*
423	SFA-5.18/SFA-5.18M	(1) In second tabular material with Fig. A2, Note reference for Standard size corrected by errata *(BC07-212)* (2) In second tabular material with Fig. A2, Resulting current, DCEN corrected to read Nominal current, DCEN; and all values to the right of that entry corrected by errata *(BC07-212)*
615, 625	SFA-5.28/SFA-5.28M	(1) Table 1 corrected by errata *(BC06-1524)* (2) In Table 7, under Preheat and Interpass Temperature, fifth entries for °F and °C corrected by errata *(BC06-1524)*
645	SFA-5.29/SFA-5.29M	Table 1U corrected by errata *(BC06-327)*

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LIST OF CHANGES IN BC ORDER

BC Number	Change
BC06-676	Adoption of AWS A5.4/A5.4M:2006 “Stainless Steel Electrodes for Shielded Metal Arc Welding” in Section II, Part C. Deletion of AWS Classification EXXX(X)-15 from Section IX, Table QW-432.
BC06-943	Adoption of AWS A5.5/A5.5M:2006 “Specification for Low-Alloy Steel Electrodes for Shielded Metal Arc Welding” into Section II, Part C. Addition of E(X)XX45 as F-Number 4 in Section IX, Table QW-432.
BC06-944	Adoption of AWS A5.9/A5.9M:2006 “Specification for Bare Stainless Steel Electrodes and Rods” as SFA-5.9 in Section II, Part C.

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FILLER METAL PROCUREMENT GUIDELINES

SFA-5.01

(Identical with AWS Specification A5.01:1993 (R1999). In case of dispute, the original AWS text applies.) **A08**

1. Scope

This document, together with an AWS filler metal specification, is intended to describe a uniform method for providing those specific details needed for filler metal procurement which consist of the following:

(1) The filler metal classification (selected from the pertinent AWS filler metal specification)

(2) The lot classification (selected from Section 5 of this document)

(3) The level of testing schedule (selected from Table 1 and Section 6, Level of Testing, of this document)

2. Certification

By affixing the AWS specification and classification designations to the packaging, or the classification to the product, the manufacturer certifies that the product meets the requirements of that specification.

3. Manufacturer's Quality Assurance System

3.1 The certification of the product is accomplished through a quality assurance program, by which the manufacturer verifies that the product meets the requirements of this specification. Such a program includes planning, documentation, surveillance, inspection, testing, and certification of the test results. It also includes control of the inspection and measuring equipment, as well as control of any nonconforming material. It involves auditing of the activities and provides for developing and implementing any corrective action that may become necessary.

3.2 It is the responsibility of the purchaser to review the quality assurance program of the manufacturer for conformance to the purchaser's specific requirements.

3.3 In the case of distributors who receive electrodes in bulk and package them for distribution, or who repackage under their own label, the distributor shall maintain an adequate control system to ensure that the package contents are traceable to the original manufacturer's records.

4. Definitions and Identification of Materials

4.1 Introduction. In production, the components of the filler metal are divided into discrete, predetermined quantities so that satisfactory tests with a sample from that quantity will establish that the entire quantity meets specification requirements. These quantities, known by such terms as *heats, lots, blends, batches,* and *mixes,* vary in size according to the manufacturer. For identification purposes, however, each manufacturer assigns a unique designation to each quantity. This designation usually consists of a series of numbers or letters, or combinations thereof, which will enable the manufacturer to determine the date and time (or shift) of manufacture, the type and source of the raw materials used, and the details of the procedures employed in producing the filler metal. This designation stays with the filler metal and can be used to identify the material later, in those cases in which identification is necessary.

4.2 Definitions. The terms *dry batch, dry blend, wet mix,* and *heat,* as they are defined and used in this document, refer to discrete quantities of the components used in producing a *lot* of filler metal. The definition of these terms and the considerations that must be given to the identification of the components to which they apply are as follows.

4.2.1 Dry Batch. A dry batch is the quantity of dry ingredients mixed at one time in one mixing vessel. Liquid binder, when added to a dry batch, produces a wet mix. A dry batch may be divided into smaller quantities, in which case the addition of the liquid binder produces as many wet mixes as there were smaller quantities.

4.2.2 Dry Blend. A dry blend consists of two or more dry batches from which quantities of each are combined proportionately, then mixed in a mixing vessel. This produces a larger quantity in which the ingredients are as uniformly dispersed as they would have been had the entire quantity been mixed together at one time in one large mixer. A dry blend, as in the case of a dry batch, may be used singly or divided into smaller quantities which, when the liquid binder is added, produce one or more wet mixes.