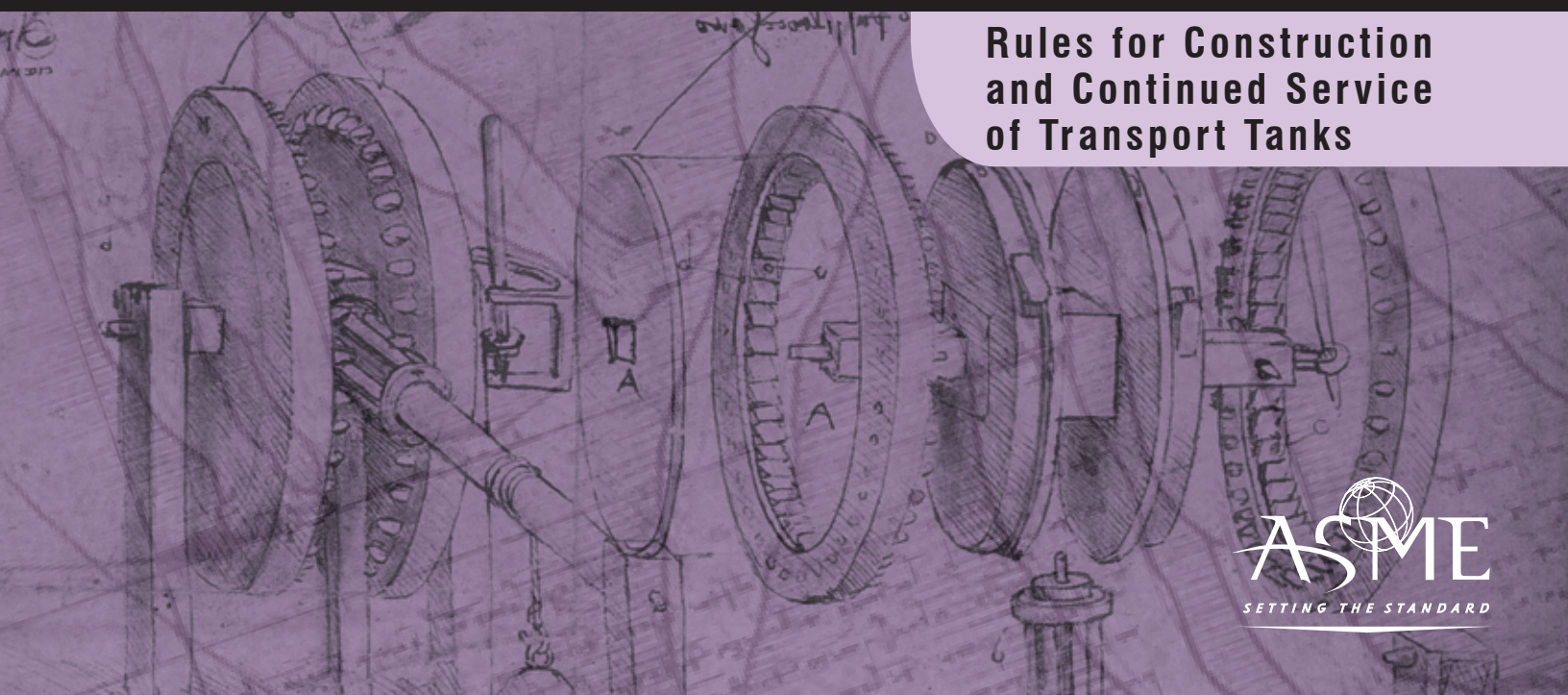
ASME BPVC.XII-2023

SECTION XII

2023 ASME Boiler and Pressure Vessel Code

An International Code

Rules for Construction and Continued Service of Transport Tanks



ASME

SETTING THE STANDARD

AN INTERNATIONAL CODE

2023 ASME Boiler & Pressure Vessel Code

2023 Edition July 1, 2023

XII

RULES FOR CONSTRUCTION AND CONTINUED SERVICE OF TRANSPORT TANKS

ASME Boiler and Pressure Vessel Committee
on Transport Tanks

The American Society of Mechanical Engineers

Two Park Avenue • New York, NY • 10016 USA

Date of Issuance: July 1, 2023

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ASME Single Certification Mark

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The American Society of Mechanical Engineers
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FOREWORD*

In 1911, The American Society of Mechanical Engineers established the Boiler and Pressure Vessel Committee to formulate standard rules for the construction of steam boilers and other pressure vessels. In 2009, the Boiler and Pressure Vessel Committee was superseded by the following committees:

(a) Committee on Power Boilers (I)
(b) Committee on Materials (II)
(c) Committee on Construction of Nuclear Facility Components (III)
(d) Committee on Heating Boilers (IV)
(e) Committee on Nondestructive Examination (V)
(f) Committee on Pressure Vessels (VIII)
(g) Committee on Welding, Brazing, and Fusing (IX)
(h) Committee on Fiber-Reinforced Plastic Pressure Vessels (X)
(i) Committee on Nuclear Inservice Inspection (XI)
(j) Committee on Transport Tanks (XII)
(k) Committee on Overpressure Protection (XIII)
(l) Technical Oversight Management Committee (TOMC)

Where reference is made to "the Committee" in this Foreword, each of these committees is included individually and collectively.

The Committee's function is to establish rules of safety relating to pressure integrity, which govern the construction** of boilers, pressure vessels, transport tanks, and nuclear components, and the inservice inspection of nuclear components and transport tanks. The Committee also interprets these rules when questions arise regarding their intent. The technical consistency of the Sections of the Code and coordination of standards development activities of the Committees is supported and guided by the Technical Oversight Management Committee. This Code does not address other safety issues relating to the construction of boilers, pressure vessels, transport tanks, or nuclear components, or the inservice inspection of nuclear components or transport tanks. Users of the Code should refer to the pertinent codes, standards, laws, regulations, or other relevant documents for safety issues other than those relating to pressure integrity. Except for Sections XI and XII, and with a few other 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. In formulating the rules, the Committee considers the needs of users, manufacturers, and inspectors of pressure vessels. The objective of the rules is to afford reasonably certain protection of life and property, and to provide a margin for deterioration in service to give a reasonably long, safe period of usefulness. Advancements in design and materials and evidence of experience have been recognized.

This Code contains mandatory requirements, specific prohibitions, and nonmandatory guidance for construction activities and inservice inspection and testing activities. The Code does not address all aspects of these activities and those aspects that 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 engineers 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 the application of these programs to their design.

* The information contained in this Foreword is not part of this American National Standard (ANS) and has not been processed in accordance with ANSI's requirements for an ANS. Therefore, this Foreword may contain material that has not been subjected to public review or a consensus process. In addition, it does not contain requirements necessary for conformance to the Code.

** *Construction*, as used in this Foreword, is an all-inclusive term comprising materials, design, fabrication, examination, inspection, testing, certification, and overpressure protection.

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 Committee meets regularly to consider revisions of the rules, new rules as dictated by technological development, Code Cases, and requests for interpretations. Only the 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 Submittal of Technical Inquiries to the Boiler and Pressure Vessel Standards Committees). Proposed revisions to the Code resulting from inquiries will be presented to the Committee for appropriate action. The action of the Committee becomes effective only after confirmation by ballot of the Committee and approval by ASME. Proposed revisions to the Code approved by the Committee are submitted to the American National Standards Institute (ANSI) and published at http://go.asme.org/BPVCPublicReview to invite comments from all interested persons. After public review and final approval by ASME, revisions are published at regular intervals in Editions of the Code.

The 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 Committee. ASME is to be notified should questions arise concerning improper use of the ASME Single Certification Mark.

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.

The words "shall," "should," and "may" are used in this Standard as follows:

- *Shall* is used to denote a requirement.
- *Should* is used to denote a recommendation.
- *May* is used to denote permission, neither a requirement nor a recommendation.

STATEMENT OF POLICY ON THE USE OF THE ASME SINGLE CERTIFICATION MARK 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 the ASME Single Certification Mark 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 ASME Single Certification Mark for the benefit of the users, the enforcement jurisdictions, and the holders of the ASME Single Certification Mark who comply with all requirements.

Based on these objectives, the following policy has been established on the usage in advertising of facsimiles of the ASME Single Certification Mark, 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 the ASME Single Certification Mark 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." An ASME corporate logo shall not be used by any organization other than ASME.

The ASME Single Certification Mark 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 the ASME Single Certification Mark who may also use the facsimile in advertising to show that clearly specified items will carry the ASME Single Certification Mark.

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 ASME Single Certification Mark described in the governing Section of the Code.

Markings such as "ASME," "ASME Standard," or any other marking including "ASME" or the ASME Single Certification Mark 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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General

ASME codes and standards are developed and maintained by committees with the intent to represent the consensus of concerned interests. Users of ASME codes and standards may correspond with the committees to propose revisions or cases, report errata, or request interpretations. Correspondence for this Section of the ASME Boiler and Pressure Vessel Code (BPVC) should be sent to the staff secretary noted on the Section's committee web page, accessible at https://go.asme.org/CSCommittees.

NOTE: See ASME BPVC Section II, Part D for guidelines on requesting approval of new materials. See Section II, Part C for guidelines on requesting approval of new welding and brazing materials ("consumables").

Revisions and Errata

The committee processes revisions to this Code on a continuous basis to incorporate changes that appear necessary or desirable as demonstrated by the experience gained from the application of the Code. Approved revisions will be published in the next edition of the Code.

In addition, the committee may post errata and Special Notices at http://go.asme.org/BPVCerrata. Errata and Special Notices become effective on the date posted. Users can register on the committee web page to receive e-mail notifications of posted errata and Special Notices.

This Code is always open for comment, and the committee welcomes proposals for revisions. Such proposals should be as specific as possible, citing the paragraph number(s), the proposed wording, and a detailed description of the reasons for the proposal, including any pertinent background information and supporting documentation.

Cases

(a) The most common applications for cases are

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

(2) to provide alternative requirements

(3) to allow users to gain experience with alternative or potential additional requirements prior to incorporation directly into the Code

(4) to permit use of a new material or process

(b) Users are cautioned that not all jurisdictions or owners automatically accept cases. Cases 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.

(c) The committee will consider proposed cases concerning the following topics only:

(1) equipment to be marked with the ASME Single Certification Mark, or

(2) equipment to be constructed as a repair/replacement activity under the requirements of Section XI

(d) A proposed case shall be written as a question and reply in the same format as existing cases. The proposal shall also include the following information:

(1) a statement of need and background information

(2) the urgency of the case (e.g., the case concerns a project that is underway or imminent)

(3) the Code Section and the paragraph, figure, or table number(s) to which the proposed case applies

(4) the edition(s) of the Code to which the proposed case applies

(e) A case is effective for use when the public review process has been completed and it is approved by the cognizant supervisory board. Cases that have been approved will appear in the next edition or supplement of the Code Cases books, "Boilers and Pressure Vessels" or "Nuclear Components." Each Code Cases book is updated with seven Supplements.

Supplements will be sent or made available automatically to the purchasers of the Code Cases books until the next edition of the Code. Annulments of Code Cases become effective six months after the first announcement of the annulment in a Code Case Supplement or Edition of the appropriate Code Case book. The status of any case is available at http://go.asme.org/BPVCCDatabase. An index of the complete list of Boiler and Pressure Vessel Code Cases and Nuclear Code Cases is available at http://go.asme.org/BPVCC.

Interpretations

(a) Interpretations clarify existing Code requirements and are written as a question and reply. Interpretations do not introduce new requirements. If a revision to resolve conflicting or incorrect wording is required to support the interpretation, the committee will issue an intent interpretation in parallel with a revision to the Code.

(b) Upon request, the committee will render an interpretation of any requirement of the Code. An interpretation can be rendered only in response to a request submitted through the online Interpretation Submittal Form at http://go.asme.org/InterpretationRequest. Upon submitting the form, the inquirer will receive an automatic e-mail confirming receipt.

(c) ASME does not act as a consultant for specific engineering problems or for the general application or understanding of the Code requirements. If, based on the information submitted, it is the opinion of the committee that the inquirer should seek assistance, the request will be returned with the recommendation that such assistance be obtained. Inquirers may track the status of their requests at http://go.asme.org/Interpretations.

(d) ASME procedures provide for reconsideration of any interpretation when or if additional information that might affect an interpretation is available. Further, persons aggrieved by an interpretation may appeal to the cognizant ASME committee or subcommittee. ASME does not “approve,” “certify,” “rate,” or “endorse” any item, construction, proprietary device, or activity.

(e) Interpretations are published in the ASME Interpretations Database at http://go.asme.org/Interpretations as they are issued.

Committee Meetings

The ASME BPVC committees regularly hold meetings that are open to the public. Persons wishing to attend any meeting should contact the secretary of the applicable committee. Information on future committee meetings can be found at http://go.asme.org/BCW.

SUMMARY OF CHANGES

Changes listed below are identified on the pages by a margin note, **(23)**, placed next to the affected area.

Page	*Location*	*Change*
xviii	List of Sections	(1) Under Section III, Division 4 added
		(2) Title of Section XI and subtitle of Section XI, Division 2 revised
		(3) Information on interpretations and Code cases moved to "Correspondence With the Committee"
xxii	Personnel	Updated
xliv	Correspondence With the Committee	Added (replaces "Submittal of Technical Inquiries to the Boiler and Pressure Vessel Standards Committees")
xlvii	Cross-Referencing in the ASME BPVC	Updated
2	TG-110.2	Subparagraph (a) revised
2	TG-120.1	Subparagraph (d) added
2	TG-130	Reference lists reformatted
17	Table TM-130.2-1	For SA-283, Type/Grade "A, B" deleted
28	Table TM-130.2-4	Entries under "Alloy Designation/UNS No." revised
29	Table TM-130.2-5	For SB-463, UNS No. revised
52	Figure TM-240.3-2	Editorially revised
66	TD-320	Added
90	TD-630	(1) Title revised
		(2) Subparagraph (b)(3) added
92	Figure TD-630	Added
96	Table TD-650	(1) For top illustration, S_v in last line of equation under "Weld Strength" deleted
		(2) For middle illustration, S_v in first and last lines of equation under "Weld Strength" deleted
170	Part TR	Last sentence deleted
173	TOP-170	Subparagraph (a) revised
176	TS-110	Subparagraph (a) revised
178	TS-200	Second line revised
199	1-1.6	(1) In subpara. (a)(1), second line revised
		(2) In subpara. (a)(3), last line revised
		(3) In subpara. (a)(5), second sentence revised
204	1-2.1	Revised
210	1-3.7	First paragraph revised
236	I-17	Revised
255	Figure VIII-2-3	In General Note (a) and its illustration, P_a/t_s and P_b/t_s corrected by errata to Pa/t_s and Pb/t_s, respectively
253	VIII-2(c)(2)	L_{b2} corrected by errata to $L_b{}^2$
253	VIII-2(d)(3)	P_a/t_s and P_b/t_s corrected by errata to Pa/t_s and Pb/t_s, respectively
278	Mandatory Appendix XIX	Deleted
303	A-9	Reference list reformatted
312	Form T-2A	For "Certificate of Shop Compliance," "T or PRT" revised to "T or PRT XII"
313	Form T-2B	For "Certificate of Shop Compliance," "T or PRT" revised to "T or PRT XII"
314	Form T-2C	For "Certificate of Shop Compliance," "T or PRT" revised to "T or PRT XII"
318	Nonmandatory Appendix D	In in-text table, for Items (1) and (3) and Note (1), "PRT" revised to "PRT XII"
325	E-6	(1) Subparagraphs (k) and (o) revised
		(2) Subparagraph (p) added
350	Nonmandatory Appendix M	Deleted
351	Nonmandatory Appendix N	Added

CROSS-REFERENCING IN THE ASME BPVC (23)

Paragraphs within the ASME BPVC may include subparagraph breakdowns, i.e., nested lists. The following is a guide to the designation and cross-referencing of subparagraph breakdowns:

(a) Hierarchy of Subparagraph Breakdowns

(1) First-level breakdowns are designated as (a), (b), (c), etc.

(2) Second-level breakdowns are designated as (1), (2), (3), etc.

(3) Third-level breakdowns are designated as (-a), (-b), (-c), etc.

(4) Fourth-level breakdowns are designated as (-1), (-2), (-3), etc.

(5) Fifth-level breakdowns are designated as (+a), (+b), (+c), etc.

(6) Sixth-level breakdowns are designated as (+1), (+2), etc.

(b) Cross-References to Subparagraph Breakdowns. Cross-references within an alphanumerically designated paragraph (e.g., PG-1, UIG-56.1, NCD-3223) do not include the alphanumerical designator of that paragraph. The crossreferences to subparagraph breakdowns follow the hierarchy of the designators under which the breakdown appears. The following examples show the format:

(1) If X.1(c)(1)(-a) is referenced in X.1(c)(1), it will be referenced as (-a).

(2) If X.1(c)(1)(-a) is referenced in X.1(c)(2), it will be referenced as (1)(-a).

(3) If X.1(c)(1)(-a) is referenced in X.1(e)(1), it will be referenced as (c)(1)(-a).

(4) If X.1(c)(1)(-a) is referenced in X.2(c)(2), it will be referenced as X.1(c)(1)(-a).

PART TG
GENERAL REQUIREMENTS

ARTICLE TG-1
SCOPE AND JURISDICTION

TG-100 INTRODUCTION

TG-100.1 INTENT

The rules of this Section constitute requirements for construction and continued service of pressure vessels for the transportation of dangerous goods via highway, rail, air, or water. *Construction* is an all-inclusive term comprising materials, design, fabrication, examination, inspection, testing, certification, and over-pressure 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. The term *pressure vessel* refers to the pressure boundary defined by the geometric scope of this Section and includes, but is not limited to, the shell, heads, and openings. The term *tank* refers to the pressure vessel, appurtenances, and additional components that are covered by the Modal Appendices (see TG-210.1).

The general requirements given in Part TG shall be met for all vessels within the scope of this Section. In addition, all the applicable requirements of Modal Appendices, which address unique service conditions of the vessel, shall be met.

TG-100.2 APPLICABILITY

(a) The rules of this Section apply specifically to pressure vessels intended for transporting dangerous goods (see Mandatory Appendix III) with design pressures appropriate for the transportation mode and volumes greater than 450 L (120 gal).

(b) Pressures normally incident to transportation, including loading and unloading operations, are to be considered.

(c) This Section does not contain rules to cover all details of design and construction, and those aspects that are not addressed shall not be considered prohibited. Where complete details are not given, the Manufacturer, subject to the acceptance of the Inspector, shall provide details of design and construction that will be as safe as those provided by the rules of this Section. In the case of Class 3 vessels, the Design Certifying Engineer shall perform this function. (For definition of *Inspector*, see TG-410.)

TG-100.3 LAWS OR REGULATIONS

The laws or regulations issued by the competent authority covering the construction and continued service of pressure vessels intended for transporting dangerous goods shall be reviewed to determine if the requirements are more restrictive than the rules of this Section. Applicable laws and regulations may contain additional requirements for pressure vessels used in the transportation of dangerous goods, which are not addressed in this Section, such as Code of Federal Regulation, Title 49, Parts 100 through 185, Transportation.

TG-110 SCOPE

TG-110.1 GEOMETRIC SCOPE OF THE PRESSURE VESSEL

(a) The geometric scope of this Section shall, as a minimum, include the pressure-containing parts of pressure vessels up to and including the following:

(1) the first threaded joint for threaded connections.

(2) the face of the first flange for flanged connections.

(3) the first sealing surface for proprietary connections or fittings for which rules are not provided in this Section.

(4) the welding end connection for the first circumferential joint for welded connections to attached piping, valves, and instruments, etc.

(5) the welding pad for attachment of any external nonpressure attachments such as shipping frames and handling points. Parts welded to these pads need not comply with (b).

(6) pressure-retaining permanent covers and closures, including seals, bolting, and other mechanical retainers at openings.

(b) Where nonpressure parts are directly welded to the pressure-retaining surface of a pressure vessel, this scope shall include the material, design, fabrication, and testing requirements established for nonpressure attachments by the applicable paragraphs of this Section.

(c) Items in addition to the *pressure vessel* transform the vessel into a *tank*. These items are addressed in the applicable Modal Appendix.

(23) TG-110.2 PHYSICAL SCOPE OF THE PRESSURE VESSEL

(a) Internal pressure shall be in the range from full vacuum to 138 bar (2,000 psig).

(b) The temperature range shall be from −269°C to 343°C (−452°F to 650°F).

(c) Thickness of shells and heads shall not exceed 38 mm (1½ in.).

TG-120 VESSEL CLASSIFICATIONS

(23) TG-120.1 CLASSIFICATIONS OUTSIDE THE SCOPE OF THIS SECTION

The following classes of pressure-containing equipment are not within the scope of this Section:

(a) those items that are within the scope of other Sections of the Code

(b) pressure-containing equipment that is an integral part or component of a rotating or reciprocating mechanical device mounted in a common setting with the vessel, where the primary design considerations and/or design stresses are derived from the functional requirements of the device

(c) piping, valves, and other components beyond the geometric scope described in TG-110.1 for the loading, transport, and unloading of the vessel contents

(d) cylinders and multiple element gas containers and the attachment of same to trailers, commonly referred to as “tube trailers”

TG-120.2 STAMPING OF VESSELS WITHIN THE SCOPE OF THIS SECTION

(a) Any vessel that meets all applicable requirements of this Section may be stamped with the Certification Mark with T designator.

(b) Vessels manufactured and stamped under this Section are not precluded from using parts stamped to Section VIII, Division 1, as long as all requirements of Section XII are met, except for marking and reporting. (See TM-110.10.)

TG-120.3 VESSEL CLASS

For the purposes of obtaining Certificates of Authorization, Inspections, and Stamping, vessels that meet all applicable requirements of this Section shall be designated as meeting one of three Classes. Vessel Class is defined in the applicable Modal Appendix. It is determined by the hazard class of the dangerous goods, pressure and mode of transport, as required by the competent authority (see, e.g., Code of Federal Regulations, Title 49, Part 173, Subpart F). Additional requirements are provided in TG-430.

TG-130 DOCUMENTS REFERENCED BY THIS SECTION (23)

TG-130.1 NORMATIVE REFERENCES

The latest edition of the following documents shall be used, unless a specific edition is listed below. Items in compliance with one of the Product Standards listed in Table TG-130 are acceptable for use in construction, unless specifically prohibited elsewhere in this Section.

ANSI/NB-23. National Board Inspection Code. National Board of Boiler and Pressure Vessel Inspectors.

ASME Boiler and Pressure Vessel Code, Section VIII. Rules for Construction of Pressure Vessels — Division 1. The American Society of Mechanical Engineers.

ASME Boiler and Pressure Vessel Code, Section VIII. Rules for Construction of Pressure Vessels — Division 2, Alternative Rules (for fatigue analysis only). The American Society of Mechanical Engineers.

ASME CA-1. Conformity Assessment Requirements. The American Society of Mechanical Engineers.

ASME QAI-1. Qualifications for Authorized Inspection. The American Society of Mechanical Engineers.

ASNT ACCP 1997, Rev. 3. ASNT Central Certification Program (for Nondestructive Testing Personnel). American Society for Nondestructive Testing.

ASNT CP-189-2006. ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel. American Society for Nondestructive Testing.

ASNT Recommended Practice No. SNT-TC-1A–2006. Guidelines for Personnel Qualification and Certification in Nondestructive Testing. American Society for Nondestructive Testing.

Code of Federal Regulations, Title 49, Parts 100 through 185, Transportation. U.S. Government Publishing Office.

ISO 1496-3:1995. Series 1 freight containers — Specification and testing — Part 3: Tank containers for liquids, gases and pressurized dry bulk. International Organization for Standardization.

ISO 21010:2017. Cryogenic vessels — Gas/materials compatibility. International Organization for Standardization.

ISO 21013-3:2016. Cryogenic vessels — Pressure relief accessories for cryogenic service — Part 3: Sizing and capacity determination. International Organization for Standardization.