ASME NM.3.1-2022
(Revision of ASME NM.3.1-2020)

Nonmetallic Materials
Part 1 — Thermoplastic Material Specifications

ASME Standards for Nonmetallic Pressure Piping Systems

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

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Date of Issuance: January 20, 2023

The next edition of this Standard is scheduled for publication in 2024. This Standard will become effective 6 months after the Date of Issuance.

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FOREWORD

In 2011, The American Society of Mechanical Engineers (ASME) established the Committee on Nonmetallic Pressure Piping Systems (NPPS) to develop standards for the construction of nonmetallic pressure piping systems. This Committee's goal was to specify construction* requirements for nonmetallic piping and piping products; such requirements were not adequately defined in existing standards.

Prior to the development of the ASME Standards for Nonmetallic Pressure Piping Systems, nonmetallic pressure piping requirements were contained within several existing standards. The nonmetallic piping requirements of the ASME B31 Code for Pressure Piping varied across Sections, with some Sections having no requirements for nonmetallic components at all. Other standards and codes, such as ASME RTP-1 and the ASME Boiler and Pressure Vessel Code (BPVC), Section X, included requirements for reinforced thermoset plastic (RTP) corrosion-resistant equipment but not for piping and piping components. ASME BPVC, Section III did have a few Code Cases that addressed requirements for some nonmetallic piping and piping components, including those made from glass-fiber-reinforced thermosetting resin and a few thermoplastics, e.g., high density polyethylene (HDPE) and poly(vinyl chloride) (PVC). However, the scope of these Code Cases was very limited, and in some cases the methodology was nearly 30 years old. The ASME NPPS Standards now serve as a centralized location for NPPS requirements and are developed by committees whose members are experts in this field. The NPPS Committee's functions are to establish requirements related to pressure integrity for the construction of nonmetallic pressure piping systems, and to interpret these requirements when questions arise regarding their intent.

ASME and the American Society for Testing and Materials (ASTM International) have cooperated for more than 50 years in the preparation of material specifications adequate for safety in the field of pressure equipment. This cooperative effort originated with metallic materials in ASME BPVC, Section II.

The evolution of this cooperative effort is described in Professor A. R. 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. The following quotations, which are based on the minutes of the ASME Boiler and Pressure Vessel Committee, are taken from Professor Greene's history and illustrate the cooperative nature of the specifications found in ASME BPVC, Section II, Material Specifications:

> "General discussion of material specifications comprising [Paragraphs] 1 to 112 of Part 2 and the advisability of having them agree with ASTM specifications." (1914)
>
> "An ASME Subcommittee . . . was appointed to confer with the American Society for Testing Materials." (1916)
>
> "Because of this co-operation the specifications of the 1918 Edition of the ASME Boiler Code were more nearly in agreement with ASTM specifications. . . . In the 1924 Edition of the Code, ten specifications were in complete agreement with ASTM specifications, four in substantial agreement, and two covered materials for which the American Society for Testing Materials had no corresponding specifications. . .
>
> "In Section II, Material Specifications, the paragraphs were given new numbers, beginning with S-1 and extending to S-213." (1925)
>
> "Section II was brought into agreement with changes made in the latest ASTM specifications since 1921." (1932)
>
> "The Subcommittee on Material Specifications . . . arranged for the introduction of the revisions of many of the specifications so that they would agree with the latest form of the earlier ASTM Specifications." (1935)

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

This cooperation has continued with the ASME NPPS Standards. ASME NM.3.1 and ASME NM.3.2 contain many material specifications that are similar to the corresponding ASTM specifications but that have been modified for use in accordance with an ASME construction standard.[**] Many of these specifications are published in dual format, i.e., they include both U.S. Customary units and SI units. The metrication protocols followed in the specifications are those adopted by ASTM, and they usually conform to the requirements of IEEE/ASTM SI 10-1997, Standard for the Use of the International System of Units (SI): The Modern Metric System.

In 1992, the ASME Board of Pressure Technology Codes and Standards endorsed the use of non-ASTM material for ASME BPVC applications with the intent that ASME's procedures and practices for the adoption of ASTM material be used for the adoption of non-ASTM materials. ASME committees continue to consider materials for use in ASME applications; see Mandatory Appendix IV for guidance on the approval of new materials.

ASME material specifications identical to those of the originating organization are identified by both the ASME symbol and the originating organization's symbol. The specifications prepared and copyrighted by ASTM and other originating organizations are reproduced in this Standard with the permission of the respective organization. The NPS Committee has carefully considered each new and revised specification, and has made such changes as deemed necessary to adapt the specification for use in accordance with an ASME construction standard. In addition, ASME has furnished ASTM with the basic requirements that should govern many proposed new specifications. Joint action will continue as to effort to make the ASTM and ASME specifications identical.

ASME NM.3.1-2020 was approved by the American National Standards Institute (ANSI) on October 29, 2020.

ASME NM.3.1-2022 was approved by ANSI on September 15, 2022.

[**] ASME construction standards include the ASME B16 series of standards, the ASME B31 Code for Pressure Piping, ASME BPVC, ASME NM.1, ASME NM.2, and ASME RTP-1.

ASME NPPS COMMITTEE
Nonmetallic Pressure Piping Systems

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

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ASTM Personnel

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CORRESPONDENCE WITH THE NPPS COMMITTEE

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 Standard should be sent to the staff secretary noted on the committee's web page, accessible at https://go.asme.org/NPPScommittee.

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

In addition, the committee may post errata on the committee web page. Errata become effective on the date posted. Users can register on the committee web page to receive e-mail notifications of posted errata.

This Standard 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 Standard

(4) to permit the 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 Standard.

(c) 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 Standard and the paragraph, figure, or table number(s)

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

(d) A case is effective for use when the public review process has been completed and it is approved by the cognizant supervisory board. Approved cases are posted on the committee web page.

Interpretations. Upon request, the committee will issue an interpretation of any requirement of this Standard. An interpretation can be issued 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.

ASME does not act as a consultant for specific engineering problems or for the general application or understanding of the Standard 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 can track the status of their requests at http://go.asme.org/Interpretations.

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.

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

Committee Meetings. The NPPS Standards Committee regularly holds meetings that are open to the public. Persons wishing to attend any meeting should contact the secretary of the committee. Information on future committee meetings can be found on the committee web page at https://go.asme.org/NPPScommittee.

SPECIFICATIONS LISTED BY MATERIALS

Polyethylene (PE)

Polyethylene of Raised Temperature (PE-RT)

Polypropylene (PP)

Polytetrafluoroethylene (PTFE)

Polyvinylidene Fluoride (PVDF)

INTRODUCTION

The ASME Standards for Nonmetallic Pressure Piping Systems (NPPS) are as follows:

NM.1 Thermoplastic Piping Systems: This Standard contains requirements for piping and piping components that are produced using thermoplastic resins or compounds. Thermoplastics are a specific group of nonmetallic materials that, for processing purposes, are capable of being repeatedly softened by increase of temperature and hardened by decrease of temperature.

NM.2 Fiber-Reinforced Thermosetting-Resin Piping Systems: This Standard contains requirements for piping and piping components that are produced using fiber reinforcement embedded in or surrounded by cured thermosetting resin.

NM.3 Nonmetallic Materials: This Standard includes specifications for nonmetallic materials (except wood, nonfibrous glass, and concrete) and, in conformance with the requirements of the individual construction standards, methodologies, design values, limits, and cautions on the use of materials. This Standard is divided into three Parts:

- NM.3.1, Nonmetallic Materials, Part 1 — Thermoplastic Material Specifications: This Part contains thermoplastic material specifications identical to or similar to those published by the American Society for Testing and Materials (ASTM International) and other recognized national or international organizations.
- NM.3.2, Nonmetallic Materials, Part 2 — Reinforced Thermoset Plastic Material Specifications: This Part contains reinforced thermoset plastic material specifications identical to or similar to those published by ASTM and other recognized national or international organizations.
- NM.3.3, Nonmetallic Materials, Part 3 — Properties: This Part provides tables and data sheets for allowable stresses, mechanical properties (e.g., tensile and yield strength), and physical properties (e.g., coefficient of thermal expansion and modulus of elasticity) for nonmetallic materials.

It is the owner's responsibility to select the piping standard that best applies to the proposed piping installation. Factors to be considered by the owner include limitations of the standard, jurisdictional requirements, and the applicability of other standards. All applicable requirements of the selected standard shall be met. For some installations, more than one standard may apply to different parts of the installation. The owner is also responsible for imposing requirements supplementary to those of the standard if such requirements are necessary to ensure safe piping for the proposed installation.

Certain piping within a facility may be subject to other codes and standards, including but not limited to the following:

ASME B31.1, Power Piping: This code contains requirements for piping typically found in electric power generating stations, industrial and institutional plants, geothermal heating systems, and central and district heating and cooling systems.

ASME B31.3, Process Piping: This code contains requirements for piping typically found in petroleum refineries; onshore and offshore petroleum and natural gas production facilities; chemical, pharmaceutical, textile, paper, ore-processing, semiconductor, and cryogenic plants; food- and beverage-processing facilities; and related processing plants and terminals.

ASME B31.4, Pipeline Transportation Systems for Liquids and Slurries: This code contains requirements for piping transporting products that are predominately liquid between plants and terminals, and within terminals and pumping, regulating, and metering stations.

ASME B31.5, Refrigeration Piping and Heat Transfer Components: This code contains requirements for piping for refrigerants and secondary coolants.

ASME B31.8, Gas Transmission and Distribution Piping Systems: This code contains requirements for piping transporting products that are predominately gas between sources and terminals, including compressor, regulating, and metering stations; and gas gathering pipelines.