ASME NM.1-2020
(Revision of ASME NM.1-2018)

Thermoplastic Piping Systems

ASME Standards for Nonmetallic Pressure Piping Systems

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

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Two Park Avenue • New York, NY • 10016 USA

Date of Issuance: December 31, 2020

The next edition of this Standard is scheduled for publication in 2022. This Standard will become effective 6 months after the Date of Issuance.

ASME issues written replies to inquiries concerning interpretations of technical aspects of this Standard. Periodically certain actions of the ASME NPPS Committee may be published as Cases. Cases and interpretations are published on the ASME website under the Committee Pages at http://cstools.asme.org/ as they are issued.

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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[1] 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 (FRP) 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 NM.1 provides requirements for the construction of thermoplastic pressure piping systems. This Standard addresses both pipe and piping components that are produced as standard products, and custom products that are designed for a specific application.

In this 2020 edition, a number of technical revisions have been made, and Chapter 5 has been rewritten in its entirety. ASME NM.1-2020 was approved by the American National Standards Institute (ANSI) on September 11, 2020.

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

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Nonmetallic Pressure Piping Systems

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General. ASME Standards are developed and maintained with the intent to represent the consensus of concerned interests. As such, users of this Standard may interact with the Committee by requesting interpretations, proposing revisions or a case, and attending Committee meetings. Correspondence should be addressed to:

Secretary, NPPS Standards Committee
The American Society of Mechanical Engineers
Two Park Avenue
New York, NY 10016-5990
http://go.asme.org/Inquiry

Proposing Revisions. Revisions are made periodically to the Standard 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 periodically.

The Committee welcomes proposals for revisions to this Standard. 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 documentation.

Proposing a Case. Cases may be issued to provide alternative rules when justified, to permit early implementation of an approved revision when the need is urgent, or to provide rules not covered by existing provisions. Cases are effective immediately upon ASME approval and shall be posted on the ASME Committee web page.

Requests for Cases shall provide a Statement of Need and Background Information. The request should identify the Standard and the paragraph, figure, or table number(s), and be written as a Question and Reply in the same format as existing Cases. Requests for Cases should also indicate the applicable edition(s) of the Standard to which the proposed Case applies.

Interpretations. Upon request, the NPPS Standards Committee will render an interpretation of any requirement of the Standard. Interpretations can only be rendered in response to a written request sent to the Secretary of the NPPS Standards Committee.

Requests for interpretation should preferably be submitted through the online Interpretation Submittal Form. The form is accessible at http://go.asme.org/InterpretationRequest. Upon submittal of the form, the Inquirer will receive an automatic e-mail confirming receipt.

If the Inquirer is unable to use the online form, he/she may mail the request to the Secretary of the NPPS Standards Committee at the above address. The request for an interpretation should be clear and unambiguous. It is further recommended that the Inquirer submit his/her request in the following format:

Subject:	Cite the applicable paragraph number(s) and the topic of the inquiry in one or two words.
Edition:	Cite the applicable edition of the Standard for which the interpretation is being requested.
Question:	Phrase the question as a request for an interpretation of a specific requirement suitable for general understanding and use, not as a request for an approval of a proprietary design or situation. Please provide a condensed and precise question, composed in such a way that a “yes” or “no” reply is acceptable.
Proposed Reply(ies):	Provide a proposed reply(ies) in the form of “Yes” or “No,” with explanation as needed. If entering replies to more than one question, please number the questions and replies.
Background Information:	Provide the Committee with any background information that will assist the Committee in understanding the inquiry. The Inquirer may also include any plans or drawings that are necessary to explain the question; however, they should not contain proprietary names or information.

Requests that are not in the format described above may be rewritten in the appropriate format by the Committee prior to being answered, which may inadvertently change the intent of the original request.

Moreover, 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 inquiry information submitted, it is the opinion of the Committee that the Inquirer should seek assistance, the inquiry will be returned with the recommendation that such assistance be obtained.

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.

Attending Committee Meetings. The NPPS Standards Committee regularly holds meetings and/or telephone conferences that are open to the public. Persons wishing to attend any meeting and/or telephone conference should contact the Secretary of the NPPS Standards Committee.

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 Glass-Fiber-Reinforced Thermosetting-Resin Piping Systems: This Standard contains requirements for piping and piping components that are produced using glass-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.

ASME B31.9, Building Services Piping: This code contains requirements for piping typically found in industrial, institutional, commercial, and public buildings, and in multi-unit residences, which does not require the range of sizes, pressures, and temperatures covered in ASME B31.1.

ASME B31.12, Hydrogen Piping and Pipelines: This code contains requirements for piping in gaseous and liquid hydrogen service, and pipelines in gaseous hydrogen service.

National Fuel Gas Code: This code contains requirements for piping for fuel gas from the point of delivery to the connection of each fuel utilization device.

NFPA 99, Health Care Facilities: This standard contains requirements for medical and laboratory gas systems.

NFPA Fire Protection Standards: These standards contain requirements for fire protection systems using water, carbon dioxide, halon, foam, dry chemicals, and wet chemicals.

The ASME NPPS Standards specify engineering requirements deemed necessary for safe design and construction of nonmetallic pressure piping. These Standards contain mandatory requirements, specific prohibitions, and nonmandatory guidance for construction activities. These Standards do not address all aspects of these activities, and those aspects that are not specifically addressed should not be considered prohibited. While safety is the overriding consideration, this factor alone will not necessarily govern the final specifications for any piping installation. With few exceptions, the requirements do not, of practical necessity, reflect the likelihood and consequences of deterioration in service related to specific service fluids or external operating environments. These Standards are not design handbooks. Many decisions that must be made to produce a safe piping installation are not specified in detail within these Standards. These Standards do not serve as substitutes for sound engineering judgment by the owner and the designer. The phrase *engineering judgment* refers to technical judgments made by knowledgeable designers experienced in the application of these Standards. Engineering judgments must be consistent with the philosophy of these Standards, and such judgments must never be used to overrule mandatory requirements or specific prohibitions of these Standards.

To the greatest possible extent, Standard requirements for design are stated in terms of basic design principles and formulas. These are supplemented as necessary with specific requirements to ensure uniform application of principles and to guide selection and application of piping elements. These Standards prohibit designs and practices known to be unsafe and contain warnings where caution, but not prohibition, is warranted.

These Standards generally specify a simplified approach for many of their requirements. A designer may choose to use a more rigorous analysis to develop design and construction requirements. When the designer decides to take this approach, he or she shall provide to the owner details and calculations demonstrating that design, fabrication, examination, inspection, testing, and overpressure protection are consistent with the criteria of these Standards. These details shall be adequate for the owner to verify the validity of the approach and shall be approved by the owner. The details shall be documented in the engineering design.

The designer is responsible for complying with requirements of these Standards and demonstrating compliance with the equations of these Standards when such equations are mandatory. These Standards neither require nor prohibit the use of computers for the design or analysis of components constructed to the requirements of these Standards. 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 for the application of these programs to their design.

These Standards do 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.

Suggested requirements of good practice are provided for the care and inspection of in-service nonmetallic pressure piping systems only as an aid to owners and their inspectors.

The requirements of these Standards 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 requirements of these Standards.

It is intended that editions of the ASME NPPS Standards not be retroactive. Unless agreement is specifically made between contracting parties to use another edition, or the regulatory body having jurisdiction imposes the use of another edition, the latest edition issued at least 6 months prior to the original contract date for the first phase of activity covering a piping installation shall be the governing document for all design, materials, fabrication, erection, examination, inspection, testing, and overpressure protection for the piping until the completion of the work and initial operation. Revisions to material specifications included in ASME NM.3.1 and ASME NM.3.2 are originated by ASTM and other recognized national or international organizations, and are usually adopted by ASME. However, those revisions do not necessarily indicate that materials produced to earlier editions of specifications are no longer suitable for ASME construction. Both ASME NM.3.1 and ASME NM.3.2 include a Mandatory Appendix, "Guideline on Acceptable ASTM Editions," that lists the

latest edition of material specifications adopted by ASME as well as other editions considered by ASME to be identical for ASME construction.

Users of these Standards are cautioned against making use of revisions to these Standards without assurance that they are acceptable to the proper authorities in the jurisdiction where the piping is to be installed.

ASME NM.1-2020
SUMMARY OF CHANGES

Following approval by the ASME NM Committee and ASME, and after public review, ASME NM.1-2020 was approved by the American National Standards Institute on September 11, 2020.

ASME NM.1-2020 includes the following changes identified by a margin note, **(20)**.

Page	*Location*	*Change*
2	1-3	(1) Definitions of *design life*, *design temperature*, *solvent-cement welding*, and *solvent-weld joint* revised (2) Definitions of *design temperature, minimum* and *qualified life* deleted (3) Definitions of *solvent welding* and *virgin plastic* added
10	2-1.2.3	Subparagraphs (b) and (e)(2) revised
14	2-3.2.1.1	Equation (2-3-2) and subpara. (a)(2) revised
16	Table 2-3.2.2-2	Under ABS Pressure Piping Components, ASTM D2661, ASTM F2135, and ASTM D3311 deleted
17	Table 2-3.2.2-3	Under ABS Pressure Piping Components, ASTM F2135 deleted
26	Table 4-2.1-1	ASTM D3311, ASTM F2135, and ASTM D2661 deleted
33	Chapter 5	Revised in its entirety
69	6-2.2.1	Subparagraphs (a) and (b) revised
69	6-2.3	First paragraph and subparas. (a)(2) and (a)(5) revised
70	6-2.7.2	Subparagraph (c)(3) revised
90	8-3.2.1	Subparagraph (c) revised
91	8-3.11	Revised in its entirety
94	8-5.4.1	Cross-reference updated
95	8-5.4.4	Former para. 8-4.4 redesignated
155	Table B-4.2.1-1	Revised
155	Table B-4.2.2-1	General Notes and Notes revised
156	Table B-4.2.2-2	Note (1) added
156	Table B-4.2.2-3	Column heads revised
157	B-5	(1) ASTM D4318 added (2) Howard, A. K. (1977) revised

Chapter 1
Scope and Definitions

1-1 SCOPE

(a) This Standard prescribes requirements for the design, materials, fabrication, erection, examination, testing, and inspection of thermoplastic piping systems.

(b) Thermoplastic piping, as used in this Standard, includes pipe, flanges, bolting, gaskets, valves, fittings, special connecting components, and the pressure-containing portions of other piping components, whether manufactured in accordance with standards referenced in this Standard or specially designed. It also includes hangers and supports and other equipment items necessary to prevent overstressing the pressure-containing components.

1-2 GENERAL

(a) Identification. This Standard covers thermoplastic pressure piping systems.

(b) Responsibilities

(1) Owner. The owner of a thermoplastic piping system installation shall have overall responsibility for compliance with this Standard, and for establishing the requirements for design, construction, examination, inspection, and testing that will govern the entire fluid-handling or process installation of which the thermoplastic piping system is a part. The owner shall also be responsible for designating the fluid service.

(2) Designer. The designer shall be responsible to the owner for assurance that the engineering design of the thermoplastic piping system complies with the requirements of this Standard and with any additional requirements established by the owner.

(3) Manufacturer, Fabricator, and Erector. The manufacturer, fabricator, and erector of thermoplastic piping systems shall be responsible for providing materials, components, and workmanship in compliance with the requirements of this Standard and of the engineering design.

(4) Owner's Inspector. The owner's Inspector (see section 6-1) shall be responsible to the owner for ensuring that the requirements of this Standard for inspection, examination, and testing, and any additional requirements established by the owner, are met.

(c) Intent of the Standard

(1) It is the intent of this Standard to set forth the requirements deemed necessary for safe construction of thermoplastic piping system installations. (Construction includes design, materials, fabrication, erection, inspection, examination, and testing.)

(2) This Standard is not intended to apply to the operation, examination, inspection, testing, maintenance, or repair of a thermoplastic piping system that has already been placed in service. The provisions of this Standard may be applied for those purposes, although other considerations may also apply.

(3) Engineering requirements of this Standard, while considered necessary and adequate for safe design, generally employ a simplified approach to the subject.

(-a) A designer capable of applying a more rigorous analysis than that included in this Standard shall have the latitude to do so; however, the approach shall be documented in the engineering design and its validity accepted by the owner.

(-b) The approach used shall provide details of design, construction, examination, inspection, and testing for the design conditions of section 2-1, with calculations consistent with the design criteria of this Standard.

(4) Thermoplastic piping systems shall conform to the specifications and standards listed in Table 4-2.1-1. Thermoplastic piping components neither specifically approved nor specifically prohibited by this Standard may be used provided they are qualified for use as set forth in applicable Chapters of this Standard.

(5) Where a thermoplastic piping system installation necessitates measures beyond those required by this Standard, such measures shall be specified in the engineering design and shall be implemented.

(6) Compatibility of materials with the intended fluid service and hazards inherent to the instability of contained fluids are not within the scope of this Standard.

(d) General Requirements

(1) The design and construction of a thermoplastic piping system shall take into consideration the limitations and conditions specific to the intended fluid service (e.g., temperature limits, necessary safeguarding), as these factors affect the selection and application of materials, components, and joints.

(2) A thermoplastic piping system shall meet the most restrictive requirements of each of its components.

(e) Fluid Service

(1) The fluid service requirements considered in the development of this Standard include those for nontoxic fluids (including slurries) and gases, and flammable or