ASME NM.3.3-2018

Nonmetallic Materials

Part 3 — Properties

ASME Standards for Nonmetallic Pressure Piping Systems

AN AMERICAN NATIONAL STANDARD

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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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CONTENTS

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.

The first edition of ASME NM.3.3 contains stress tables and physical properties tables for thermoplastic materials as well as data sheets for six reinforced thermoset plastic material constructions. ASME NM.3.3-2018 was approved by the American National Standards Institute (ANSI) on August 16, 2018.

[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

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.

SUBPART 1
STRESS TABLES

STATEMENT OF POLICY ON INFORMATION PROVIDED IN THE STRESS TABLES

The purpose of this Statement of Policy is to clarify which information in the stress tables is mandatory and which is not. The information and restrictions provided in the Notes found throughout the various stress tables provided in this Subpart are mandatory. It is vital to recognize that lines of information in Tables 1-1-1, 1-1-2, and 1-1-3 (Tables 1-1-1M, 1-1-2M, and 1-1-3M) frequently have essential information referenced in the Notes column. These Notes are organized as follows:

(a) General Notes. These notes are applicable to all materials presented in the specific table.

(b) MXX — Material Notes. These notes are applicable to materials of a specific material nominal composition (e.g., polyethylene), product form (e.g., extruded pipe), and/or type/grade (e.g., PE4710).

(c) CXX — Construction Standard Notes. These notes are applicable to requirements for a specific construction standard (e.g., ASME NM.1).

The specifications and grades or types, coupled with the assigned Notes for each line, provide the complete description of material in the context of the allowable stresses or allowable stress ranges. Additional requirements for particular types of construction must also be obtained from the requirements governing the construction.

In Tables 1-1-1, 1-1-2, and 1-1-3 (Tables 1-1-1M, 1-1-2M, and 1-1-3M), the information in the nominal composition column is nonmandatory and is for information only. However, these nominal compositions are the primary sorting used in these tables.

Where provided, the information in the columns for product form, specification number, type/grade, size/thickness, and external pressure chart number is mandatory. The information in the material grouping column is also mandatory; however, the primary source for this information is ASME BPVC, Section IX, Table QF-422. When there is a conflict between the material grouping information in these stress tables and that in ASME BPVC, Section IX, the numbers in Section IX shall govern.

The information in the minimum tensile strength and minimum yield strength columns is nonmandatory. These values, as well as the temperature-dependent values provided in Table 1-1-Y (Table 1-1-YM) may be invoked by the construction standard in the determination of some form of allowable stress values (e.g., a short-duration load) but do not typically form the basis for long-term allowable stress values for nonmetallic materials. When there is a conflict between the tensile and yield strength values in the stress tables and those in the material specifications in ASME NM.3.1 and ASME NM.3.2, the values in ASME NM.3.1 and ASME NM.3.2 shall govern.

The information in the applicability and maximum temperature limits columns is mandatory. Different construction standards often have different use-temperature limits for the same material and condition. Where a material is permitted for use in the construction code or standard, and is in the SI units version of these tables, the maximum use-temperature limit in these columns is critical. Further, in the SI units version of the stress tables, values may be listed in the table at temperatures above the maximum use-temperature limit. These stress values are provided solely to permit interpolation to be used to determine the allowable stress or allowable stress range at temperatures between the next lowest temperature for which stress values are listed and the maximum use-temperature limit listed in these columns.

GUIDELINE ON LOCATING MATERIALS IN STRESS TABLES, AND IN TABLES OF MECHANICAL AND PHYSICAL PROPERTIES

1 INTRODUCTION

The goal of this Guideline is to assist the users of ASME NM.3.3 in locating materials in the thermoplastic stress tables, tables of thermoplastic mechanical properties, tables of thermoplastic physical properties, and thermoset data sheets. This Guideline defines the logic used to place materials within these tables.

Tables and data sheets whose designators have a prefix of "1-" or "2-" can be found in Subpart 1 or Subpart 2, respectively. Stress tables and mechanical property tables have prefixes of "1-1-," data sheets have prefixes of "1-2-," and physical property tables have prefixes of "2-." The suffix "M" indicates that SI units (metric) are used.

2 STRESS TABLES

Tables 1-1-1 and 1-1-2 (Tables 1-1-1M and 1-1-2M) cover allowable stresses, while Table 1-1-3 (Table 1-1-3M) covers allowable stress ranges. Although Subpart 1 also covers (where applicable based on material type) yield strength, the organization of those mechanical property tables is discussed separately in section 3. A table-by-table explanation of the materials organization logic used to place materials within the designated tables follows.

2.1 Table 1-1-1 (Table 1-1-1M)

Table 1-1-1 (Table 1-1-1M) provides allowable stresses for thermoplastic[1] materials used in ASME NM.1 construction. Within these tables, the first step in ordering materials is to use their nominal compositions. These nominal compositions are nothing more than widely recognized designators for each thermoplastic material. These nominal compositions are arranged as follows:

(a) chlorinated poly(vinyl chlorides) (CPVCs)
(b) polyamides (PAs)
(c) polyethylenes (PEs)
(d) polyethylenes of raised temperatures (PE-RTs)
(e) poly(vinyl chlorides) (PVCs)
(f) poly(vinylidene fluorides) (PVDFs)

For a given nominal composition, these tables are arranged by increasing yield strength. For a given nominal composition and yield strength, stress listings are provided in order of increasing specification number.

Sometimes, for a given nominal composition, yield strength, specification number, and grade or type, there may be more than one line of stresses. At this point, the Notes referenced will define why there are two or more lines of stresses and when each applies.

2.2 Table 1-1-2 (Table 1-1-2M)

Table 1-1-2 (Table 1-1-2M) provides allowable compressive stresses for thermoplastic materials used in ASME NM.1 construction. This table is organized in the same manner as Table 1-1-1 (Table 1-1-1M); see para. 2.1.

2.3 Table 1-1-3 (Table 1-1-3M)

Table 1-1-3 (Table 1-1-3M) provides allowable secondary stress ranges for thermoplastic materials used in ASME NM.1 construction. These tables are organized in the same manner as the preceding tables; see para. 2.1.

3 MECHANICAL PROPERTY TABLES

Yield strength values (where applicable based on material type) are to be used in design calculations according to the requirements of the construction standards. However, they are not to be construed as minimum strength values at temperature. This is explained in the General Notes to these tables. Paragraph 3.1 explains the materials-organization logic.

3.1 Table 1-1-Y (Table 1-1-YM)

Table 1-1-Y (Table 1-1-YM) provides yield strength values for thermoplastic materials. The ordering of yield strength lines parallels the logic described for thermoplastic materials in para. 2.1. It is important to note that yield strength typically does not form the basis for long-term allowable stress values for thermoplastic materials; values of yield strength should therefore only be used in design where allowed by the construction standard.

[1] ASME uses the current ASTM definition of *thermoplastic* — a plastic that repeatedly can be softened by heating and hardened by cooling through a temperature range characteristic of the plastic, and that in the softened state can be shaped by flow into articles by molding or extrusion.

4 PHYSICAL PROPERTY TABLES

Physical properties (thermal conductivity, thermal diffusivity, thermal expansion, and density), modulus of elasticity, and Poisson's ratio values are presented in the tables in Subpart 2 and are based on nominal composition (e.g., polyethylene), product form (e.g., extruded pipe), and/or type/grade (e.g., PE4710). Paragraphs 4.1 through 4.4 describe how these tables are organized.

4.1 Table 2-1 (Table 2-1M)

Table 2-1 (Table 2-1M) covers thermal expansion behavior, presented in terms of A (instantaneous coefficient of thermal expansion), B (mean coefficient of thermal expansion), and C (linear thermal expansion). They cover numerous individual thermoplastic materials and thermoplastic material groupings (as applicable). Notes at the end of the tables list the materials covered by the designated groupings. Groupings may be by nominal composition (e.g., polyethylene), product form (e.g., extruded pipe), and/or type/grade (e.g., PE4710), as applicable.

4.2 Table 2-2 (Table 2-2M)

Table 2-2 (Table 2-2M) provides both thermal conductivity (TC) and thermal diffusivity (TD) values. They cover numerous individual thermoplastic materials and thermoplastic material groupings (as applicable). Notes at the end of the tables list the materials covered by the designated groupings. Groupings may be by nominal composition (e.g., polyethylene), product form (e.g., extruded pipe), and/or type/grade (e.g., PE4710), as applicable.

4.3 Table 2-3 (Table 2-3M)

Table 2-3 (Table 2-3M) provides moduli of elasticity for materials. For some materials, moduli of elasticity may vary significantly with stress and/or load duration, in addition to temperature; for such materials, moduli of elasticity values are provided in terms of stress and/or load duration, in addition to temperature. The tables cover numerous individual thermoplastic materials and thermoplastic material groupings (as applicable). Notes at the end of the tables list the materials covered by the designated groupings. Groupings may be by nominal composition (e.g., polyethylene), product form (e.g., extruded pipe), and/or type/grade (e.g., PE4710), as applicable.

4.4 Table 2-4 (Table 2-4M)

Table 2-4 (Table 2-4M) provides Poisson's ratio and density for thermoplastic materials.

5 THERMOSET DATA SHEETS

Allowable stress values, mechanical properties, and physical properties required for all constructions are provided in data sheets. Data sheets are provided for the following thermoset[2] constructions:

(a) Type I unsaturated polyester resin [Table 1-2.1-1 (Table 1-2.1-1M)]

(b) Type II unsaturated polyester resin [Table 1-2.1-2 (Table 1-2.1-2M)]

(c) 55-deg wind angle unsaturated polyester resin (Type III) [Table 1-2.1-3 (Table 1-2.1-3M)]

(d) Type I vinyl ester resin [Table 1-2.2-1 (Table 1-2.2-1M)]

(e) Type II vinyl ester resin [Table 1-2.2-2 (Table 1-2.2-2M)]

(f) 55-deg wind angle vinyl ester resin (Type III) [Table 1-2.2-3 (Table 1-2.2-3M)]

6 REFERENCES

Plastic definitions and abbreviations used in this Standard are taken from ASTM D883, Standard Terminology Relating to Plastics, and ASTM D1600, Standard Terminology for Abbreviated Terms Relating to Plastics, respectively.

[2] ASME uses the current ASTM definition of *thermoset* — a plastic that, after having been cured by heat or other means, is substantially infusible and insoluble.

Table 1-1-1 Maximum Allowable Stress Values, S, for Thermoplastic Materials

Line No.	Nominal Composition	Product Form	ASME Spec. No.	Type/Grade	Construction Code Notes	Minimum Yield Strength, ksi	Maximum Temperature Limit, °F	Design Factor
1	CPVC	Extruded pipe	SD-2846	CPVC 4120-05	C01	7.0	200	D01
2	CPVC	Extruded pipe	SD-2846	CPVC 4120-05	C01	7.0	200	D02
3	CPVC	Extruded pipe	SD-2846	CPVC 4120-05	C01	7.0	200	D03
4	CPVC	Extruded pipe	SD-2846	CPVC 4120-06	C01	7.0	200	D01
5	CPVC	Extruded pipe	SD-2846	CPVC 4120-06	C01	7.0	200	D02
6	CPVC	Extruded pipe	SD-2846	CPVC 4120-06	C01	7.0	200	D03
7	CPVC	Extruded pipe	SF-441	CPVC 4120-05	C01	7.0	200	D01
8	CPVC	Extruded pipe	SF-441	CPVC 4120-05	C01	7.0	200	D02
9	CPVC	Extruded pipe	SF-441	CPVC 4120-05	C01	7.0	200	D03
10	CPVC	Extruded pipe	SF-441	CPVC 4120-06	C01	7.0	200	D01
11	CPVC	Extruded pipe	SF-441	CPVC 4120-06	C01	7.0	200	D02
12	CPVC	Extruded pipe	SF-441	CPVC 4120-06	C01	7.0	200	D03
13	CPVC	Extruded pipe	SF-442	CPVC 4120-05	C01	7.0	200	D01
14	CPVC	Extruded pipe	SF-442	CPVC 4120-05	C01	7.0	200	D02
15	CPVC	Extruded pipe	SF-442	CPVC 4120-05	C01	7.0	200	D03
16	CPVC	Extruded pipe	SF-442	CPVC 4120-06	C01	7.0	200	D01
17	CPVC	Extruded pipe	SF-442	CPVC 4120-06	C01	7.0	200	D02
19	Polyamide	Extruded pipe	SF-2945	PA 32312	...	7.0	180	D01
20	Polyamide	Extruded pipe	SF-2945	PA 32312	...	7.0	180	D02
21	Polyamide	Extruded pipe	SF-2945	PA 32312	...	7.0	180	D03
22	Polyamide	Extruded pipe	SF-2945	PA 32316	...	7.0	180	D01
23	Polyamide	Extruded pipe	SF-2945	PA 32316	...	7.0	180	D02
24	Polyamide	Extruded pipe	SF-2945	PA 32316	...	7.0	180	D03
25	Polyethylene	Extruded pipe	SD-2239	PE2708	...	2.6	140	D04
26	Polyethylene	Extruded pipe	SD-2239	PE2708	...	2.6	140	D05
27	Polyethylene	Extruded pipe	SD-2239	PE2708	...	2.6	140	D07
28	Polyethylene	Extruded pipe	SD-2239	PE2708	...	2.6	140	D08
29	Polyethylene	Extruded pipe	SD-2239	PE2708	...	2.6	180	D04
30	Polyethylene	Extruded pipe	SD-2239	PE2708	...	2.6	180	D05
31	Polyethylene	Extruded pipe	SD-2239	PE2708	...	2.6	180	D07
32	Polyethylene	Extruded pipe	SD-2239	PE2708	...	2.6	180	D08
33	Polyethylene	Extruded pipe	SD-2513	PE2708	...	2.6	140	D04
34	Polyethylene	Extruded pipe	SD-2513	PE2708	...	2.6	140	D05
35	Polyethylene	Extruded pipe	SD-2513	PE2708	...	2.6	140	D07
36	Polyethylene	Extruded pipe	SD-2513	PE2708	...	2.6	140	D08

Table 1-1-1 Maximum Allowable Stress Values, *S*, for Thermoplastic Materials

Line No.	Notes	Maximum Allowable Stress, ksi [Note (1)], for Material Temperature, °F, Not Exceeding													
		73	80	90	100	110	120	130	140	150	160	170	180	190	200
1	M01	1.60	1.51	1.38	1.25	1.13	1.02	0.907	0.798	0.694	0.593	0.495	0.400	0.308	0.219
2	M01	2.00	1.88	1.72	1.57	1.42	1.27	1.13	0.998	0.867	0.741	0.619	0.500	0.385	0.274
3	M01	4.00	3.77	3.45	3.14	2.84	2.55	2.27	2.00	1.74	1.48	1.24	1.00	0.770	0.547
4	M02	1.60	1.52	1.40	1.28	1.17	1.07	0.964	0.865	0.769	0.677	0.587	0.500	0.416	0.334
5	M02	2.00	1.89	1.75	1.60	1.47	1.33	1.21	1.08	0.962	0.846	0.734	0.625	0.520	0.417
6	M02	4.00	3.79	3.49	3.21	2.93	2.67	2.41	2.16	1.92	1.69	1.47	1.25	1.04	0.835
7	M01	1.60	1.51	1.38	1.25	1.13	1.02	0.907	0.798	0.694	0.593	0.495	0.400	0.308	0.219
8	M01	2.00	1.88	1.72	1.57	1.42	1.27	1.13	0.998	0.867	0.741	0.619	0.500	0.385	0.274
9	M01	4.00	3.77	3.45	3.14	2.84	2.55	2.27	2.00	1.74	1.48	1.24	1.00	0.770	0.547
10	M02	1.60	1.52	1.40	1.28	1.17	1.07	0.964	0.865	0.769	0.677	0.587	0.500	0.416	0.334
11	M02	2.00	1.89	1.75	1.60	1.47	1.33	1.21	1.08	0.962	0.846	0.734	0.625	0.520	0.417
12	M02	4.00	3.79	3.49	3.21	2.93	2.67	2.41	2.16	1.92	1.69	1.47	1.25	1.04	0.835
13	M01	1.60	1.51	1.38	1.25	1.13	1.02	0.907	0.798	0.694	0.593	0.495	0.400	0.308	0.219
14	M01	2.00	1.88	1.72	1.57	1.42	1.27	1.13	0.998	0.867	0.741	0.619	0.500	0.385	0.274
15	M01	4.00	3.77	3.45	3.14	2.84	2.55	2.27	2.00	1.74	1.48	1.24	1.00	0.770	0.547
16	M02	1.60	1.52	1.40	1.28	1.17	1.07	0.964	0.865	0.769	0.677	0.587	0.500	0.416	0.334
17	M02	2.00	1.89	1.75	1.60	1.47	1.33	1.21	1.08	0.962	0.846	0.734	0.625	0.520	0.417
19	M03	1.00	0.958	0.900	0.845	0.791	0.739	0.689	0.640	0.603	0.568	0.533	0.500	...	...
20	M03	1.25	1.20	1.13	1.06	0.988	0.923	0.861	0.800	0.754	0.710	0.667	0.625	...	...
21	M03	2.50	2.40	2.25	2.11	1.98	1.85	1.72	1.60	1.51	1.42	1.33	1.25	...	...
22	M04	1.26	1.21	1.15	1.08	1.02	0.959	0.902	0.846	0.792	0.740	0.689	0.640	...	...
23	M04	1.58	1.52	1.43	1.35	1.27	1.20	1.13	1.06	0.990	0.925	0.861	0.800	...	...
24	M04	3.15	3.03	2.86	2.70	2.55	2.40	2.25	2.12	1.98	1.85	1.72	1.60	...	...
25	M05, M06	0.400	0.391	0.378	0.365	0.353	0.342	0.331	0.320	...	...	...	...	...	...
26	M05, M06	0.500	0.488	0.472	0.457	0.442	0.427	0.413	0.400	...	...	...	...	...	...
27	M05, M06	0.788	0.769	0.744	0.719	0.696	0.673	0.651	0.630	...	...	...	...	...	...
28	M05, M06	1.25	1.22	1.18	1.14	1.11	1.07	1.03	1.00	...	...	...	...	...	...
29	M05, M07	0.400	0.385	0.363	0.343	0.323	0.304	0.285	0.267	0.250	0.233	0.217	0.202	...	...
30	M05, M07	0.500	0.481	0.454	0.428	0.404	0.380	0.357	0.334	0.313	0.292	0.272	0.252	...	...
31	M05, M07	0.788	0.757	0.715	0.675	0.636	0.598	0.562	0.527	0.493	0.460	0.428	0.397	...	...
32	M05, M07	1.25	1.20	1.14	1.07	1.01	0.949	0.892	0.836	0.782	0.730	0.679	0.630	...	...
33	M06, M08	0.400	0.391	0.378	0.365	0.353	0.342	0.331	0.320	...	...	...	...	...	...
34	M06, M08	0.500	0.488	0.472	0.457	0.442	0.427	0.413	0.400	...	...	...	...	...	...
35	M06, M08	0.788	0.769	0.744	0.719	0.696	0.673	0.651	0.630	...	...	...	...	...	...
36	M06, M08	1.25	1.22	1.18	1.14	1.11	1.07	1.03	1.00	...	...	...	...	...	...

Table 1-1-1 Maximum Allowable Stress Values, *S*, for Thermoplastic Materials (Cont'd)

Line No.	Nominal Composition	Product Form	ASME Spec. No.	Type/Grade	Construction Code Notes	Minimum Yield Strength, ksi	Maximum Temperature Limit, °F	Design Factor
37	Polyethylene	Extruded pipe	SD-2513	PE2708	...	2.6	180	D04
38	Polyethylene	Extruded pipe	SD-2513	PE2708	...	2.6	180	D05
39	Polyethylene	Extruded pipe	SD-2513	PE2708	...	2.6	180	D07
40	Polyethylene	Extruded pipe	SD-2513	PE2708	...	2.6	180	D08
41	Polyethylene	Extruded tube	SD-2737	PE2708	...	2.6	140	D04
42	Polyethylene	Extruded tube	SD-2737	PE2708	...	2.6	140	D05
43	Polyethylene	Extruded tube	SD-2737	PE2708	...	2.6	140	D07
44	Polyethylene	Extruded tube	SD-2737	PE2708	...	2.6	140	D08
45	Polyethylene	Extruded tube	SD-2737	PE2708	...	2.6	180	D04
46	Polyethylene	Extruded tube	SD-2737	PE2708	...	2.6	180	D05
47	Polyethylene	Extruded tube	SD-2737	PE2708	...	2.6	180	D07
48	Polyethylene	Extruded tube	SD-2737	PE2708	...	2.6	180	D08
49	Polyethylene	Extruded pipe	SD-3035	PE2708	...	2.6	140	D04
50	Polyethylene	Extruded pipe	SD-3035	PE2708	...	2.6	140	D05
51	Polyethylene	Extruded pipe	SD-3035	PE2708	...	2.6	140	D07
52	Polyethylene	Extruded pipe	SD-3035	PE2708	...	2.6	140	D08
53	Polyethylene	Extruded pipe	SD-3035	PE2708	...	2.6	180	D04
54	Polyethylene	Extruded pipe	SD-3035	PE2708	...	2.6	180	D05
55	Polyethylene	Extruded pipe	SD-3035	PE2708	...	2.6	180	D07
56	Polyethylene	Extruded pipe	SD-3035	PE2708	...	2.6	180	D08
57	Polyethylene	Extruded pipe	SF-714	PE2708	...	2.6	140	D04
58	Polyethylene	Extruded pipe	SF-714	PE2708	...	2.6	140	D05
59	Polyethylene	Extruded pipe	SF-714	PE2708	...	2.6	140	D07
60	Polyethylene	Extruded pipe	SF-714	PE2708	...	2.6	140	D08
61	Polyethylene	Extruded pipe	SF-714	PE2708	...	2.6	180	D04
62	Polyethylene	Extruded pipe	SF-714	PE2708	...	2.6	180	D05
63	Polyethylene	Extruded pipe	SF-714	PE2708	...	2.6	180	D07
64	Polyethylene	Extruded pipe	SF-714	PE2708	...	2.6	180	D08
65	Polyethylene	Extruded pipe	SD-2239	PE3608	...	3.0	140	D04
66	Polyethylene	Extruded pipe	SD-2239	PE3608	...	3.0	140	D05
67	Polyethylene	Extruded pipe	SD-2239	PE3608	...	3.0	140	D06
68	Polyethylene	Extruded pipe	SD-2239	PE3608	...	3.0	140	D08
69	Polyethylene	Extruded pipe	SD-2239	PE3608	...	3.0	140	D04
70	Polyethylene	Extruded pipe	SD-2239	PE3608	...	3.0	140	D05
71	Polyethylene	Extruded pipe	SD-2239	PE3608	...	3.0	140	D06
72	Polyethylene	Extruded pipe	SD-2239	PE3608	...	3.0	140	D08
73	Polyethylene	Extruded pipe	SD-2239	PE4608	...	3.0	140	D04
74	Polyethylene	Extruded pipe	SD-2239	PE4608	...	3.0	140	D05
75	Polyethylene	Extruded pipe	SD-2239	PE4608	...	3.0	140	D06
76	Polyethylene	Extruded pipe	SD-2239	PE4608	...	3.0	140	D08

Table 1-1-1 Maximum Allowable Stress Values, *S*, for Thermoplastic Materials (Cont'd)

Line No.	Notes	Maximum Allowable Stress, ksi [Note (1)], for Material Temperature, °F, Not Exceeding													
		73	80	90	100	110	120	130	140	150	160	170	180	190	200
37	M07, M08	0.400	0.385	0.363	0.343	0.323	0.304	0.285	0.267	0.250	0.233	0.217	0.202	...	...
38	M07, M08	0.500	0.481	0.454	0.428	0.404	0.380	0.357	0.334	0.313	0.292	0.272	0.252	...	...
39	M07, M08	0.788	0.757	0.715	0.675	0.636	0.598	0.562	0.527	0.493	0.460	0.428	0.397	...	...
40	M07, M08	1.25	1.20	1.14	1.07	1.01	0.949	0.892	0.836	0.782	0.730	0.679	0.630	...	...
41	M05, M06	0.400	0.391	0.378	0.365	0.353	0.342	0.331	0.320	...	...	...	...	...	...
42	M05, M06	0.500	0.488	0.472	0.457	0.442	0.427	0.413	0.400	...	...	...	...	...	...
43	M05, M06	0.788	0.769	0.744	0.719	0.696	0.673	0.651	0.630	...	...	...	...	...	...
44	M05, M06	1.25	1.22	1.18	1.14	1.11	1.07	1.03	1.00	...	...	...	...	...	...
45	M05, M07	0.400	0.385	0.363	0.343	0.323	0.304	0.285	0.267	0.250	0.233	0.217	0.202	...	...
46	M05, M07	0.500	0.481	0.454	0.428	0.404	0.380	0.357	0.334	0.313	0.292	0.272	0.252	...	...
47	M05, M07	0.788	0.757	0.715	0.675	0.636	0.598	0.562	0.527	0.493	0.460	0.428	0.397	...	...
48	M05, M07	1.25	1.20	1.14	1.07	1.01	0.949	0.892	0.836	0.782	0.730	0.679	0.630	...	...
49	M05, M06	0.400	0.391	0.378	0.365	0.353	0.342	0.331	0.320	...	...	...	...	...	...
50	M05, M06	0.500	0.488	0.472	0.457	0.442	0.427	0.413	0.400	...	...	...	...	...	...
51	M05, M06	0.788	0.769	0.744	0.719	0.696	0.673	0.651	0.630	...	...	...	...	...	...
52	M05, M06	1.25	1.22	1.18	1.14	1.11	1.07	1.03	1.00	...	...	...	...	...	...
53	M05, M07	0.400	0.385	0.363	0.343	0.323	0.304	0.285	0.267	0.250	0.233	0.217	0.202	...	...
54	M05, M07	0.500	0.481	0.454	0.428	0.404	0.380	0.357	0.334	0.313	0.292	0.272	0.252	...	...
55	M05, M07	0.788	0.757	0.715	0.675	0.636	0.598	0.562	0.527	0.493	0.460	0.428	0.397	...	...
56	M05, M07	1.25	1.20	1.14	1.07	1.01	0.949	0.892	0.836	0.782	0.730	0.679	0.630	...	...
57	M06, M08	0.400	0.391	0.378	0.365	0.353	0.342	0.331	0.320	...	...	...	...	...	...
58	M06, M08	0.500	0.488	0.472	0.457	0.442	0.427	0.413	0.400	...	...	...	...	...	...
59	M06, M08	0.788	0.769	0.744	0.719	0.696	0.673	0.651	0.630	...	...	...	...	...	...
60	M06, M08	1.25	1.22	1.18	1.14	1.11	1.07	1.03	1.00	...	...	...	...	...	...
61	M07, M08	0.400	0.385	0.363	0.343	0.323	0.304	0.285	0.267	0.250	0.233	0.217	0.202	...	...
62	M07, M08	0.500	0.481	0.454	0.428	0.404	0.380	0.357	0.334	0.313	0.292	0.272	0.252	...	...
63	M07, M08	0.788	0.757	0.715	0.675	0.636	0.598	0.562	0.527	0.493	0.460	0.428	0.397	...	...
64	M07, M08	1.25	1.20	1.14	1.07	1.01	0.949	0.892	0.836	0.782	0.730	0.679	0.630	...	...
65	M05, M09	0.512	0.482	0.441	0.401	0.363	0.326	0.291	0.256	...	...	...	...	...	...
66	M05, M09	0.640	0.603	0.551	0.502	0.454	0.408	0.363	0.320	...	...	...	...	...	...
67	M05, M09	0.800	0.754	0.689	0.627	0.567	0.510	0.454	0.400	...	...	...	...	...	...
68	M05, M09	1.60	1.51	1.38	1.26	1.14	1.02	0.908	0.800	...	...	...	...	...	...
69	M05, M10	0.512	0.490	0.459	0.429	0.400	0.373	0.346	0.320	...	...	...	...	...	...
70	M05, M10	0.640	0.612	0.574	0.536	0.500	0.466	0.432	0.400	...	...	...	...	...	...
71	M05, M10	0.800	0.765	0.717	0.670	0.626	0.582	0.540	0.500	...	...	...	...	...	...
72	M05, M10	1.60	1.53	1.43	1.34	1.25	1.17	1.08	1.00	...	...	...	...	...	...
73	M05, M10	0.512	0.490	0.459	0.429	0.400	0.373	0.346	0.320	...	...	...	...	...	...
74	M05, M10	0.640	0.612	0.574	0.536	0.500	0.466	0.432	0.400	...	...	...	...	...	...
75	M05, M10	0.800	0.765	0.717	0.670	0.626	0.582	0.540	0.500	...	...	...	...	...	...
76	M05, M10	1.60	1.53	1.43	1.34	1.25	1.17	1.08	1.00	...	...	...	...	...	...

Table 1-1-1 Maximum Allowable Stress Values, *S*, for Thermoplastic Materials (Cont'd)

Line No.	Nominal Composition	Product Form	ASME Spec. No.	Type/Grade	Construction Code Notes	Minimum Yield Strength, ksi	Maximum Temperature Limit, °F	Design Factor
77	Polyethylene	Extruded pipe	SD-2239	PE4710	...	3.0	140	D04
78	Polyethylene	Extruded pipe	SD-2239	PE4710	...	3.0	140	D05
79	Polyethylene	Extruded pipe	SD-2239	PE4710	...	3.0	140	D07
80	Polyethylene	Extruded pipe	SD-2239	PE4710	...	3.0	140	D08
81	Polyethylene	Extruded pipe	SD-2239	PE4710	...	3.0	140	D04
82	Polyethylene	Extruded pipe	SD-2239	PE4710	...	3.0	140	D05
83	Polyethylene	Extruded pipe	SD-2239	PE4710	...	3.0	140	D07
84	Polyethylene	Extruded pipe	SD-2239	PE4710	...	3.0	140	D08
85	Polyethylene	Extruded pipe	SD-2239	PE4710	...	3.0	180	D04
86	Polyethylene	Extruded pipe	SD-2239	PE4710	...	3.0	180	D05
87	Polyethylene	Extruded pipe	SD-2239	PE4710	...	3.0	180	D07
88	Polyethylene	Extruded pipe	SD-2239	PE4710	...	3.0	180	D08
89	Polyethylene	Extruded pipe	SD-2513	PE4710	...	3.0	140	D04
90	Polyethylene	Extruded pipe	SD-2513	PE4710	...	3.0	140	D05
91	Polyethylene	Extruded pipe	SD-2513	PE4710	...	3.0	140	D07
92	Polyethylene	Extruded pipe	SD-2513	PE4710	...	3.0	140	D08
93	Polyethylene	Extruded pipe	SD-2513	PE4710	...	3.0	140	D04
94	Polyethylene	Extruded pipe	SD-2513	PE4710	...	3.0	140	D05
95	Polyethylene	Extruded pipe	SD-2513	PE4710	...	3.0	140	D07
96	Polyethylene	Extruded pipe	SD-2513	PE4710	...	3.0	140	D08
97	Polyethylene	Extruded pipe	SD-2513	PE4710	...	3.0	180	D04
98	Polyethylene	Extruded pipe	SD-2513	PE4710	...	3.0	180	D05
99	Polyethylene	Extruded pipe	SD-2513	PE4710	...	3.0	180	D07
100	Polyethylene	Extruded pipe	SD-2513	PE4710	...	3.0	180	D08
101	Polyethylene	Extruded tube	SD-2737	PE3608	...	3.0	140	D04
102	Polyethylene	Extruded tube	SD-2737	PE3608	...	3.0	140	D05
103	Polyethylene	Extruded tube	SD-2737	PE3608	...	3.0	140	D06
104	Polyethylene	Extruded tube	SD-2737	PE3608	...	3.0	140	D08
105	Polyethylene	Extruded tube	SD-2737	PE3608	...	3.0	140	D04
106	Polyethylene	Extruded tube	SD-2737	PE3608	...	3.0	140	D05
107	Polyethylene	Extruded tube	SD-2737	PE3608	...	3.0	140	D06
108	Polyethylene	Extruded tube	SD-2737	PE3608	...	3.0	140	D08
109	Polyethylene	Extruded tube	SD-2737	PE4608	...	3.0	140	D04
110	Polyethylene	Extruded tube	SD-2737	PE4608	...	3.0	140	D05
111	Polyethylene	Extruded tube	SD-2737	PE4608	...	3.0	140	D06
112	Polyethylene	Extruded tube	SD-2737	PE4608	...	3.0	140	D08
113	Polyethylene	Extruded tube	SD-2737	PE4710	...	3.0	140	D04
114	Polyethylene	Extruded tube	SD-2737	PE4710	...	3.0	140	D05
115	Polyethylene	Extruded tube	SD-2737	PE4710	...	3.0	140	D07
116	Polyethylene	Extruded tube	SD-2737	PE4710	...	3.0	140	D08

Table 1-1-1 Maximum Allowable Stress Values, *S*, for Thermoplastic Materials (Cont'd)

Line No.	Notes	Maximum Allowable Stress, ksi [Note (1)], for Material Temperature, °F, Not Exceeding													
		73	80	90	100	110	120	130	140	150	160	170	180	190	200
77	M05, M11	0.512	0.482	0.441	0.401	0.363	0.326	0.291	0.256	...	...	...	...	...	...
78	M05, M11	0.640	0.603	0.551	0.502	0.454	0.408	0.363	0.320	...	...	...	...	...	...
79	M05, M11	1.01	0.949	0.868	0.790	0.715	0.642	0.572	0.504	...	...	...	...	...	...
80	M05, M11	1.60	1.51	1.38	1.26	1.14	1.02	0.908	0.800	...	...	...	...	...	...
81	M05, M12	0.512	0.490	0.459	0.429	0.400	0.373	0.346	0.320	...	...	...	...	...	...
82	M05, M12	0.640	0.612	0.574	0.536	0.500	0.466	0.432	0.400	...	...	...	...	...	...
83	M05, M12	1.00	0.964	0.903	0.845	0.788	0.734	0.681	0.630	...	...	...	...	...	...
84	M05, M12	1.60	1.53	1.43	1.34	1.25	1.17	1.08	1.00	...	...	...	...	...	...
85	M05, M13	0.512	0.492	0.465	0.438	0.413	0.388	0.364	0.341	0.319	0.297	0.276	0.256	...	...
86	M05, M13	0.640	0.615	0.581	0.548	0.516	0.485	0.455	0.426	0.398	0.371	0.345	0.320	...	...
87	M05, M13	1.01	0.969	0.915	0.863	0.812	0.764	0.717	0.671	0.627	0.585	0.544	0.504	...	...
88	M05, M13	1.60	1.54	1.45	1.37	1.29	1.21	1.14	1.07	0.996	0.929	0.863	0.800	...	...
89	M08, M11	0.512	0.482	0.441	0.401	0.363	0.326	0.291	0.256	...	...	...	...	...	...
90	M08, M11	0.640	0.603	0.551	0.502	0.454	0.408	0.363	0.320	...	...	...	...	...	...
91	M08, M11	1.01	0.949	0.868	0.790	0.715	0.642	0.572	0.504	...	...	...	...	...	...
92	M08, M11	1.60	1.51	1.38	1.26	1.14	1.02	0.908	0.800	...	...	...	...	...	...
93	M08, M12	0.512	0.490	0.459	0.429	0.400	0.373	0.346	0.320	...	...	...	...	...	...
94	M08, M12	0.640	0.612	0.574	0.536	0.500	0.466	0.432	0.400	...	...	...	...	...	...
95	M08, M12	1.00	0.964	0.903	0.845	0.788	0.734	0.681	0.630	...	...	...	...	...	...
96	M08, M12	1.60	1.53	1.43	1.34	1.25	1.17	1.08	1.00	...	...	...	...	...	...
97	M08, M13	0.512	0.492	0.465	0.438	0.413	0.388	0.364	0.341	0.319	0.297	0.276	0.256	...	...
98	M08, M13	0.640	0.615	0.581	0.548	0.516	0.485	0.455	0.426	0.398	0.371	0.345	0.320	...	...
99	M08, M13	1.01	0.969	0.915	0.863	0.812	0.764	0.717	0.671	0.627	0.585	0.544	0.504	...	...
100	M08, M13	1.60	1.54	1.45	1.37	1.29	1.21	1.14	1.07	0.996	0.929	0.863	0.800	...	...
101	M05, M09	0.512	0.482	0.441	0.401	0.363	0.326	0.291	0.256	...	...	...	...	...	...
102	M05, M09	0.640	0.603	0.551	0.502	0.454	0.408	0.363	0.320	...	...	...	...	...	...
103	M05, M09	0.800	0.754	0.689	0.627	0.567	0.510	0.454	0.400	...	...	...	...	...	...
104	M05, M09	1.60	1.51	1.38	1.26	1.14	1.02	0.908	0.800	...	...	...	...	...	...
105	M05, M10	0.512	0.490	0.459	0.429	0.400	0.373	0.346	0.320	...	...	...	...	...	...
106	M05, M10	0.640	0.612	0.574	0.536	0.500	0.466	0.432	0.400	...	...	...	...	...	...
107	M05, M10	0.800	0.765	0.717	0.670	0.626	0.582	0.540	0.500	...	...	...	...	...	...
108	M05, M10	1.60	1.53	1.43	1.34	1.25	1.17	1.08	1.00	...	...	...	...	...	...
109	M05, M10	0.512	0.490	0.459	0.429	0.400	0.373	0.346	0.320	...	...	...	...	...	...
110	M05, M10	0.640	0.612	0.574	0.536	0.500	0.466	0.432	0.400	...	...	...	...	...	...
111	M05, M10	0.800	0.765	0.717	0.670	0.626	0.582	0.540	0.500	...	...	...	...	...	...
112	M05, M10	1.60	1.53	1.43	1.34	1.25	1.17	1.08	1.00	...	...	...	...	...	...
113	M05, M11	0.512	0.482	0.441	0.401	0.363	0.326	0.291	0.256	...	...	...	...	...	...
114	M05, M11	0.640	0.603	0.551	0.502	0.454	0.408	0.363	0.320	...	...	...	...	...	...
115	M05, M11	1.01	0.949	0.868	0.790	0.715	0.642	0.572	0.504	...	...	...	...	...	...
116	M05, M11	1.60	1.51	1.38	1.26	1.14	1.02	0.908	0.800	...	...	...	...	...	...

Table 1-1-1 Maximum Allowable Stress Values, *S*, for Thermoplastic Materials (Cont'd)

Line No.	Nominal Composition	Product Form	ASME Spec. No.	Type/Grade	Construction Code Notes	Minimum Yield Strength, ksi	Maximum Temperature Limit, °F	Design Factor
117	Polyethylene	Extruded tube	SD-2737	PE4710	...	3.0	140	D04
118	Polyethylene	Extruded tube	SD-2737	PE4710	...	3.0	140	D05
119	Polyethylene	Extruded tube	SD-2737	PE4710	...	3.0	140	D07
120	Polyethylene	Extruded tube	SD-2737	PE4710	...	3.0	140	D08
121	Polyethylene	Extruded tube	SD-2737	PE4710	...	3.0	180	D04
122	Polyethylene	Extruded tube	SD-2737	PE4710	...	3.0	180	D05
123	Polyethylene	Extruded tube	SD-2737	PE4710	...	3.0	180	D07
124	Polyethylene	Extruded tube	SD-2737	PE4710	...	3.0	180	D08
125	Polyethylene	Extruded pipe	SD-3035	PE3608	...	3.0	140	D04
126	Polyethylene	Extruded pipe	SD-3035	PE3608	...	3.0	140	D05
127	Polyethylene	Extruded pipe	SD-3035	PE3608	...	3.0	140	D06
128	Polyethylene	Extruded pipe	SD-3035	PE3608	...	3.0	140	D08
129	Polyethylene	Extruded pipe	SD-3035	PE3608	...	3.0	140	D04
130	Polyethylene	Extruded pipe	SD-3035	PE3608	...	3.0	140	D05
131	Polyethylene	Extruded pipe	SD-3035	PE3608	...	3.0	140	D06
132	Polyethylene	Extruded pipe	SD-3035	PE3608	...	3.0	140	D08
133	Polyethylene	Extruded pipe	SD-3035	PE4608	...	3.0	140	D04
134	Polyethylene	Extruded pipe	SD-3035	PE4608	...	3.0	140	D05
135	Polyethylene	Extruded pipe	SD-3035	PE4608	...	3.0	140	D06
136	Polyethylene	Extruded pipe	SD-3035	PE4608	...	3.0	140	D08
137	Polyethylene	Extruded pipe	SD-3035	PE4710	...	3.0	140	D04
138	Polyethylene	Extruded pipe	SD-3035	PE4710	...	3.0	140	D05
139	Polyethylene	Extruded pipe	SD-3035	PE4710	...	3.0	140	D07
140	Polyethylene	Extruded pipe	SD-3035	PE4710	...	3.0	140	D08
141	Polyethylene	Extruded pipe	SD-3035	PE4710	...	3.0	140	D04
142	Polyethylene	Extruded pipe	SD-3035	PE4710	...	3.0	140	D05
143	Polyethylene	Extruded pipe	SD-3035	PE4710	...	3.0	140	D07
144	Polyethylene	Extruded pipe	SD-3035	PE4710	...	3.0	140	D08
145	Polyethylene	Extruded pipe	SD-3035	PE4710	...	3.0	180	D04
146	Polyethylene	Extruded pipe	SD-3035	PE4710	...	3.0	180	D05
147	Polyethylene	Extruded pipe	SD-3035	PE4710	...	3.0	180	D07
148	Polyethylene	Extruded pipe	SD-3035	PE4710	...	3.0	180	D08
149	Polyethylene	Extruded pipe	SF-714	PE3608	...	3.0	140	D04
150	Polyethylene	Extruded pipe	SF-714	PE3608	...	3.0	140	D05
151	Polyethylene	Extruded pipe	SF-714	PE3608	...	3.0	140	D06
152	Polyethylene	Extruded pipe	SF-714	PE3608	...	3.0	140	D08
153	Polyethylene	Extruded pipe	SF-714	PE3608	...	3.0	140	D04
154	Polyethylene	Extruded pipe	SF-714	PE3608	...	3.0	140	D05
155	Polyethylene	Extruded pipe	SF-714	PE3608	...	3.0	140	D06
156	Polyethylene	Extruded pipe	SF-714	PE3608	...	3.0	140	D08

Table 1-1-1 Maximum Allowable Stress Values, *S*, for Thermoplastic Materials (Cont'd)

Line No.	Notes	Maximum Allowable Stress, ksi [Note (1)], for Material Temperature, °F, Not Exceeding													
		73	80	90	100	110	120	130	140	150	160	170	180	190	200
117	M05, M12	0.512	0.490	0.459	0.429	0.400	0.373	0.346	0.320	...	...	...	...	...	...
118	M05, M12	0.640	0.612	0.574	0.536	0.500	0.466	0.432	0.400	...	...	...	...	...	...
119	M05, M12	1.00	0.964	0.903	0.845	0.788	0.734	0.681	0.630	...	...	...	...	...	...
120	M05, M12	1.60	1.53	1.43	1.34	1.25	1.17	1.08	1.00	...	...	...	...	...	...
121	M05, M13	0.512	0.492	0.465	0.438	0.413	0.388	0.364	0.341	0.319	0.297	0.276	0.256	...	...
122	M05, M13	0.640	0.615	0.581	0.548	0.516	0.485	0.455	0.426	0.398	0.371	0.345	0.320	...	...
123	M05, M13	1.01	0.969	0.915	0.863	0.812	0.764	0.717	0.671	0.627	0.585	0.544	0.504	...	...
124	M05, M13	1.60	1.54	1.45	1.37	1.29	1.21	1.14	1.07	0.996	0.929	0.863	0.800	...	...
125	M05, M09	0.512	0.482	0.441	0.401	0.363	0.326	0.291	0.256	...	...	...	...	...	...
126	M05, M09	0.640	0.603	0.551	0.502	0.454	0.408	0.363	0.320	...	...	...	...	...	...
127	M05, M09	0.800	0.754	0.689	0.627	0.567	0.510	0.454	0.400	...	...	...	...	...	...
128	M05, M09	1.60	1.51	1.38	1.26	1.14	1.02	0.908	0.800	...	...	...	...	...	...
129	M05, M10	0.512	0.490	0.459	0.429	0.400	0.373	0.346	0.320	...	...	...	...	...	...
130	M05, M10	0.640	0.612	0.574	0.536	0.500	0.466	0.432	0.400	...	...	...	...	...	...
131	M05, M10	0.800	0.765	0.717	0.670	0.626	0.582	0.540	0.500	...	...	...	...	...	...
132	M05, M10	1.60	1.53	1.43	1.34	1.25	1.17	1.08	1.00	...	...	...	...	...	...
133	M05, M10	0.512	0.490	0.459	0.429	0.400	0.373	0.346	0.320	...	...	...	...	...	...
134	M05, M10	0.640	0.612	0.574	0.536	0.500	0.466	0.432	0.400	...	...	...	...	...	...
135	M05, M10	0.800	0.765	0.717	0.670	0.626	0.582	0.540	0.500	...	...	...	...	...	...
136	M05, M10	1.60	1.53	1.43	1.34	1.25	1.17	1.08	1.00	...	...	...	...	...	...
137	M05, M11	0.512	0.482	0.441	0.401	0.363	0.326	0.291	0.256	...	...	...	...	...	...
138	M05, M11	0.640	0.603	0.551	0.502	0.454	0.408	0.363	0.320	...	...	...	...	...	...
139	M05, M11	1.01	0.949	0.868	0.790	0.715	0.642	0.572	0.504	...	...	...	...	...	...
140	M05, M11	1.60	1.51	1.38	1.26	1.14	1.02	0.908	0.800	...	...	...	...	...	...
141	M05, M12	0.512	0.490	0.459	0.429	0.400	0.373	0.346	0.320	...	...	...	...	...	...
142	M05, M12	0.640	0.612	0.574	0.536	0.500	0.466	0.432	0.400	...	...	...	...	...	...
143	M05, M12	1.00	0.964	0.903	0.845	0.788	0.734	0.681	0.630	...	...	...	...	...	...
144	M05, M12	1.60	1.53	1.43	1.34	1.25	1.17	1.08	1.00	...	...	...	...	...	...
145	M05, M13	0.512	0.492	0.465	0.438	0.413	0.388	0.364	0.341	0.319	0.297	0.276	0.256	...	...
146	M05, M13	0.640	0.615	0.581	0.548	0.516	0.485	0.455	0.426	0.398	0.371	0.345	0.320	...	...
147	M05, M13	1.01	0.969	0.915	0.863	0.812	0.764	0.717	0.671	0.627	0.585	0.544	0.504	...	...
148	M05, M13	1.60	1.54	1.45	1.37	1.29	1.21	1.14	1.07	0.996	0.929	0.863	0.800	...	...
149	M08, M09	0.512	0.482	0.441	0.401	0.363	0.326	0.291	0.256	...	...	...	...	...	...
150	M08, M09	0.640	0.603	0.551	0.502	0.454	0.408	0.363	0.320	...	...	...	...	...	...
151	M08, M09	0.800	0.754	0.689	0.627	0.567	0.510	0.454	0.400	...	...	...	...	...	...
152	M08, M09	1.60	1.51	1.38	1.26	1.14	1.02	0.908	0.800	...	...	...	...	...	...
153	M08, M10	0.512	0.490	0.459	0.429	0.400	0.373	0.346	0.320	...	...	...	...	...	...
154	M08, M10	0.640	0.612	0.574	0.536	0.500	0.466	0.432	0.400	...	...	...	...	...	...
155	M08, M10	0.800	0.765	0.717	0.670	0.626	0.582	0.540	0.500	...	...	...	...	...	...
156	M08, M10	1.60	1.53	1.43	1.34	1.25	1.17	1.08	1.00	...	...	...	...	...	...

Table 1-1-1 Maximum Allowable Stress Values, *S*, for Thermoplastic Materials (Cont'd)

Line No.	Nominal Composition	Product Form	ASME Spec. No.	Type/Grade	Construction Code Notes	Minimum Yield Strength, ksi	Maximum Temperature Limit, °F	Design Factor
157	Polyethylene	Extruded pipe	SF-714	PE4608	...	3.0	140	D04
158	Polyethylene	Extruded pipe	SF-714	PE4608	...	3.0	140	D05
159	Polyethylene	Extruded pipe	SF-714	PE4608	...	3.0	140	D06
160	Polyethylene	Extruded pipe	SF-714	PE4608	...	3.0	140	D08
161	Polyethylene	Extruded pipe	SF-714	PE4710	...	3.0	140	D04
162	Polyethylene	Extruded pipe	SF-714	PE4710	...	3.0	140	D05
163	Polyethylene	Extruded pipe	SF-714	PE4710	...	3.0	140	D07
164	Polyethylene	Extruded pipe	SF-714	PE4710	...	3.0	140	D08
165	Polyethylene	Extruded pipe	SF-714	PE4710	...	3.0	140	D04
166	Polyethylene	Extruded pipe	SF-714	PE4710	...	3.0	140	D05
167	Polyethylene	Extruded pipe	SF-714	PE4710	...	3.0	140	D07
168	Polyethylene	Extruded pipe	SF-714	PE4710	...	3.0	140	D08
169	Polyethylene	Extruded pipe	SF-714	PE4710	...	3.0	180	D04
170	Polyethylene	Extruded pipe	SF-714	PE4710	...	3.0	180	D05
171	Polyethylene	Extruded pipe	SF-714	PE4710	...	3.0	180	D07
172	Polyethylene	Extruded pipe	SF-714	PE4710	...	3.0	180	D08
173	Polyethylene	Extruded pipe	SF-2619	PE3608	...	3.0	140	D04
174	Polyethylene	Extruded pipe	SF-2619	PE3608	...	3.0	140	D05
175	Polyethylene	Extruded pipe	SF-2619	PE3608	...	3.0	140	D06
176	Polyethylene	Extruded pipe	SF-2619	PE3608	...	3.0	140	D08
177	Polyethylene	Extruded pipe	SF-2619	PE3608	...	3.0	140	D04
178	Polyethylene	Extruded pipe	SF-2619	PE3608	...	3.0	140	D05
179	Polyethylene	Extruded pipe	SF-2619	PE3608	...	3.0	140	D06
180	Polyethylene	Extruded pipe	SF-2619	PE3608	...	3.0	140	D08
181	Polyethylene	Extruded pipe	SF-2619	PE4710	...	3.0	140	D04
182	Polyethylene	Extruded pipe	SF-2619	PE4710	...	3.0	140	D05
183	Polyethylene	Extruded pipe	SF-2619	PE4710	...	3.0	140	D07
184	Polyethylene	Extruded pipe	SF-2619	PE4710	...	3.0	140	D08
185	Polyethylene	Extruded pipe	SF-2619	PE4710	...	3.0	140	D04
186	Polyethylene	Extruded pipe	SF-2619	PE4710	...	3.0	140	D05
187	Polyethylene	Extruded pipe	SF-2619	PE4710	...	3.0	140	D07
188	Polyethylene	Extruded pipe	SF-2619	PE4710	...	3.0	140	D08
189	Polyethylene	Extruded pipe	SF-2619	PE4710	...	3.0	180	D04
190	Polyethylene	Extruded pipe	SF-2619	PE4710	...	3.0	180	D05
191	Polyethylene	Extruded pipe	SF-2619	PE4710	...	3.0	180	D07
192	Polyethylene	Extruded pipe	SF-2619	PE4710	...	3.0	180	D08
193	PVC	Extruded pipe	SD-1785	PVC2110	C01	6.0	140	D01
194	PVC	Extruded pipe	SD-1785	PVC2110	C01	6.0	140	D02
195	PVC	Extruded pipe	SD-1785	PVC2110	C01	6.0	140	D03

Table 1-1-1 Maximum Allowable Stress Values, *S*, for Thermoplastic Materials (Cont'd)

Line No.	Notes	Maximum Allowable Stress, ksi [Note (1)], for Material Temperature, °F, Not Exceeding													
		73	80	90	100	110	120	130	140	150	160	170	180	190	200
157	M08, M10	0.512	0.490	0.459	0.429	0.400	0.373	0.346	0.320	...	...	...	...	...	...
158	M08, M10	0.640	0.612	0.574	0.536	0.500	0.466	0.432	0.400	...	...	...	...	...	...
159	M08, M10	0.800	0.765	0.717	0.670	0.626	0.582	0.540	0.500	...	...	...	...	...	...
160	M08, M10	1.60	1.53	1.43	1.34	1.25	1.17	1.08	1.00	...	...	...	...	...	...
161	M08, M11	0.512	0.482	0.441	0.401	0.363	0.326	0.291	0.256	...	...	...	...	...	...
162	M08, M11	0.640	0.603	0.551	0.502	0.454	0.408	0.363	0.320	...	...	...	...	...	...
163	M08, M11	1.01	0.949	0.868	0.790	0.715	0.642	0.572	0.504	...	...	...	...	...	...
164	M08, M11	1.60	1.51	1.38	1.26	1.14	1.02	0.908	0.800	...	...	...	...	...	...
165	M08, M12	0.512	0.490	0.459	0.429	0.400	0.373	0.346	0.320	...	...	...	...	...	...
166	M08, M12	0.640	0.612	0.574	0.536	0.500	0.466	0.432	0.400	...	...	...	...	...	...
167	M08, M12	1.00	0.964	0.903	0.845	0.788	0.734	0.681	0.630	...	...	...	...	...	...
168	M08, M12	1.60	1.53	1.43	1.34	1.25	1.17	1.08	1.00	...	...	...	...	...	...
169	M08, M13	0.512	0.492	0.465	0.438	0.413	0.388	0.364	0.341	0.319	0.297	0.276	0.256	...	...
170	M08, M13	0.640	0.615	0.581	0.548	0.516	0.485	0.455	0.426	0.398	0.371	0.345	0.320	...	...
171	M08, M13	1.01	0.969	0.915	0.863	0.812	0.764	0.717	0.671	0.627	0.585	0.544	0.504	...	...
172	M08, M13	1.60	1.54	1.45	1.37	1.29	1.21	1.14	1.07	0.996	0.929	0.863	0.800	...	...
173	M09, M14	0.512	0.482	0.441	0.401	0.363	0.326	0.291	0.256	...	...	...	...	...	...
174	M09, M14	0.640	0.603	0.551	0.502	0.454	0.408	0.363	0.320	...	...	...	...	...	...
175	M09, M14	0.800	0.754	0.689	0.627	0.567	0.510	0.454	0.400	...	...	...	...	...	...
176	M09, M14	1.60	1.51	1.38	1.26	1.14	1.02	0.908	0.800	...	...	...	...	...	...
177	M10, M14	0.512	0.490	0.459	0.429	0.400	0.373	0.346	0.320	...	...	...	...	...	...
178	M10, M14	0.640	0.612	0.574	0.536	0.500	0.466	0.432	0.400	...	...	...	...	...	...
179	M10, M14	0.800	0.765	0.717	0.670	0.626	0.582	0.540	0.500	...	...	...	...	...	...
180	M10, M14	1.60	1.53	1.43	1.34	1.25	1.17	1.08	1.00	...	...	...	...	...	...
181	M11, M14	0.512	0.482	0.441	0.401	0.363	0.326	0.291	0.256	...	...	...	...	...	...
182	M11, M14	0.640	0.603	0.551	0.502	0.454	0.408	0.363	0.320	...	...	...	...	...	...
183	M11, M14	1.01	0.949	0.868	0.790	0.715	0.642	0.572	0.504	...	...	...	...	...	...
184	M11, M14	1.60	1.51	1.38	1.26	1.14	1.02	0.908	0.800	...	...	...	...	...	...
185	M12, M14	0.512	0.490	0.459	0.429	0.400	0.373	0.346	0.320	...	...	...	...	...	...
186	M12, M14	0.640	0.612	0.574	0.536	0.500	0.466	0.432	0.400	...	...	...	...	...	...
187	M12, M14	1.00	0.964	0.903	0.845	0.788	0.734	0.681	0.630	...	...	...	...	...	...
188	M12, M14	1.60	1.53	1.43	1.34	1.25	1.17	1.08	1.00	...	...	...	...	...	...
189	M13, M14	0.512	0.492	0.465	0.438	0.413	0.388	0.364	0.341	0.319	0.297	0.276	0.256	...	...
190	M13, M14	0.640	0.615	0.581	0.548	0.516	0.485	0.455	0.426	0.398	0.371	0.345	0.320	...	...
191	M13, M14	1.01	0.969	0.915	0.863	0.812	0.764	0.717	0.671	0.627	0.585	0.544	0.504	...	...
192	M13, M14	1.60	1.54	1.45	1.37	1.29	1.21	1.14	1.07	0.996	0.929	0.863	0.800	...	...
193	M15	0.800	0.704	0.600	0.496	0.400	0.320	0.240	0.176	...	...	...	...	...	...
194	M15	1.00	0.880	0.750	0.620	0.500	0.400	0.300	0.220	...	...	...	...	...	...
195	M15	2.00	1.76	1.50	1.24	1.00	0.800	0.600	0.440	...	...	...	...	...	...

Table 1-1-1 Maximum Allowable Stress Values, *S*, for Thermoplastic Materials (Cont'd)

Line No.	Nominal Composition	Product Form	ASME Spec. No.	Type/Grade	Construction Code Notes	Minimum Yield Strength, ksi	Maximum Temperature Limit, °F	Design Factor
196	PVC	Extruded pipe	SD-1785	PVC2112	C01	6.0	140	D01
197	PVC	Extruded pipe	SD-1785	PVC2112	C01	6.0	140	D02
198	PVC	Extruded pipe	SD-1785	PVC2112	C01	6.0	140	D03
199	PVC	Extruded pipe	SD-1785	PVC2116	C01	6.0	140	D01
200	PVC	Extruded pipe	SD-1785	PVC2116	C01	6.0	140	D02
201	PVC	Extruded pipe	SD-1785	PVC2116	C01	6.0	140	D03
202	PVC	Extruded pipe	SD-1785	PVC2120	C01	6.0	140	D01
203	PVC	Extruded pipe	SD-1785	PVC2120	C01	6.0	140	D02
204	PVC	Extruded pipe	SD-1785	PVC2120	C01	6.0	140	D03
205	PVC	Extruded tube	SD-2241	PVC2110	C01	6.0	140	D01
206	PVC	Extruded tube	SD-2241	PVC2110	C01	6.0	140	D02
207	PVC	Extruded tube	SD-2241	PVC2110	C01	6.0	140	D03
208	PVC	Extruded tube	SD-2241	PVC2112	C01	6.0	140	D01
209	PVC	Extruded tube	SD-2241	PVC2112	C01	6.0	140	D02
210	PVC	Extruded tube	SD-2241	PVC2112	C01	6.0	140	D03
211	PVC	Extruded tube	SD-2241	PVC2116	C01	6.0	140	D01
212	PVC	Extruded tube	SD-2241	PVC2116	C01	6.0	140	D02
213	PVC	Extruded tube	SD-2241	PVC2116	C01	6.0	140	D03
214	PVC	Extruded tube	SD-2241	PVC2120	C01	6.0	140	D01
215	PVC	Extruded tube	SD-2241	PVC2120	C01	6.0	140	D02
216	PVC	Extruded tube	SD-2241	PVC2120	C01	6.0	140	D03
217	PVC	Extruded pipe	SD-1785	PVC1120	C01	7.0	140	D01
218	PVC	Extruded pipe	SD-1785	PVC1120	C01	7.0	140	D02
219	PVC	Extruded pipe	SD-1785	PVC1120	C01	7.0	140	D03
220	PVC	Extruded pipe	SD-1785	PVC1220	C01	7.0	140	D01
221	PVC	Extruded pipe	SD-1785	PVC1220	C01	7.0	140	D02
222	PVC	Extruded pipe	SD-1785	PVC1220	C01	7.0	140	D03
223	PVC	Extruded pipe	SD-2241	PVC1120	C01	7.0	140	D01
224	PVC	Extruded pipe	SD-2241	PVC1120	C01	7.0	140	D02
225	PVC	Extruded pipe	SD-2241	PVC1120	C01	7.0	140	D03
226	PVC	Extruded pipe	SD-2241	PVC1220	C01	7.0	140	D01
227	PVC	Extruded pipe	SD-2241	PVC1220	C01	7.0	140	D02
228	PVC	Extruded pipe	SD-2241	PVC1220	C01	7.0	140	D03
229	PVC	Extruded pipe	SF-1483	PVCO 1135	C01	7.0	130	D01
230	PVC	Extruded pipe	SF-1483	PVCO 1135	C01	7.0	130	D02
231	PVC	Extruded pipe	SF-1483	PVCO 1135	C01	7.0	130	D03

Table 1-1-1 Maximum Allowable Stress Values, *S*, for Thermoplastic Materials (Cont'd)

Line No.	Notes	Maximum Allowable Stress, ksi [Note (1)], for Material Temperature, °F, Not Exceeding													
		73	80	90	100	110	120	130	140	150	160	170	180	190	200
196	M16	1.00	0.880	0.750	0.620	0.500	0.400	0.300	0.220	...	...	...	...	...	...
197	M16	1.25	1.10	0.938	0.775	0.625	0.500	0.375	0.275	...	...	...	...	...	...
198	M16	2.50	2.20	1.88	1.55	1.25	1.00	0.750	0.550	...	...	...	...	...	...
199	M17	1.28	1.13	0.960	0.794	0.640	0.512	0.384	0.282	...	...	...	...	...	...
200	M17	1.60	1.41	1.20	0.992	0.800	0.640	0.480	0.352	...	...	...	...	...	...
201	M17	3.20	2.82	2.40	1.98	1.60	1.28	0.960	0.704	...	...	...	...	...	...
202	M18	1.60	1.41	1.20	0.992	0.800	0.640	0.480	0.352	...	...	...	...	...	...
203	M18	2.00	1.76	1.50	1.24	1.00	0.800	0.600	0.440	...	...	...	...	...	...
204	M18	4.00	3.52	3.00	2.48	2.00	1.60	1.20	0.880	...	...	...	...	...	...
205	M15	0.800	0.704	0.600	0.496	0.400	0.320	0.240	0.176	...	...	...	...	...	...
206	M15	1.00	0.880	0.750	0.620	0.500	0.400	0.300	0.220	...	...	...	...	...	...
207	M15	2.00	1.76	1.50	1.24	1.00	0.800	0.600	0.440	...	...	...	...	...	...
208	M16	1.00	0.880	0.750	0.620	0.500	0.400	0.300	0.220	...	...	...	...	...	...
209	M16	1.25	1.10	0.938	0.775	0.625	0.500	0.375	0.275	...	...	...	...	...	...
210	M16	2.50	2.20	1.88	1.55	1.25	1.00	0.750	0.550	...	...	...	...	...	...
211	M17	1.28	1.13	0.960	0.794	0.640	0.512	0.384	0.282	...	...	...	...	...	...
212	M17	1.60	1.41	1.20	0.992	0.800	0.640	0.480	0.352	...	...	...	...	...	...
213	M17	3.20	2.82	2.40	1.98	1.60	1.28	0.960	0.704	...	...	...	...	...	...
214	M18	1.60	1.41	1.20	0.992	0.800	0.640	0.480	0.352	...	...	...	...	...	...
215	M18	2.00	1.76	1.50	1.24	1.00	0.800	0.600	0.440	...	...	...	...	...	...
216	M18	4.00	3.52	3.00	2.48	2.00	1.60	1.20	0.880	...	...	...	...	...	...
217	M19	1.60	1.41	1.20	0.992	0.800	0.640	0.480	0.352	...	...	...	...	...	...
218	M19	2.00	1.76	1.50	1.24	1.00	0.800	0.600	0.440	...	...	...	...	...	...
219	M19	4.00	3.52	3.00	2.48	2.00	1.60	1.20	0.880	...	...	...	...	...	...
220	M19	1.60	1.41	1.20	0.992	0.800	0.640	0.480	0.352	...	...	...	...	...	...
221	M19	2.00	1.76	1.50	1.24	1.00	0.800	0.600	0.440	...	...	...	...	...	...
222	M19	4.00	3.52	3.00	2.48	2.00	1.60	1.20	0.880	...	...	...	...	...	...
223	M19	1.60	1.41	1.20	0.992	0.800	0.640	0.480	0.352	...	...	...	...	...	...
224	M19	2.00	1.76	1.50	1.24	1.00	0.800	0.600	0.440	...	...	...	...	...	...
225	M19	4.00	3.52	3.00	2.48	2.00	1.60	1.20	0.880	...	...	...	...	...	...
226	M19	1.60	1.41	1.20	0.992	0.800	0.640	0.480	0.352	...	...	...	...	...	...
227	M19	2.00	1.76	1.50	1.24	1.00	0.800	0.600	0.440	...	...	...	...	...	...
228	M19	4.00	3.52	3.00	2.48	2.00	1.60	1.20	0.880	...	...	...	...	...	...
229	M20, M21	1.60	1.41	1.20	0.992	0.800	0.640	0.480	...	...	...	...	...	...	...
230	M20, M21	2.00	1.76	1.50	1.24	1.00	0.800	0.600	...	...	...	...	...	...	...
231	M20, M21	4.00	3.52	3.00	2.48	2.00	1.60	1.20	...	...	...	...	...	...	...

Table 1-1-1 Maximum Allowable Stress Values, *S*, for Thermoplastic Materials (Cont'd)

Line No.	Nominal Composition	Product Form	ASME Spec. No.	Type/Grade	Construction Code Notes	Minimum Yield Strength, ksi	Maximum Temperature Limit, °F	Design Factor
232	PVC	Extruded pipe	SF-1483	PVCO 1135	C01	11.1	130	D01
233	PVC	Extruded pipe	SF-1483	PVCO 1135	C01	11.1	130	D02
234	PVC	Extruded pipe	SF-1483	PVCO 1135	C01	11.1	130	D03
235	PVDF	Extruded pipe	SF-1673	PVDF 2020	...	6.5	200	D02
236	PVDF	Extruded pipe	SF-1673	PVDF 2020	...	6.5	200	D03
237	PVDF	Extruded pipe	SF-1673	PVDF 2025	...	7.7	200	D02
238	PVDF	Extruded pipe	SF-1673	PVDF 2025	...	7.7	200	D03

Table 1-1-1 Maximum Allowable Stress Values, *S*, for Thermoplastic Materials (Cont'd)

Line No.	Notes	Maximum Allowable Stress, ksi [Note (1)], for Material Temperature, °F, Not Exceeding													
		73	80	90	100	110	120	130	140	150	160	170	180	190	200
232	M20, M22	2.84	2.50	2.13	1.76	1.42	1.14	0.852	...	...	...	...	...	...	...
233	M20, M22	3.55	3.12	2.66	2.20	1.78	1.42	1.07	...	...	...	...	...	...	...
234	M20, M22	7.10	6.25	5.33	4.40	3.55	2.84	2.13	...	...	...	...	...	...	...
235	M23	2.00	1.91	1.78	1.66	1.54	1.42	1.31	1.20	1.10	0.997	0.900	0.805	0.714	0.625
236	M23	4.00	3.82	3.56	3.31	3.07	2.84	2.62	2.40	2.20	2.00	1.80	1.61	1.43	1.25
237	M24	2.50	2.40	2.27	2.13	2.01	1.89	1.77	1.65	1.54	1.44	1.33	1.23	1.14	1.04
238	M24	5.00	4.80	4.53	4.27	4.02	3.77	3.53	3.31	3.09	2.87	2.66	2.46	2.27	2.08

Table 1-1-1 Maximum Allowable Stress Values, *S*, for Thermoplastic Materials (Cont'd)

GENERAL NOTES:

(a) The stress values in this Table may be interpolated to determine values for intermediate temperatures. The values at intermediate temperatures shall be rounded to the same number of decimal places as the value at the higher temperature between which values are being interpolated. The rounding rule is: when the next digit beyond the last place to be retained is less than 5, retain unchanged the digit in the last place retained; when the digit next beyond the last place to be retained is 5 or greater, increase by 1 the digit in the last place retained.

(b) The following abbreviations are used: CPVC, chlorinated poly(vinyl chloride); PVC, poly(vinyl chloride); and PVDF, poly(vinylidene fluoride).

NOTE: (1) Multiply ksi by 1,000 to obtain psi.

CONSTRUCTION CODE NOTE (ASME NM.1):

C01 Compounding ingredients may vary between material manufacturers for the same grade of CPVC or PVC. While these different ingredients do not impact the allowable stress values provided in this Table, they can influence the acceptability of the various joining methods allowed by ASME NM.1. In addition to the material and joining requirements set forth in ASME NM.1, the joining method to be used shall be approved by the piping component manufacturer.

DESIGN FACTOR NOTES (ASME NM.1):

D01 The allowable stress values are based on the hydrostatic design basis (HDB) as determined in accordance with ASTM D2837 multiplied by a design factor (DF) of 0.40.

D02 The allowable stress values are based on the hydrostatic design basis (HDB) as determined in accordance with ASTM D2837 multiplied by a design factor (DF) of 0.50.

D03 The allowable stress values are based on the hydrostatic design basis (HDB) as determined in accordance with ASTM D2837 multiplied by a design factor (DF) of 1.0. These values are only to be used when the DF is incorporated in the construction code equations.

D04 The allowable stress values are based on the hydrostatic design basis (HDB) as identified in PPI TR-4 multiplied by a design factor (DF) of 0.32.

D05 The allowable stress values are based on the hydrostatic design basis (HDB) as identified in PPI TR-4 multiplied by a design factor (DF) of 0.40.

D06 The allowable stress values are based on the hydrostatic design basis (HDB) as identified in PPI TR-4 multiplied by a design factor (DF) of 0.50.

D07 The allowable stress values are based on the hydrostatic design basis (HDB) as identified in PPI TR-4 multiplied by a design factor (DF) of 0.63.

D08 The allowable stress values are based on the hydrostatic design basis (HDB) as identified in PPI TR-4 multiplied by a design factor (DF) of 1.0. These values are only to be used when the DF is incorporated in the construction code equations.

MATERIAL NOTES — CHLORINATED POLY(VINYL CHLORIDE):

M01 Material shall have a

(a) minimum impact resistance of 1.5 ft-lb/in. of notch at 73°F in accordance with ASTM D256
(b) minimum modulus of elasticity in tension of 360,000 psi at 73°F in accordance with ASTM D638
(c) minimum deflection temperature under load of 212°F at a load of 264 psi in accordance with ASTM D648
(d) average extent of burning of under 25 mm and an average time of burning of under 10 sec in accordance with ASTM D635
(e) hydrostatic design basis (HDB) of 4,000 psi at 73°F and 1,000 psi at 180°F in accordance with ASTM D2837
(f) hydrostatic design stress (HDS) of 2,000 psi at 73°F and 500 psi at 180°F in accordance with ASTM D2837

M02 Material shall have a

(a) minimum impact resistance of 1.5 ft-lb/in. of notch at 73°F in accordance with ASTM D256
(b) minimum modulus of elasticity in tension of 360,000 psi at 73°F in accordance with ASTM D638
(c) minimum deflection temperature under load of 212°F at a load of 264 psi in accordance with ASTM D648
(d) average extent of burning of under 25 mm and an average time of burning of under 10 sec in accordance with ASTM D635
(e) hydrostatic design basis (HDB) of 4,000 psi at 73°F and 1,250 psi at 180°F in accordance with ASTM D2837
(f) hydrostatic design stress (HDS) of 2,000 psi at 73°F and 625 psi at 180°F in accordance with ASTM D2837

MATERIAL NOTES — POLYAMIDE:

M03 Material shall have a

(a) classification of Group 03, Class 2, and Grade 3 in accordance with ASTM D4066.
(b) minimum elongation at break of 200% in accordance with ASTM D638, using a 3.2 mm ± 0.4 mm thick test specimen. The speed of testing shall be 50 mm/min ±10% at 23°C ± 2°C and 50% ± 5% relative humidity.
(c) minimum flexural modulus of 900 MPa in accordance with ASTM D790, Procedure A using a 3.2 mm × 12.7 mm × 127 mm test specimen. The testing shall be performed with a crosshead speed of 1.3 mm/min ±50% at 23°C ± 2°C and 50% ± 5% relative humidity.
(d) minimum izod impact resistance of 55 J/m in accordance with ASTM D256, using a test specimen with a 12.7-mm depth, a 3.17-mm width, and a notch radius of 0.25 mm.
(e) minimum deflection temperature of 40°C at 1.82 MPa in accordance with ASTM D648, using an unannealed test specimen 3.17 mm in width.
(f) hydrostatic design basis (HDB) of 2,500 psi at 73°F, 1,600 psi at 140°F, and 1,250 psi at 180°F in accordance with ASTM D2837.
(g) hydrostatic design stress (HDS) of 1,250 psi at 73°F, 800 psi at 140°F, and 625 psi at 180°F in accordance with ASTM D2837.

M04 Material shall have a

(a) classification of Group 03, Class 2, and Grade 3 in accordance with ASTM D4066.

Table 1-1-1 Maximum Allowable Stress Values, *S*, for Thermoplastic Materials (Cont'd)

MATERIAL NOTES — POLYAMIDE: (Cont'd):

(b) minimum elongation at break of 200% in accordance with ASTM D638, using a 3.2 mm ± 0.4 mm thick test specimen. The speed of testing shall be 50 mm/min ±10% at 23°C ± 2°C and 50% ± 5% relative humidity.

(c) minimum flexural modulus of 900 MPa in accordance with ASTM D790, Procedure A using a 3.2 mm × 12.7 mm × 127 mm test specimen. The testing shall be performed with a crosshead speed of 1.3 mm/min ±50% at 23°C ± 2°C and 50% ± 5% relative humidity.

(d) minimum izod impact resistance of 55 J/m in accordance with ASTM D256, using a test specimen with a 12.7-mm depth, a 3.17-mm width, and a notch radius of 0.25 mm.

(e) minimum deflection temperature of 40°C at 1.82 MPa in accordance with ASTM D648, using an unannealed test specimen 3.17 mm in width.

(f) hydrostatic design basis (HDB) of 3,150 psi at 73°F and 1,600 psi at 180°F in accordance with ASTM D2837.

(g) hydrostatic design stress (HDS) of 1,600 psi at 73°F and 800 psi at 180°F in accordance with ASTM D2837.

MATERIAL NOTES — POLYETHYLENE:

M05 Material shall have a carbon black percentage of 2% to 3% in accordance with ASTM D4218 or ASTM D1603, natural with UV stabilizer, or colored with UV stabilizer.

M06 Material shall have a

(a) thermal stability of over 428°F in accordance with ASTM D3350

(b) maximum brittleness temperature of −76°F in accordance with ASTM D746

(c) minimum tensile elongation at break of 400% in accordance with ASTM D638, using a Type IV tensile bar at 2 in./min at 73°F

(d) slow crack growth resistance of over 500 hr in accordance with ASTM F1473 at 2.4 MPa and 80°C in air

(e) hydrostatic design basis (HDB) of 1,250 psi at 73°F and 1,000 psi at 140°F in accordance with ASTM D2837, PPI TR-3, and PPI TR-4

(f) hydrostatic design stress (HDS) of 800 psi at 73°F in accordance with ASTM D2837, PPI TR-3, and PPI TR-4

M07 Material shall have a

(a) thermal stability of over 428°F in accordance with ASTM D3350

(b) maximum brittleness temperature of −76°F in accordance with ASTM D746

(c) minimum tensile elongation at break of 400% in accordance with ASTM D638, using a Type IV tensile bar at 2 in./min at 73°F

(d) slow crack growth resistance of over 500 hr in accordance with ASTM F1473 at 2.4 MPa and 80°C in air

(e) hydrostatic design basis (HDB) of 1,250 psi at 73°F and 630 psi at 180°F in accordance with ASTM D2837, PPI TR-3, and PPI TR-4

(f) hydrostatic design stress (HDS) of 800 psi at 73°F in accordance with ASTM D2837, PPI TR-3, and PPI TR-4

M08 Material shall have a carbon black percentage of 2% to 3% in accordance with ASTM D4218 or ASTM D1603, or colored with UV stabilizer.

M09 Material shall have a

(a) thermal stability of over 428°F in accordance with ASTM D3350

(b) maximum brittleness temperature of −76°F in accordance with ASTM D746

(c) minimum tensile elongation at break of 400% in accordance with ASTM D638, using a Type IV tensile bar at 2 in./min at 73°F

(d) slow crack growth resistance of over 100 hr in accordance with ASTM F1473 at 2.4 MPa and 80°C in air

(e) hydrostatic design basis (HDB) of 1,600 psi at 73°F and 800 psi at 140°F in accordance with ASTM D2837, PPI TR-3, and PPI TR-4

(f) hydrostatic design stress (HDS) of 800 psi at 73°F in accordance with ASTM D2837, PPI TR-3, and PPI TR-4

M10 Material shall have a

(a) thermal stability of over 428°F in accordance with ASTM D3350

(b) maximum brittleness temperature of −76°F in accordance with ASTM D746

(c) minimum tensile elongation at break of 400% in accordance with ASTM D638, using a Type IV tensile bar at 2 in./min at 73°F

(d) slow crack growth resistance of over 100 hr in accordance with ASTM F1473 at 2.4 MPa and 80°C in air

(e) hydrostatic design basis (HDB) of 1,600 psi at 73°F and 1,000 psi at 140°F in accordance with ASTM D2837, PPI TR-3, and PPI TR-4

(f) hydrostatic design stress (HDS) of 800 psi at 73°F in accordance with ASTM D2837, PPI TR-3, and PPI TR-4

M11 Material shall have a

(a) thermal stability of over 428°F in accordance with ASTM D3350

(b) maximum brittleness temperature of −76°F in accordance with ASTM D746

(c) minimum tensile elongation at break of 400% in accordance with ASTM D638, using a Type IV tensile bar at 2 in./min at 73°F

(d) slow crack growth resistance of over 500 hr in accordance with ASTM F1473 at 2.4 MPa and 80°C in air

(e) hydrostatic design basis (HDB) of 1,600 psi at 73°F and 800 psi at 140°F in accordance with ASTM D2837, PPI TR-3, and PPI TR-4

(f) hydrostatic design stress (HDS) of 1,000 psi at 73°F in accordance with ASTM D2837, PPI TR-3, and PPI TR-4

M12 Material shall have a

(a) thermal stability of over 428°F in accordance with ASTM D3350

(b) maximum brittleness temperature of −76°F in accordance with ASTM D746

(c) minimum tensile elongation at break of 400% in accordance with ASTM D638, using a Type IV tensile bar at 2 in./min at 73°F

(d) slow crack growth resistance of over 500 hr in accordance with ASTM F1473 at 2.4 MPa and 80°C in air

(e) hydrostatic design basis (HDB) of 1,600 psi at 73°F and 1,000 psi at 140°F in accordance with ASTM D2837, PPI TR-3, and PPI TR-4

(f) hydrostatic design stress (HDS) of 1,000 psi at 73°F in accordance with ASTM D2837, PPI TR-3, and PPI TR-4

M13 Material shall have a

(a) thermal stability of over 428°F in accordance with ASTM D3350

(b) maximum brittleness temperature of −76°F in accordance with ASTM D746

(c) minimum tensile elongation at break of 400% in accordance with ASTM D638, using a Type IV tensile bar at 2 in./min at 73°F

(d) slow crack growth resistance of over 500 hr in accordance with ASTM F1473 at 2.4 MPa and 80°C in air

(e) hydrostatic design basis (HDB) of 1,600 psi at 73°F and 800 psi at 180°F in accordance with ASTM D2837, PPI TR-3, and PPI TR-4

(f) hydrostatic design stress (HDS) of 1,000 psi at 73°F in accordance with ASTM D2837, PPI TR-3, and PPI TR-4

M14 Material shall have a carbon black percentage of 2% to 3% in accordance with ASTM D4218 or ASTM D1603.

MATERIAL NOTES — POLY(VINYL CHLORIDE):

M15 Material shall have a

(a) minimum impact resistance of 5.0 ft-lb/in. of notch at 73°F in accordance with ASTM D256

Table 1-1-1 Maximum Allowable Stress Values, *S*, for Thermoplastic Materials (Cont'd)

MATERIAL NOTES — POLY(VINYL CHLORIDE): (Cont'd):
(b) minimum modulus of elasticity in tension of 320,000 psi at 73°F in accordance with ASTM D638
(c) minimum deflection temperature under load of 140°F at a load of 264 psi in accordance with ASTM D648
(d) average extent of burning of under 25 mm and an average time of burning of under 10 sec in accordance with ASTM D635
(e) hydrostatic design basis (HDB) of 2,000 psi at 73°F in accordance with ASTM D2837
(f) hydrostatic design stress (HDS) of 1,000 psi at 73°F in accordance with ASTM D2837

M16 Material shall have a
(a) minimum impact resistance of 5.0 ft-lb/in. of notch at 73°F in accordance with ASTM D256
(b) minimum modulus of elasticity in tension of 320,000 psi at 73°F in accordance with ASTM D638
(c) minimum deflection temperature under load of 140°F at a load of 264 psi in accordance with ASTM D648
(d) average extent of burning of under 25 mm and an average time of burning of under 10 sec in accordance with ASTM D635
(e) hydrostatic design basis (HDB) of 2,500 psi at 73°F in accordance with ASTM D2837
(f) hydrostatic design stress (HDS) of 1,250 psi at 73°F in accordance with ASTM D2837

M17 Material shall have a
(a) minimum impact resistance of 5.0 ft-lb/in. of notch at 73°F in accordance with ASTM D256
(b) minimum modulus of elasticity in tension of 320,000 psi at 73°F in accordance with ASTM D638
(c) minimum deflection temperature under load of 140°F at a load of 264 psi in accordance with ASTM D648
(d) average extent of burning of under 25 mm and an average time of burning of under 10 sec in accordance with ASTM D635
(e) hydrostatic design basis (HDB) of 3,200 psi at 73°F in accordance with ASTM D2837
(f) hydrostatic design stress (HDS) of 1,600 psi at 73°F in accordance with ASTM D2837

M18 Material shall have a
(a) minimum impact resistance of 5.0 ft-lb/in. of notch at 73°F in accordance with ASTM D256
(b) minimum modulus of elasticity in tension of 320,000 psi at 73°F in accordance with ASTM D638
(c) minimum deflection temperature under load of 140°F at a load of 264 psi in accordance with ASTM D648
(d) average extent of burning of under 25 mm and an average time of burning of under 10 sec in accordance with ASTM D635
(e) hydrostatic design basis (HDB) of 4,000 psi at 73°F in accordance with ASTM D2837
(f) hydrostatic design stress (HDS) of 2,000 psi at 73°F in accordance with ASTM D2837

M19 Material shall have a
(a) minimum impact resistance of 0.65 ft-lb/in. of notch at 73°F in accordance with ASTM D256
(b) minimum modulus of elasticity in tension of 400,000 psi at 73°F in accordance with ASTM D638
(c) minimum deflection temperature under load of 158°F at a load of 264 psi in accordance with ASTM D648
(d) average extent of burning of under 25 mm and an average time of burning of under 10 sec in accordance with ASTM D635
(e) hydrostatic design basis (HDB) of 4,000 psi at 73°F in accordance with ASTM D2837
(f) hydrostatic design stress (HDS) of 2,000 psi at 73°F in accordance with ASTM D2837

M20 Material shall have a
(a) minimum impact resistance of 5.0 ft-lb/in. of notch at 73°F in accordance with ASTM D256
(b) minimum modulus of elasticity in tension of 320,000 psi at 73°F in accordance with ASTM D638
(c) minimum deflection temperature under load of 140°F at a load of 264 psi in accordance with ASTM D648
(d) average extent of burning of under 25 mm and an average time of burning of under 10 sec in accordance with ASTM D635
(e) hydrostatic design basis (HDB) of 7,100 psi at 73°F in accordance with ASTM D2837
(f) hydrostatic design stress (HDS) of 3,550 psi at 73°F in accordance with ASTM D2837

M21 Allowable stress values apply to the unoriented directions only.

M22 Allowable stress values apply to the oriented direction only.

MATERIAL NOTES — POLY(VINYLIDENE FLUORIDE):

M23 Material shall have a
(a) classification of Type I in accordance with ASME SD-3222
(b) minimum impact resistance of 1.5 ft-lb/in. of notch at 73°F in accordance with ASTM D256
(c) minimum flexural modulus of 190,000 psi at 73°F in accordance with ASTM D790, using Method I
(d) minimum tensile elongation at break of 10% in accordance with ASTM D638, using a Type I tensile bar at 2 in./min at 73°F
(e) hydrostatic design basis (HDB) of 4,000 psi at 73°F and 1,250 psi at 200°F in accordance with ASTM D2837
(f) hydrostatic design stress (HDS) of 2,000 psi at 73°F and 625 psi at 200°F in accordance with ASTM D2837

M24 Material shall have a
(a) classification of Type II in accordance with ASME SD-3222
(b) minimum flexural modulus of 190,000 psi at 73°F in accordance with ASTM D790, using Method I
(c) minimum tensile elongation at break of 10% in accordance with ASTM D638, using a Type I tensile bar at 2 in./min at 73°F
(d) hydrostatic design basis (HDB) of 5,000 psi at 73°F and 1,250 psi at 248°F in accordance with ASTM D2837
(e) hydrostatic design stress (HDS) of 2,500 psi at 73°F and 625 psi at 248°F in accordance with ASTM D2837

TABLE STARTS ON NEXT PAGE

Table 1-1-2 Maximum Allowable Compression Stress Values, S_{comp}, for Thermoplastic Materials

Line No.	Nominal Composition	Product Form	ASME Spec. No.	Type/Grade	Construction Code Notes	Minimum Yield Strength, ksi	Maximum Temperature Limit, °F	Notes
1	CPVC	Extruded pipe	SD-2846	CPVC 4120-05	C01	7.0	200	M01
2	CPVC	Extruded pipe	SD-2846	CPVC 4120-06	C01	7.0	200	M02
3	CPVC	Extruded pipe	SF-441	CPVC 4120-05	C01	7.0	200	M01
4	CPVC	Extruded pipe	SF-441	CPVC 4120-06	C01	7.0	200	M02
5	CPVC	Extruded pipe	SF-442	CPVC 4120-05	C01	7.0	200	M01
6	CPVC	Extruded pipe	SF-442	CPVC 4120-06	C01	7.0	200	M02
7	Polyamide	Extruded pipe	SF-2945	PA 32312	...	7.0	180	M03
8	Polyamide	Extruded pipe	SF-2945	PA 32316	...	7.0	180	M04
9	Polyethylene	Extruded pipe	SD-2239	PE2708	...	2.6	140	M05, M06
10	Polyethylene	Extruded pipe	SD-2239	PE2708	...	2.6	180	M05, M07
11	Polyethylene	Extruded pipe	SD-2513	PE2708	...	2.6	140	M06, M08
12	Polyethylene	Extruded pipe	SD-2513	PE2708	...	2.6	180	M07, M08
13	Polyethylene	Extruded tube	SD-2737	PE2708	...	2.6	140	M05, M06
14	Polyethylene	Extruded tube	SD-2737	PE2708	...	2.6	180	M05, M07
15	Polyethylene	Extruded pipe	SD-3035	PE2708	...	2.6	140	M05, M06
16	Polyethylene	Extruded pipe	SD-3035	PE2708	...	2.6	180	M05, M07
17	Polyethylene	Extruded pipe	SF-714	PE2708	...	2.6	140	M06, M08
18	Polyethylene	Extruded pipe	SF-714	PE2708	...	2.6	180	M07, M08
19	Polyethylene	Extruded pipe	SD-2239	PE3608	...	3.0	140	M05, M09
20	Polyethylene	Extruded pipe	SD-2239	PE3608	...	3.0	140	M05, M10
21	Polyethylene	Extruded pipe	SD-2513	PE4710	...	3.0	140	M08, M11
22	Polyethylene	Extruded pipe	SD-2513	PE4710	...	3.0	140	M08, M12
23	Polyethylene	Extruded pipe	SD-2513	PE4710	...	3.0	180	M08, M13
24	Polyethylene	Extruded tube	SD-2737	PE3608	...	3.0	140	M05, M09
25	Polyethylene	Extruded tube	SD-2737	PE3608	...	3.0	140	M05, M10
26	Polyethylene	Extruded tube	SD-2737	PE4608	...	3.0	140	M05, M10
27	Polyethylene	Extruded pipe	SD-2737	PE4710	...	3.0	140	M05, M11
28	Polyethylene	Extruded pipe	SD-2737	PE4710	...	3.0	140	M05, M12
29	Polyethylene	Extruded pipe	SD-2737	PE4710	...	3.0	180	M05, M13
30	Polyethylene	Extruded pipe	SD-3035	PE3608	...	3.0	140	M05, M09
31	Polyethylene	Extruded pipe	SD-3035	PE3608	...	3.0	140	M05, M10
32	Polyethylene	Extruded pipe	SD-3035	PE4608	...	3.0	140	M05, M10
33	Polyethylene	Extruded pipe	SD-3035	PE4710	...	3.0	140	M05, M11
34	Polyethylene	Extruded pipe	SD-3035	PE4710	...	3.0	140	M05, M12
35	Polyethylene	Extruded pipe	SD-3035	PE4710	...	3.0	180	M05, M13
36	Polyethylene	Extruded pipe	SF-714	PE3608	...	3.0	140	M08, M09
37	Polyethylene	Extruded pipe	SF-714	PE3608	...	3.0	140	M08, M10
38	Polyethylene	Extruded pipe	SF-714	PE4608	...	3.0	140	M08, M10
39	Polyethylene	Extruded pipe	SF-714	PE4710	...	3.0	140	M08, M11
40	Polyethylene	Extruded pipe	SF-714	PE4710	...	3.0	140	M08, M12
41	Polyethylene	Extruded pipe	SF-714	PE4710	...	3.0	180	M08, M13

Table 1-1-2 Maximum Allowable Compression Stress Values, S_{comp}, for Thermoplastic Materials

Line No.	Maximum Allowable Compression Stress, ksi [Note (1)], for Material Temperature, °F, Not Exceeding													
	73	80	90	100	110	120	130	140	150	160	170	180	190	200
1	2.50	2.36	2.15	1.96	1.77	1.59	1.42	1.25	1.08	0.926	0.774	0.625	0.481	0.343
2	2.50	2.37	2.18	2.00	1.83	1.67	1.51	1.35	1.20	1.06	0.918	0.781	0.650	0.521
3	2.50	2.36	2.15	1.96	1.77	1.59	1.42	1.25	1.08	0.926	0.774	0.625	0.481	0.343
4	2.50	2.37	2.18	2.00	1.83	1.67	1.51	1.35	1.20	1.06	0.918	0.781	0.650	0.521
5	2.50	2.36	2.15	1.96	1.77	1.59	1.42	1.25	1.08	0.926	0.774	0.625	0.481	0.343
6	2.50	2.37	2.18	2.00	1.83	1.67	1.51	1.35	1.20	1.06	0.918	0.781	0.650	0.521
7	1.56	1.50	1.41	1.32	1.24	1.15	1.08	1.00	0.943	0.888	0.834	0.781	...	...
8	1.97	1.89	1.79	1.69	1.59	1.50	1.41	1.32	1.24	1.16	1.08	1.00	...	...
9	0.800	0.781	0.756	0.731	0.707	0.684	0.662	0.640	...	...	...	...	...	...
10	0.800	0.769	0.727	0.686	0.646	0.608	0.571	0.535	0.500	0.467	0.435	0.403	...	...
11	0.800	0.781	0.756	0.731	0.707	0.684	0.662	0.640	...	...	...	...	...	...
12	0.800	0.769	0.727	0.686	0.646	0.608	0.571	0.535	0.500	0.467	0.435	0.403	...	...
13	0.800	0.781	0.756	0.731	0.707	0.684	0.662	0.640	...	...	...	...	...	...
14	0.800	0.769	0.727	0.686	0.646	0.608	0.571	0.535	0.500	0.467	0.435	0.403	...	...
15	0.800	0.781	0.756	0.731	0.707	0.684	0.662	0.640	...	...	...	...	...	...
16	0.800	0.769	0.727	0.686	0.646	0.608	0.571	0.535	0.500	0.467	0.435	0.403	...	...
17	0.800	0.781	0.756	0.731	0.707	0.684	0.662	0.640	...	...	...	...	...	...
18	0.800	0.769	0.727	0.686	0.646	0.608	0.571	0.535	0.500	0.467	0.435	0.403	...	...
19	1.00	0.942	0.862	0.784	0.709	0.637	0.567	0.500	...	...	...	...	...	...
20	1.00	0.956	0.896	0.838	0.782	0.728	0.676	0.625	...	...	...	...	...	...
21	1.15	1.08	0.991	0.902	0.816	0.733	0.653	0.575	...	...	...	...	...	...
22	1.15	1.10	1.03	0.964	0.899	0.837	0.777	0.719	...	...	...	...	...	...
23	1.15	1.11	1.04	0.984	0.927	0.871	0.818	0.766	0.716	0.667	0.620	0.575	...	...
24	1.00	0.942	0.862	0.784	0.709	0.637	0.567	0.500	...	...	...	...	...	...
25	1.00	0.956	0.896	0.838	0.782	0.728	0.676	0.625	...	...	...	...	...	...
26	1.00	0.956	0.896	0.838	0.782	0.728	0.676	0.625	...	...	...	...	...	...
27	1.15	1.08	0.991	0.902	0.816	0.733	0.653	0.575	...	...	...	...	...	...
28	1.15	1.10	1.03	0.964	0.899	0.837	0.777	0.719	...	...	...	...	...	...
29	1.15	1.11	1.04	0.984	0.927	0.871	0.818	0.766	0.716	0.667	0.620	0.575	...	...
30	1.00	0.942	0.862	0.784	0.709	0.637	0.567	0.500	...	...	...	...	...	...
31	1.00	0.956	0.896	0.838	0.782	0.728	0.676	0.625	...	...	...	...	...	...
32	1.00	0.956	0.896	0.838	0.782	0.728	0.676	0.625	...	...	...	...	...	...
33	1.15	1.08	0.991	0.902	0.816	0.733	0.653	0.575	...	...	...	...	...	...
34	1.15	1.10	1.03	0.964	0.899	0.837	0.777	0.719	...	...	...	...	...	...
35	1.15	1.11	1.04	0.984	0.927	0.871	0.818	0.766	0.716	0.667	0.620	0.575	...	...
36	1.00	0.942	0.862	0.784	0.709	0.637	0.567	0.500	...	...	...	...	...	...
37	1.00	0.956	0.896	0.838	0.782	0.728	0.676	0.625	...	...	...	...	...	...
38	1.00	0.956	0.896	0.838	0.782	0.728	0.676	0.625	...	...	...	...	...	...
39	1.15	1.08	0.991	0.902	0.816	0.733	0.653	0.575	...	...	...	...	...	...
40	1.15	1.10	1.03	0.964	0.899	0.837	0.777	0.719	...	...	...	...	...	...
41	1.15	1.11	1.04	0.984	0.927	0.871	0.818	0.766	0.716	0.667	0.620	0.575	...	...

Table 1-1-2 Maximum Allowable Compression Stress Values, S_{comp}, for Thermoplastic Materials (Cont'd)

Line No.	Nominal Composition	Product Form	ASME Spec. No.	Type/Grade	Construction Code Notes	Minimum Yield Strength, ksi	Maximum Temperature Limit, °F	Notes
42	Polyethylene	Extruded pipe	SF-2619	PE3608	...	3.0	140	M09, M14
43	Polyethylene	Extruded pipe	SF-2619	PE3608	...	3.0	140	M10, M14
44	Polyethylene	Extruded pipe	SF-2619	PE4710	...	3.0	140	M11, M14
45	Polyethylene	Extruded pipe	SF-2619	PE4710	...	3.0	140	M12, M14
46	Polyethylene	Extruded pipe	SF-2619	PE4710	...	3.0	180	M13, M14
47	Polyethylene	Extruded pipe	SD-2239	PE4608	...	3.0	140	M05, M10
48	Polyethylene	Extruded pipe	SD-2239	PE4710	...	3.0	140	M05, M11
49	Polyethylene	Extruded pipe	SD-2239	PE4710	...	3.0	140	M05, M12
50	Polyethylene	Extruded pipe	SD-2239	PE4710	...	3.0	180	M05, M13
51	PVC	Extruded pipe	SD-1785	PVC2110	C01	6.0	140	M15
52	PVC	Extruded pipe	SD-1785	PVC2112	C01	6.0	140	M16
53	PVC	Extruded pipe	SD-1785	PVC2116	C01	6.0	140	M17
54	PVC	Extruded pipe	SD-1785	PVC2120	C01	6.0	140	M18
55	PVC	Extruded tube	SD-2241	PVC2110	C01	6.0	140	M15
56	PVC	Extruded tube	SD-2241	PVC2112	C01	6.0	140	M16
57	PVC	Extruded tube	SD-2241	PVC2116	C01	6.0	140	M17
58	PVC	Extruded tube	SD-2241	PVC2120	C01	6.0	140	M18
59	PVC	Extruded pipe	SD-1785	PVC1120	C01	7.0	140	M19
60	PVC	Extruded pipe	SD-1785	PVC1220	C01	7.0	140	M19
61	PVC	Extruded pipe	SD-2241	PVC1120	C01	7.0	140	M19
62	PVC	Extruded pipe	SD-2241	PVC1220	C01	7.0	140	M19
63	PVC	Extruded pipe	SF-1483	PVCO 1135	C01	7.0	130	M20, M21
64	PVC	Extruded pipe	SF-1483	PVCO 1135	C01	11.1	130	M20, M22
65	PVDF	Extruded pipe	SF-1673	PVDF 2020	...	6.5	200	M23
66	PVDF	Extruded pipe	SF-1673	PVDF 2025	...	7.7	200	M24

Table 1-1-2 Maximum Allowable Compression Stress Values, S_{comp}, for Thermoplastic Materials (Cont'd)

Line No.	Maximum Allowable Compression Stress, ksi [Note (1)], for Material Temperature, °F, Not Exceeding													
	73	80	90	100	110	120	130	140	150	160	170	180	190	200
42	1.00	0.942	0.862	0.784	0.709	0.637	0.567	0.500	...	...	...	...	...	...
43	1.00	0.956	0.896	0.838	0.782	0.728	0.676	0.625	...	...	...	...	...	...
44	1.15	1.08	0.991	0.902	0.816	0.733	0.653	0.575	...	...	...	...	...	...
45	1.15	1.10	1.03	0.964	0.899	0.837	0.777	0.719	...	...	...	...	...	...
46	1.15	1.11	1.04	0.984	0.927	0.871	0.818	0.766	0.716	0.667	0.620	0.575	...	...
47	1.00	0.956	0.896	0.838	0.782	0.728	0.676	0.625	...	...	...	...	...	...
48	1.15	1.08	0.991	0.902	0.816	0.733	0.653	0.575	...	...	...	...	...	...
49	1.15	1.10	1.03	0.964	0.899	0.837	0.777	0.719	...	...	...	...	...	...
50	1.15	1.11	1.04	0.984	0.927	0.871	0.818	0.766	0.716	0.667	0.620	0.575	...	...
51	1.25	1.10	0.938	0.775	0.625	0.500	0.375	0.275	...	...	...	...	...	...
52	1.56	1.38	1.17	0.969	0.781	0.625	0.469	0.344	...	...	...	...	...	...
53	2.00	1.76	1.50	1.24	1.00	0.800	0.600	0.440	...	...	...	...	...	...
54	2.50	2.20	1.88	1.55	1.25	1.00	0.750	0.550	...	...	...	...	...	...
55	1.25	1.10	0.938	0.775	0.625	0.500	0.375	0.275	...	...	...	...	...	...
56	1.56	1.38	1.17	0.969	0.781	0.625	0.469	0.344	...	...	...	...	...	...
57	2.00	1.76	1.50	1.24	1.00	0.800	0.600	0.440	...	...	...	...	...	...
58	2.50	2.20	1.88	1.55	1.25	1.00	0.750	0.550	...	...	...	...	...	...
59	2.50	2.20	1.88	1.55	1.25	1.00	0.750	0.550	...	...	...	...	...	...
60	2.50	2.20	1.88	1.55	1.25	1.00	0.750	0.550	...	...	...	...	...	...
61	2.50	2.20	1.88	1.55	1.25	1.00	0.750	0.550	...	...	...	...	...	...
62	2.50	2.20	1.88	1.55	1.25	1.00	0.750	0.550	...	...	...	...	...	...
63	2.50	2.20	1.88	1.55	1.25	1.00	0.750	...	...	...	...	...	...	...
64	4.44	3.91	3.33	2.75	2.22	1.78	1.33	...	...	...	...	...	...	...
65	2.50	2.38	2.22	2.07	1.92	1.78	1.64	1.50	1.37	1.25	1.13	1.01	0.893	0.781
66	3.13	3.00	2.83	2.67	2.51	2.36	2.21	2.07	1.93	1.79	1.67	1.54	1.42	1.30

Table 1-1-2 Maximum Allowable Compression Stress Values, S_{comp}, for Thermoplastic Materials (Cont'd)

GENERAL NOTES:

(a) The stress values in this Table may be interpolated to determine values for intermediate temperatures. The values at intermediate temperatures shall be rounded to the same number of decimal places as the value at the higher temperature between which values are being interpolated. The rounding rule is: when the next digit beyond the last place to be retained is less than 5, retain unchanged the digit in the last place retained; when the digit next beyond the last place to be retained is 5 or greater, increase by 1 the digit in the last place retained.

(b) The following abbreviations are used: CPVC, chlorinated poly(vinyl chloride); PVC, poly(vinyl chloride); and PVDF, poly(vinylidene fluoride).

NOTE: (1) Multiply ksi by 1,000 to obtain psi.

CONSTRUCTION CODE NOTE (ASME NM.1):

C01 Compounding ingredients may vary between material manufacturers for the same grade of CPVC or PVC. While these different ingredients do not impact the allowable stress values provided in this Table, they can influence the acceptability of the various joining methods allowed by ASME NM.1. In addition to the material and joining requirements set forth in ASME NM.1, the joining method to be used shall be approved by the piping component manufacturer.

MATERIAL NOTES — CHLORINATED POLY(VINYL CHLORIDE):

M01 Material shall have a
- *(a)* minimum impact resistance of 1.5 ft-lb/in. of notch at 73°F in accordance with ASTM D256
- *(b)* minimum modulus of elasticity in tension of 360,000 psi at 73°F in accordance with ASTM D638
- *(c)* minimum deflection temperature under load of 212°F at a load of 264 psi in accordance with ASTM D648
- *(d)* average extent of burning of under 25 mm and an average time of burning of under 10 sec in accordance with ASTM D635
- *(e)* hydrostatic design basis (HDB) of 4,000 psi at 73°F and 1,000 psi at 180°F in accordance with ASTM D2837
- *(f)* hydrostatic design stress (HDS) of 2,000 psi at 73°F and 500 psi at 180°F in accordance with ASTM D2837

M02 Material shall have a
- *(a)* minimum impact resistance of 1.5 ft-lb/in. of notch at 73°F in accordance with ASTM D256
- *(b)* minimum modulus of elasticity in tension of 360,000 psi at 73°F in accordance with ASTM D638
- *(c)* minimum deflection temperature under load of 212°F at a load of 264 psi in accordance with ASTM D648
- *(d)* average extent of burning of under 25 mm and an average time of burning of under 10 sec in accordance with ASTM D635
- *(e)* hydrostatic design basis (HDB) of 4,000 psi at 73°F and 1,250 psi at 180°F in accordance with ASTM D2837
- *(f)* hydrostatic design stress (HDS) of 2,000 psi at 73°F and 625 psi at 180°F in accordance with ASTM D2837

MATERIAL NOTES — POLYAMIDE:

M03 Material shall have a
- *(a)* classification of Group 03, Class 2, and Grade 3 in accordance with ASTM D4066.
- *(b)* minimum elongation at break of 200% in accordance with ASTM D638, using a 3.2 mm ± 0.4 mm thick test specimen. The speed of testing shall be 50 mm/min ±10% at 23°C ± 2°C and 50% ± 5% relative humidity.
- *(c)* minimum flexural modulus of 900 MPa in accordance with ASTM D790, Procedure A using a 3.2 mm × 12.7 mm × 127 mm test specimen. The testing shall be performed with a crosshead speed of 1.3 mm/min ±50% at 23°C ± 2°C and 50% ± 5% relative humidity.
- *(d)* minimum izod impact resistance of 55 J/m in accordance with ASTM D256, using a test specimen with a 12.7-mm depth, a 3.17-mm width, and a notch radius of 0.25 mm.
- *(e)* minimum deflection temperature of 40°C at 1.82 MPa in accordance with ASTM D648, using an unannealed test specimen 3.17 mm in width.
- *(f)* hydrostatic design basis (HDB) of 2,500 psi at 73°F, 1,600 psi at 140°F, and 1,250 psi at 180°F in accordance with ASTM D2837.
- *(g)* hydrostatic design stress (HDS) of 1,250 psi at 73°F, 800 psi at 140°F, and 625 psi at 180°F in accordance with ASTM D2837.

M04 Material shall have a
- *(a)* classification of Group 03, Class 2, and Grade 3 in accordance with ASTM D4066.
- *(b)* minimum elongation at break of 200% in accordance with ASTM D638, using a 3.2 mm ± 0.4 mm thick test specimen. The speed of testing shall be 50 mm/min ±10% at 23°C ± 2°C and 50% ± 5% relative humidity.
- *(c)* minimum flexural modulus of 900 MPa in accordance with ASTM D790, Procedure A using a 3.2 mm × 12.7 mm × 127 mm test specimen. The testing shall be performed with a crosshead speed of 1.3 mm/min ±50% at 23°C ± 2°C and 50% ± 5% relative humidity.
- *(d)* minimum izod impact resistance of 55 J/m in accordance with ASTM D256, using a test specimen with a 12.7-mm depth, a 3.17-mm width, and a notch radius of 0.25 mm.
- *(e)* minimum deflection temperature of 40°C at 1.82 MPa in accordance with ASTM D648, using an unannealed test specimen 3.17 mm in width.
- *(f)* hydrostatic design basis (HDB) of 3,150 psi at 73°F and 1,600 psi at 180°F in accordance with ASTM D2837.
- *(g)* hydrostatic design stress (HDS) of 1,600 psi at 73°F and 800 psi at 180°F in accordance with ASTM D2837.

MATERIAL NOTES — POLYETHYLENE:

M05 Material shall have a carbon black percentage of 2% to 3% in accordance with ASTM D4218 or ASTM D1603, natural with UV stabilizer, or colored with UV stabilizer.

M06 Material shall have a
- *(a)* thermal stability of over 428°F in accordance with ASTM D3350
- *(b)* maximum brittleness temperature of −76°F in accordance with ASTM D746
- *(c)* minimum tensile elongation at break of 400% in accordance with ASTM D638, using a Type IV tensile bar at 2 in./min at 73°F
- *(d)* slow crack growth resistance of over 500 hr in accordance with ASTM F1473 at 2.4 MPa and 80°C in air
- *(e)* hydrostatic design basis (HDB) of 1,250 psi at 73°F and 1,000 psi at 140°F in accordance with ASTM D2837, PPI TR-3, and PPI TR-4

Table 1-1-2 Maximum Allowable Compression Stress Values, S_{comp}, for Thermoplastic Materials (Cont'd)

MATERIAL NOTES — POLYETHYLENE: (Cont'd):
(f) hydrostatic design stress (HDS) of 800 psi at 73°F in accordance with ASTM D2837, PPI TR-3, and PPI TR-4

M07 Material shall have a
(a) thermal stability of over 428°F in accordance with ASTM D3350
(b) maximum brittleness temperature of −76°F in accordance with ASTM D746
(c) minimum tensile elongation at break of 400% in accordance with ASTM D638, using a Type IV tensile bar at 2 in./min at 73°F
(d) slow crack growth resistance of over 500 hr in accordance with ASTM F1473 at 2.4 MPa and 80°C in air
(e) hydrostatic design basis (HDB) of 1,250 psi at 73°F and 630 psi at 180°F in accordance with ASTM D2837, PPI TR-3, and PPI TR-4
(f) hydrostatic design stress (HDS) of 800 psi at 73°F in accordance with ASTM D2837, PPI TR-3, and PPI TR-4

M08 Material shall have a carbon black percentage of 2% to 3% in accordance with ASTM D4218 or ASTM D1603, or colored with UV stabilizer.

M09 Material shall have a
(a) thermal stability of over 428°F in accordance with ASTM D3350
(b) maximum brittleness temperature of −76°F in accordance with ASTM D746
(c) minimum tensile elongation at break of 400% in accordance with ASTM D638, using a Type IV tensile bar at 2 in./min at 73°F
(d) slow crack growth resistance of over 100 hr in accordance with ASTM F1473 at 2.4 MPa and 80°C in air
(e) hydrostatic design basis (HDB) of 1,600 psi at 73°F and 800 psi at 140°F in accordance with ASTM D2837, PPI TR-3, and PPI TR-4
(f) hydrostatic design stress (HDS) of 800 psi at 73°F in accordance with ASTM D2837, PPI TR-3, and PPI TR-4

M10 Material shall have a
(a) thermal stability of over 428°F in accordance with ASTM D3350
(b) maximum brittleness temperature of −76°F in accordance with ASTM D746
(c) minimum tensile elongation at break of 400% in accordance with ASTM D638, using a Type IV tensile bar at 2 in./min at 73°F
(d) slow crack growth resistance of over 100 hr in accordance with ASTM F1473 at 2.4 MPa and 80°C in air
(e) hydrostatic design basis (HDB) of 1,600 psi at 73°F and 1,000 psi at 140°F in accordance with ASTM D2837, PPI TR-3, and PPI TR-4
(f) hydrostatic design stress (HDS) of 800 psi at 73°F in accordance with ASTM D2837, PPI TR-3, and PPI TR-4

M11 Material shall have a
(a) thermal stability of over 428°F in accordance with ASTM D3350
(b) maximum brittleness temperature of −76°F in accordance with ASTM D746
(c) minimum tensile elongation at break of 400% in accordance with ASTM D638, using a Type IV tensile bar at 2 in./min at 73°F
(d) slow crack growth resistance of over 500 hr in accordance with ASTM F1473 at 2.4 MPa and 80°C in air
(e) hydrostatic design basis (HDB) of 1,600 psi at 73°F and 800 psi at 140°F in accordance with ASTM D2837, PPI TR-3, and PPI TR-4
(f) hydrostatic design stress (HDS) of 1,000 psi at 73°F in accordance with ASTM D2837, PPI TR-3, and PPI TR-4

M12 Material shall have a
(a) thermal stability of over 428°F in accordance with ASTM D3350
(b) maximum brittleness temperature of −76°F in accordance with ASTM D746
(c) minimum tensile elongation at break of 400% in accordance with ASTM D638, using a Type IV tensile bar at 2 in./min at 73°F
(d) slow crack growth resistance of over 500 hr in accordance with ASTM F1473 at 2.4 MPa and 80°C in air
(e) hydrostatic design basis (HDB) of 1,600 psi at 73°F and 1,000 psi at 140°F in accordance with ASTM D2837, PPI TR-3, and PPI TR-4
(f) hydrostatic design stress (HDS) of 1,000 psi at 73°F in accordance with ASTM D2837, PPI TR-3, and PPI TR-4

M13 Material shall have a
(a) thermal stability of over 428°F in accordance with ASTM D3350
(b) maximum brittleness temperature of −76°F in accordance with ASTM D746
(c) minimum tensile elongation at break of 400% in accordance with ASTM D638, using a Type IV tensile bar at 2 in./min at 73°F
(d) slow crack growth resistance of over 500 hr in accordance with ASTM F1473 at 2.4 MPa and 80°C in air
(e) hydrostatic design basis (HDB) of 1,600 psi at 73°F and 800 psi at 180°F in accordance with ASTM D2837, PPI TR-3, and PPI TR-4
(f) hydrostatic design stress (HDS) of 1,000 psi at 73°F in accordance with ASTM D2837, PPI TR-3, and PPI TR-4

M14 Material shall have a carbon black percentage of 2% to 3% in accordance with ASTM D4218 or ASTM D1603.

MATERIAL NOTES — POLY(VINYL CHLORIDE):

M15 Material shall have a
(a) minimum impact resistance of 5.0 ft-lb/in. of notch at 73°F in accordance with ASTM D256
(b) minimum modulus of elasticity in tension of 320,000 psi at 73°F in accordance with ASTM D638
(c) minimum deflection temperature under load of 140°F at a load of 264 psi in accordance with ASTM D648
(d) average extent of burning of under 25 mm and an average time of burning of under 10 sec in accordance with ASTM D635
(e) hydrostatic design basis (HDB) of 2,000 psi at 73°F in accordance with ASTM D2837
(f) hydrostatic design stress (HDS) of 1,000 psi at 73°F in accordance with ASTM D2837

M16 Material shall have a
(a) minimum impact resistance of 5.0 ft-lb/in. of notch at 73°F in accordance with ASTM D256
(b) minimum modulus of elasticity in tension of 320,000 psi at 73°F in accordance with ASTM D638
(c) minimum deflection temperature under load of 140°F at a load of 264 psi in accordance with ASTM D648
(d) average extent of burning of under 25 mm and an average time of burning of under 10 sec in accordance with ASTM D635
(e) hydrostatic design basis (HDB) of 2,500 psi at 73°F in accordance with ASTM D2837
(f) hydrostatic design stress (HDS) of 1,250 psi at 73°F in accordance with ASTM D2837

M17 Material shall have a
(a) minimum impact resistance of 5.0 ft-lb/in. of notch at 73°F in accordance with ASTM D256
(b) minimum modulus of elasticity in tension of 320,000 psi at 73°F in accordance with ASTM D638
(c) minimum deflection temperature under load of 140°F at a load of 264 psi in accordance with ASTM D648
(d) average extent of burning of under 25 mm and an average time of burning of under 10 sec in accordance with ASTM D635

Table 1-1-2 Maximum Allowable Compression Stress Values, S_{comp}, for Thermoplastic Materials (Cont'd)

MATERIAL NOTES — POLY(VINYL CHLORIDE): (Cont'd):
(e) hydrostatic design basis (HDB) of 3,200 psi at 73°F in accordance with ASTM D2837
(f) hydrostatic design stress (HDS) of 1,600 psi at 73°F in accordance with ASTM D2837

M18 Material shall have a
(a) minimum impact resistance of 5.0 ft-lb/in. of notch at 73°F in accordance with ASTM D256
(b) minimum modulus of elasticity in tension of 320,000 psi at 73°F in accordance with ASTM D638
(c) minimum deflection temperature under load of 140°F at a load of 264 psi in accordance with ASTM D648
(d) average extent of burning of under 25 mm and an average time of burning of under 10 sec in accordance with ASTM D635
(e) hydrostatic design basis (HDB) of 4,000 psi at 73°F in accordance with ASTM D2837
(f) hydrostatic design stress (HDS) of 2,000 psi at 73°F in accordance with ASTM D2837

M19 Material shall have a
(a) minimum impact resistance of 0.65 ft-lb/in. of notch at 73°F in accordance with ASTM D256
(b) minimum modulus of elasticity in tension of 400,000 psi at 73°F in accordance with ASTM D638
(c) minimum deflection temperature under load of 158°F at a load of 264 psi in accordance with ASTM D648
(d) average extent of burning of under 25 mm and an average time of burning of under 10 sec in accordance with ASTM D635
(e) hydrostatic design basis (HDB) of 4,000 psi at 73°F in accordance with ASTM D2837
(f) hydrostatic design stress (HDS) of 2,000 psi at 73°F in accordance with ASTM D2837

M20 Material shall have a
(a) minimum impact resistance of 5.0 ft-lb/in. of notch at 73°F in accordance with ASTM D256
(b) minimum modulus of elasticity in tension of 320,000 psi at 73°F in accordance with ASTM D638
(c) minimum deflection temperature under load of 140°F at a load of 264 psi in accordance with ASTM D648
(d) average extent of burning of under 25 mm and an average time of burning of under 10 sec in accordance with ASTM D635
(e) hydrostatic design basis (HDB) of 7,100 psi at 73°F in accordance with ASTM D2837
(f) hydrostatic design stress (HDS) of 3,550 psi at 73°F in accordance with ASTM D2837

M21 Allowable stress values apply to the unoriented directions only.

M22 Allowable stress values apply to the oriented direction only.

MATERIAL NOTES — POLY(VINYLIDENE FLUORIDE):

M23 Material shall have a
(a) classification of Type I in accordance with ASME SD-3222
(b) minimum impact resistance of 1.5 ft-lb/in. of notch at 73°F in accordance with ASTM D256
(c) minimum flexural modulus of 190,000 psi at 73°F in accordance with ASTM D790, using Method I
(d) minimum tensile elongation at break of 10% in accordance with ASTM D638, using a Type I tensile bar at 2 in./min at 73°F
(e) hydrostatic design basis (HDB) of 4,000 psi at 73°F and 1,250 psi at 200°F in accordance with ASTM D2837
(f) hydrostatic design stress (HDS) of 2,000 psi at 73°F and 625 psi at 200°F in accordance with ASTM D2837

M24 Material shall have a
(a) classification of Type II in accordance with ASME SD-3222
(b) minimum flexural modulus of 190,000 psi at 73°F in accordance with ASTM D790, using Method I
(c) minimum tensile elongation at break of 10% in accordance with ASTM D638, using a Type I tensile bar at 2 in./min at 73°F
(d) hydrostatic design basis (HDB) of 5,000 psi at 73°F and 1,250 psi at 248°F in accordance with ASTM D2837
(e) hydrostatic design stress (HDS) of 2,500 psi at 73°F and 625 psi at 248°F in accordance with ASTM D2837

TABLE STARTS ON NEXT PAGE

Table 1-1-3 Maximum Allowable Secondary Stress Range Values, S_A, for Thermoplastic Materials

Line No.	Nominal Composition	Product Form	ASME Spec. No.	Type/Grade	Construction Code Notes	Minimum Yield Strength, ksi	Maximum Temperature Limit, °F	Design Factor	Notes
1	CPVC	Extruded pipe	SD-2846	CPVC 4120-05	C01	7.0	200	D01	M01
2	CPVC	Extruded pipe	SD-2846	CPVC 4120-05	C01	7.0	200	D01	M01
3	CPVC	Extruded pipe	SD-2846	CPVC 4120-05	C01	7.0	200	D01	M01
4	CPVC	Extruded pipe	SD-2846	CPVC 4120-05	C01	7.0	200	D01	M01
5	CPVC	Extruded pipe	SD-2846	CPVC 4120-05	C01	7.0	200	D01	M01
6	CPVC	Extruded pipe	SD-2846	CPVC 4120-05	C01	7.0	200	D01	M01
7	CPVC	Extruded pipe	SD-2846	CPVC 4120-06	C01	7.0	200	D01	M02
8	CPVC	Extruded pipe	SD-2846	CPVC 4120-06	C01	7.0	200	D01	M02
9	CPVC	Extruded pipe	SD-2846	CPVC 4120-06	C01	7.0	200	D01	M02
10	CPVC	Extruded pipe	SD-2846	CPVC 4120-06	C01	7.0	200	D01	M02
11	CPVC	Extruded pipe	SD-2846	CPVC 4120-06	C01	7.0	200	D01	M02
12	CPVC	Extruded pipe	SD-2846	CPVC 4120-06	C01	7.0	200	D01	M02
13	CPVC	Extruded pipe	SF-441	CPVC 4120-05	C01	7.0	200	D01	M01
14	CPVC	Extruded pipe	SF-441	CPVC 4120-05	C01	7.0	200	D01	M01
15	CPVC	Extruded pipe	SF-441	CPVC 4120-05	C01	7.0	200	D01	M01
16	CPVC	Extruded pipe	SF-441	CPVC 4120-05	C01	7.0	200	D01	M01
17	CPVC	Extruded pipe	SF-441	CPVC 4120-05	C01	7.0	200	D01	M01
18	CPVC	Extruded pipe	SF-441	CPVC 4120-05	C01	7.0	200	D01	M01
19	CPVC	Extruded pipe	SF-441	CPVC 4120-06	C01	7.0	200	D01	M02
20	CPVC	Extruded pipe	SF-441	CPVC 4120-06	C01	7.0	200	D01	M02
21	CPVC	Extruded pipe	SF-441	CPVC 4120-06	C01	7.0	200	D01	M02
22	CPVC	Extruded pipe	SF-441	CPVC 4120-06	C01	7.0	200	D01	M02
23	CPVC	Extruded pipe	SF-441	CPVC 4120-06	C01	7.0	200	D01	M02
24	CPVC	Extruded pipe	SF-441	CPVC 4120-06	C01	7.0	200	D01	M02
25	CPVC	Extruded pipe	SF-442	CPVC 4120-05	C01	7.0	200	D01	M01
26	CPVC	Extruded pipe	SF-442	CPVC 4120-05	C01	7.0	200	D01	M01
27	CPVC	Extruded pipe	SF-442	CPVC 4120-05	C01	7.0	200	D01	M01
28	CPVC	Extruded pipe	SF-442	CPVC 4120-05	C01	7.0	200	D01	M01
29	CPVC	Extruded pipe	SF-442	CPVC 4120-05	C01	7.0	200	D01	M01
30	CPVC	Extruded pipe	SF-442	CPVC 4120-05	C01	7.0	200	D01	M01
31	CPVC	Extruded pipe	SF-442	CPVC 4120-06	C01	7.0	200	D01	M02
32	CPVC	Extruded pipe	SF-442	CPVC 4120-06	C01	7.0	200	D01	M02
33	CPVC	Extruded pipe	SF-442	CPVC 4120-06	C01	7.0	200	D01	M02
34	CPVC	Extruded pipe	SF-442	CPVC 4120-06	C01	7.0	200	D01	M02
35	CPVC	Extruded pipe	SF-442	CPVC 4120-06	C01	7.0	200	D01	M02
36	CPVC	Extruded pipe	SF-442	CPVC 4120-06	C01	7.0	200	D01	M02
37	Polyamide	Extruded pipe	SF-2945	PA 32312	...	7.0	180	D01	M03
38	Polyamide	Extruded pipe	SF-2945	PA 32312	...	7.0	180	D01	M03
39	Polyamide	Extruded pipe	SF-2945	PA 32312	...	7.0	180	D01	M03
40	Polyamide	Extruded pipe	SF-2945	PA 32312	...	7.0	180	D01	M03
41	Polyamide	Extruded pipe	SF-2945	PA 32312	...	7.0	180	D01	M03
42	Polyamide	Extruded pipe	SF-2945	PA 32312	...	7.0	180	D01	M03

Table 1-1-3 Maximum Allowable Secondary Stress Range Values, S_A, for Thermoplastic Materials

Line No.	Number of Equivalent Thermal Cycles, N	Maximum Allowable Secondary Stress Range, ksi [Note (1)], for Material Temperature, °F, Not Exceeding													
		73	80	90	100	110	120	130	140	150	160	170	180	190	200
1	$N \le 1{,}000$	3.10	3.00	2.88	2.73	2.60	2.45	2.32	2.20	2.04	1.92	1.77	1.64	1.47	1.27
2	$1{,}000 < N \le 10{,}000$	1.85	1.79	1.72	1.63	1.55	1.46	1.39	1.31	1.22	1.15	1.05	0.981	0.879	0.757
3	$10{,}000 < N \le 25{,}000$	1.52	1.47	1.41	1.33	1.27	1.20	1.14	1.08	1.00	0.940	0.864	0.803	0.720	0.620
4	$25{,}000 < N \le 50{,}000$	1.30	1.26	1.21	1.15	1.09	1.03	0.976	0.924	0.859	0.807	0.742	0.690	0.619	0.533
5	$50{,}000 < N \le 75{,}000$	1.19	1.15	1.11	1.05	1.00	0.940	0.892	0.844	0.785	0.737	0.678	0.630	0.565	0.487
6	$75{,}000 < N \le 100{,}000$	1.11	1.08	1.04	0.981	0.936	0.881	0.836	0.791	0.736	0.691	0.635	0.591	0.530	0.456
7	$N \le 1{,}000$	3.10	3.00	2.88	2.73	2.60	2.45	2.32	2.20	2.04	1.92	1.77	1.64	1.47	1.27
8	$1{,}000 < N \le 10{,}000$	1.85	1.79	1.72	1.63	1.55	1.46	1.39	1.31	1.22	1.15	1.05	0.981	0.879	0.757
9	$10{,}000 < N \le 25{,}000$	1.52	1.47	1.41	1.33	1.27	1.20	1.14	1.08	1.00	0.940	0.864	0.803	0.720	0.620
10	$25{,}000 < N \le 50{,}000$	1.30	1.26	1.21	1.15	1.09	1.03	0.976	0.924	0.859	0.807	0.742	0.690	0.619	0.533
11	$50{,}000 < N \le 75{,}000$	1.19	1.15	1.11	1.05	1.00	0.940	0.892	0.844	0.785	0.737	0.678	0.630	0.565	0.487
12	$75{,}000 < N \le 100{,}000$	1.11	1.08	1.04	0.981	0.936	0.881	0.836	0.791	0.736	0.691	0.635	0.591	0.530	0.456
13	$N \le 1{,}000$	3.10	3.00	2.88	2.73	2.60	2.45	2.32	2.20	2.04	1.92	1.77	1.64	1.47	1.27
14	$1{,}000 < N \le 10{,}000$	1.85	1.79	1.72	1.63	1.55	1.46	1.39	1.31	1.22	1.15	1.05	0.981	0.879	0.757
15	$10{,}000 < N \le 25{,}000$	1.52	1.47	1.41	1.33	1.27	1.20	1.14	1.08	1.00	0.940	0.864	0.803	0.720	0.620
16	$25{,}000 < N \le 50{,}000$	1.30	1.26	1.21	1.15	1.09	1.03	0.976	0.924	0.859	0.807	0.742	0.690	0.619	0.533
17	$50{,}000 < N \le 75{,}000$	1.19	1.15	1.11	1.05	1.00	0.940	0.892	0.844	0.785	0.737	0.678	0.630	0.565	0.487
18	$75{,}000 < N \le 100{,}000$	1.11	1.08	1.04	0.981	0.936	0.881	0.836	0.791	0.736	0.691	0.635	0.591	0.530	0.456
19	$N \le 1{,}000$	3.10	3.00	2.88	2.73	2.60	2.45	2.32	2.20	2.04	1.92	1.77	1.64	1.47	1.27
20	$1{,}000 < N \le 10{,}000$	1.85	1.79	1.72	1.63	1.55	1.46	1.39	1.31	1.22	1.15	1.05	0.981	0.879	0.757
21	$10{,}000 < N \le 25{,}000$	1.52	1.47	1.41	1.33	1.27	1.20	1.14	1.08	1.00	0.940	0.864	0.803	0.720	0.620
22	$25{,}000 < N \le 50{,}000$	1.30	1.26	1.21	1.15	1.09	1.03	0.976	0.924	0.859	0.807	0.742	0.690	0.619	0.533
23	$50{,}000 < N \le 75{,}000$	1.19	1.15	1.11	1.05	1.00	0.940	0.892	0.844	0.785	0.737	0.678	0.630	0.565	0.487
24	$75{,}000 < N \le 100{,}000$	1.11	1.08	1.04	0.981	0.936	0.881	0.836	0.791	0.736	0.691	0.635	0.591	0.530	0.456
25	$N \le 1{,}000$	3.10	3.00	2.88	2.73	2.60	2.45	2.32	2.20	2.04	1.92	1.77	1.64	1.47	1.27
26	$1{,}000 < N \le 10{,}000$	1.85	1.79	1.72	1.63	1.55	1.46	1.39	1.31	1.22	1.15	1.05	0.981	0.879	0.757
27	$10{,}000 < N \le 25{,}000$	1.52	1.47	1.41	1.33	1.27	1.20	1.14	1.08	1.00	0.940	0.864	0.803	0.720	0.620
28	$25{,}000 < N \le 50{,}000$	1.30	1.26	1.21	1.15	1.09	1.03	0.976	0.924	0.859	0.807	0.742	0.690	0.619	0.533
29	$50{,}000 < N \le 75{,}000$	1.19	1.15	1.11	1.05	1.00	0.940	0.892	0.844	0.785	0.737	0.678	0.630	0.565	0.487
30	$75{,}000 < N \le 100{,}000$	1.11	1.08	1.04	0.981	0.936	0.881	0.836	0.791	0.736	0.691	0.635	0.591	0.530	0.456
31	$N \le 1{,}000$	3.10	3.00	2.88	2.73	2.60	2.45	2.32	2.20	2.04	1.92	1.77	1.64	1.47	1.27
32	$1{,}000 < N \le 10{,}000$	1.85	1.79	1.72	1.63	1.55	1.46	1.39	1.31	1.22	1.15	1.05	0.981	0.879	0.757
33	$10{,}000 < N \le 25{,}000$	1.52	1.47	1.41	1.33	1.27	1.20	1.14	1.08	1.00	0.940	0.864	0.803	0.720	0.620
34	$25{,}000 < N \le 50{,}000$	1.30	1.26	1.21	1.15	1.09	1.03	0.976	0.924	0.859	0.807	0.742	0.690	0.619	0.533
35	$50{,}000 < N \le 75{,}000$	1.19	1.15	1.11	1.05	1.00	0.940	0.892	0.844	0.785	0.737	0.678	0.630	0.565	0.487
36	$75{,}000 < N \le 100{,}000$	1.11	1.08	1.04	0.981	0.936	0.881	0.836	0.791	0.736	0.691	0.635	0.591	0.530	0.456
37	$N \le 1{,}000$	1.25	1.20	1.13	1.06	0.988	0.923	0.861	0.800	0.754	0.710	0.667	0.625	...	...
38	$1{,}000 < N \le 10{,}000$	1.25	1.20	1.13	1.06	0.988	0.923	0.861	0.800	0.754	0.710	0.667	0.625	...	...
39	$10{,}000 < N \le 25{,}000$	1.25	1.20	1.13	1.06	0.988	0.923	0.861	0.800	0.754	0.710	0.667	0.625	...	...
40	$25{,}000 < N \le 50{,}000$	1.25	1.20	1.13	1.06	0.988	0.923	0.861	0.800	0.754	0.710	0.667	0.625	...	...
41	$50{,}000 < N \le 75{,}000$	1.25	1.20	1.13	1.06	0.988	0.923	0.861	0.800	0.754	0.710	0.667	0.625	...	...
42	$75{,}000 < N \le 100{,}000$	1.25	1.20	1.13	1.06	0.988	0.923	0.861	0.800	0.754	0.710	0.667	0.625	...	...

Table 1-1-3 Maximum Allowable Secondary Stress Range Values, S_A, for Thermoplastic Materials (Cont'd)

Line No.	Nominal Composition	Product Form	ASME Spec. No.	Type/Grade	Construction Code Notes	Minimum Yield Strength, ksi	Maximum Temperature Limit, °F	Design Factor	Notes
43	Polyamide	Extruded pipe	SF-2945	PA 32316	...	7.0	180	D01	M04
44	Polyamide	Extruded pipe	SF-2945	PA 32316	...	7.0	180	D01	M04
45	Polyamide	Extruded pipe	SF-2945	PA 32316	...	7.0	180	D01	M04
46	Polyamide	Extruded pipe	SF-2945	PA 32316	...	7.0	180	D01	M04
47	Polyamide	Extruded pipe	SF-2945	PA 32316	...	7.0	180	D01	M04
48	Polyamide	Extruded pipe	SF-2945	PA 32316	...	7.0	180	D01	M04
49	Polyethylene	Extruded pipe	SD-2239	PE2708	...	2.6	140	D01	M05, M06
50	Polyethylene	Extruded pipe	SD-2239	PE2708	...	2.6	140	D01	M05, M06
51	Polyethylene	Extruded pipe	SD-2239	PE2708	...	2.6	140	D01	M05, M06
52	Polyethylene	Extruded pipe	SD-2239	PE2708	...	2.6	140	D01	M05, M06
53	Polyethylene	Extruded pipe	SD-2239	PE2708	...	2.6	140	D01	M05, M06
54	Polyethylene	Extruded pipe	SD-2239	PE2708	...	2.6	140	D01	M05, M06
55	Polyethylene	Extruded pipe	SD-2239	PE2708	...	2.6	180	D01	M05, M07
56	Polyethylene	Extruded pipe	SD-2239	PE2708	...	2.6	180	D01	M05, M07
57	Polyethylene	Extruded pipe	SD-2239	PE2708	...	2.6	180	D01	M05, M07
58	Polyethylene	Extruded pipe	SD-2239	PE2708	...	2.6	180	D01	M05, M07
59	Polyethylene	Extruded pipe	SD-2239	PE2708	...	2.6	180	D01	M05, M07
60	Polyethylene	Extruded pipe	SD-2239	PE2708	...	2.6	180	D01	M05, M07
61	Polyethylene	Extruded pipe	SD-2513	PE2708	...	2.6	140	D01	M06, M08
62	Polyethylene	Extruded pipe	SD-2513	PE2708	...	2.6	140	D01	M06, M08
63	Polyethylene	Extruded pipe	SD-2513	PE2708	...	2.6	140	D01	M06, M08
64	Polyethylene	Extruded pipe	SD-2513	PE2708	...	2.6	140	D01	M06, M08
65	Polyethylene	Extruded pipe	SD-2513	PE2708	...	2.6	140	D01	M06, M08
66	Polyethylene	Extruded pipe	SD-2513	PE2708	...	2.6	140	D01	M06, M08
67	Polyethylene	Extruded pipe	SD-2513	PE2708	...	2.6	180	D01	M07, M08
68	Polyethylene	Extruded pipe	SD-2513	PE2708	...	2.6	180	D01	M07, M08
69	Polyethylene	Extruded pipe	SD-2513	PE2708	...	2.6	180	D01	M07, M08
70	Polyethylene	Extruded pipe	SD-2513	PE2708	...	2.6	180	D01	M07, M08
71	Polyethylene	Extruded pipe	SD-2513	PE2708	...	2.6	180	D01	M07, M08
72	Polyethylene	Extruded pipe	SD-2513	PE2708	...	2.6	180	D01	M07, M08
73	Polyethylene	Extruded tube	SD-2737	PE2708	...	2.6	140	D01	M05, M06
74	Polyethylene	Extruded tube	SD-2737	PE2708	...	2.6	140	D01	M05, M06
75	Polyethylene	Extruded tube	SD-2737	PE2708	...	2.6	140	D01	M05, M06
76	Polyethylene	Extruded tube	SD-2737	PE2708	...	2.6	140	D01	M05, M06
77	Polyethylene	Extruded tube	SD-2737	PE2708	...	2.6	140	D01	M05, M06
78	Polyethylene	Extruded tube	SD-2737	PE2708	...	2.6	140	D01	M05, M06
79	Polyethylene	Extruded tube	SD-2737	PE2708	...	2.6	180	D01	M05, M07
80	Polyethylene	Extruded tube	SD-2737	PE2708	...	2.6	180	D01	M05, M07
81	Polyethylene	Extruded tube	SD-2737	PE2708	...	2.6	180	D01	M05, M07
82	Polyethylene	Extruded tube	SD-2737	PE2708	...	2.6	180	D01	M05, M07
83	Polyethylene	Extruded tube	SD-2737	PE2708	...	2.6	180	D01	M05, M07
84	Polyethylene	Extruded tube	SD-2737	PE2708	...	2.6	180	D01	M05, M07

Table 1-1-3 Maximum Allowable Secondary Stress Range Values, S_A, for Thermoplastic Materials (Cont'd)

Line No.	Number of Equivalent Thermal Cycles, N	Maximum Allowable Secondary Stress Range, ksi [Note (1)], for Material Temperature, °F, Not Exceeding													
		73	80	90	100	110	120	130	140	150	160	170	180	190	200
43	$N \le 1{,}000$	1.25	1.20	1.13	1.06	0.988	0.923	0.861	0.800	0.754	0.710	0.667	0.625	...	...
44	$1{,}000 < N \le 10{,}000$	1.25	1.20	1.13	1.06	0.988	0.923	0.861	0.800	0.754	0.710	0.667	0.625	...	...
45	$10{,}000 < N \le 25{,}000$	1.25	1.20	1.13	1.06	0.988	0.923	0.861	0.800	0.754	0.710	0.667	0.625	...	...
46	$25{,}000 < N \le 50{,}000$	1.25	1.20	1.13	1.06	0.988	0.923	0.861	0.800	0.754	0.710	0.667	0.625	...	...
47	$50{,}000 < N \le 75{,}000$	1.25	1.20	1.13	1.06	0.988	0.923	0.861	0.800	0.754	0.710	0.667	0.625	...	...
48	$75{,}000 < N \le 100{,}000$	1.25	1.20	1.13	1.06	0.988	0.923	0.861	0.800	0.754	0.710	0.667	0.625	...	...
49	$N \le 1{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
50	$1{,}000 < N \le 10{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
51	$10{,}000 < N \le 25{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
52	$25{,}000 < N \le 50{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
53	$50{,}000 < N \le 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
54	$N > 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
55	$N \le 1{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
56	$1{,}000 < N \le 10{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
57	$10{,}000 < N \le 25{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
58	$25{,}000 < N \le 50{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
59	$50{,}000 < N \le 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
60	$N > 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
61	$N \le 1{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
62	$1{,}000 < N \le 10{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
63	$10{,}000 < N \le 25{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
64	$25{,}000 < N \le 50{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
65	$50{,}000 < N \le 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
66	$N > 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
67	$N \le 1{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
68	$1{,}000 < N \le 10{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
69	$10{,}000 < N \le 25{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
70	$25{,}000 < N \le 50{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
71	$50{,}000 < N \le 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
72	$N > 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
73	$N \le 1{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
74	$1{,}000 < N \le 10{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
75	$10{,}000 < N \le 25{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
76	$25{,}000 < N \le 50{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
77	$50{,}000 < N \le 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
78	$N > 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
79	$N \le 1{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
80	$1{,}000 < N \le 10{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
81	$10{,}000 < N \le 25{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
82	$25{,}000 < N \le 50{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
83	$50{,}000 < N \le 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
84	$N > 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1-1-3 Maximum Allowable Secondary Stress Range Values, S_A, for Thermoplastic Materials (Cont'd)

Line No.	Nominal Composition	Product Form	ASME Spec. No.	Type/Grade	Construction Code Notes	Minimum Yield Strength, ksi	Maximum Temperature Limit, °F	Design Factor	Notes
85	Polyethylene	Extruded pipe	SD-3035	PE2708	...	2.6	140	D01	M05, M06
86	Polyethylene	Extruded pipe	SD-3035	PE2708	...	2.6	140	D01	M05, M06
87	Polyethylene	Extruded pipe	SD-3035	PE2708	...	2.6	140	D01	M05, M06
88	Polyethylene	Extruded pipe	SD-3035	PE2708	...	2.6	140	D01	M05, M06
89	Polyethylene	Extruded pipe	SD-3035	PE2708	...	2.6	140	D01	M05, M06
90	Polyethylene	Extruded pipe	SD-3035	PE2708	...	2.6	140	D01	M05, M06
91	Polyethylene	Extruded pipe	SD-3035	PE2708	...	2.6	180	D01	M05, M07
92	Polyethylene	Extruded pipe	SD-3035	PE2708	...	2.6	180	D01	M05, M07
93	Polyethylene	Extruded pipe	SD-3035	PE2708	...	2.6	180	D01	M05, M07
94	Polyethylene	Extruded pipe	SD-3035	PE2708	...	2.6	180	D01	M05, M07
95	Polyethylene	Extruded pipe	SD-3035	PE2708	...	2.6	180	D01	M05, M07
96	Polyethylene	Extruded pipe	SD-3035	PE2708	...	2.6	180	D01	M05, M07
97	Polyethylene	Extruded pipe	SF-714	PE2708	...	2.6	140	D01	M06, M08
98	Polyethylene	Extruded pipe	SF-714	PE2708	...	2.6	140	D01	M06, M08
99	Polyethylene	Extruded pipe	SF-714	PE2708	...	2.6	140	D01	M06, M08
100	Polyethylene	Extruded pipe	SF-714	PE2708	...	2.6	140	D01	M06, M08
101	Polyethylene	Extruded pipe	SF-714	PE2708	...	2.6	140	D01	M06, M08
102	Polyethylene	Extruded pipe	SF-714	PE2708	...	2.6	140	D01	M06, M08
103	Polyethylene	Extruded pipe	SD-3035	PE2708	...	2.6	180	D01	M07, M08
104	Polyethylene	Extruded pipe	SD-3035	PE2708	...	2.6	180	D01	M07, M08
105	Polyethylene	Extruded pipe	SD-3035	PE2708	...	2.6	180	D01	M07, M08
106	Polyethylene	Extruded pipe	SD-3035	PE2708	...	2.6	180	D01	M07, M08
107	Polyethylene	Extruded pipe	SD-3035	PE2708	...	2.6	180	D01	M07, M08
108	Polyethylene	Extruded pipe	SD-3035	PE2708	...	2.6	180	D01	M07, M08
109	Polyethylene	Extruded pipe	SD-2239	PE3608	...	3.0	140	D01	M05, M09
110	Polyethylene	Extruded pipe	SD-2239	PE3608	...	3.0	140	D01	M05, M09
111	Polyethylene	Extruded pipe	SD-2239	PE3608	...	3.0	140	D01	M05, M09
112	Polyethylene	Extruded pipe	SD-2239	PE3608	...	3.0	140	D01	M05, M09
113	Polyethylene	Extruded pipe	SD-2239	PE3608	...	3.0	140	D01	M05, M09
114	Polyethylene	Extruded pipe	SD-2239	PE3608	...	3.0	140	D01	M05, M09
115	Polyethylene	Extruded pipe	SD-2239	PE3608	...	3.0	140	D01	M05, M10
116	Polyethylene	Extruded pipe	SD-2239	PE3608	...	3.0	140	D01	M05, M10
117	Polyethylene	Extruded pipe	SD-2239	PE3608	...	3.0	140	D01	M05, M10
118	Polyethylene	Extruded pipe	SD-2239	PE3608	...	3.0	140	D01	M05, M10
119	Polyethylene	Extruded pipe	SD-2239	PE3608	...	3.0	140	D01	M05, M10
120	Polyethylene	Extruded pipe	SD-2239	PE3608	...	3.0	140	D01	M05, M10
121	Polyethylene	Extruded pipe	SD-2239	PE4608	...	3.0	140	D01	M05, M10
122	Polyethylene	Extruded pipe	SD-2239	PE4608	...	3.0	140	D01	M05, M10
123	Polyethylene	Extruded pipe	SD-2239	PE4608	...	3.0	140	D01	M05, M10
124	Polyethylene	Extruded pipe	SD-2239	PE4608	...	3.0	140	D01	M05, M10
125	Polyethylene	Extruded pipe	SD-2239	PE4608	...	3.0	140	D01	M05, M10
126	Polyethylene	Extruded pipe	SD-2239	PE4608	...	3.0	140	D01	M05, M10

Table 1-1-3 Maximum Allowable Secondary Stress Range Values, S_A, for Thermoplastic Materials (Cont'd)

Line No.	Number of Equivalent Thermal Cycles, N	Maximum Allowable Secondary Stress Range, ksi [Note (1)], for Material Temperature, °F, Not Exceeding													
		73	80	90	100	110	120	130	140	150	160	170	180	190	200
85	$N \le 1{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
86	$1{,}000 < N \le 10{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
87	$10{,}000 < N \le 25{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
88	$25{,}000 < N \le 50{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
89	$50{,}000 < N \le 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
90	$N > 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
91	$N \le 1{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
92	$1{,}000 < N \le 10{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
93	$10{,}000 < N \le 25{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
94	$25{,}000 < N \le 50{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
95	$50{,}000 < N \le 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
96	$N > 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
97	$N \le 1{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
98	$1{,}000 < N \le 10{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
99	$10{,}000 < N \le 25{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
100	$25{,}000 < N \le 50{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
101	$50{,}000 < N \le 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
102	$N > 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
103	$N \le 1{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
104	$1{,}000 < N \le 10{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
105	$10{,}000 < N \le 25{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
106	$25{,}000 < N \le 50{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
107	$50{,}000 < N \le 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
108	$N > 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
109	$N \le 1{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
110	$1{,}000 < N \le 10{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
111	$10{,}000 < N \le 25{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
112	$25{,}000 < N \le 50{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
113	$50{,}000 < N \le 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
114	$N > 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
115	$N \le 1{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
116	$1{,}000 < N \le 10{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
117	$10{,}000 < N \le 25{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
118	$25{,}000 < N \le 50{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
119	$50{,}000 < N \le 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
120	$N > 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
121	$N \le 1{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
122	$1{,}000 < N \le 10{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
123	$10{,}000 < N \le 25{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
124	$25{,}000 < N \le 50{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
125	$50{,}000 < N \le 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
126	$N > 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1-1-3 Maximum Allowable Secondary Stress Range Values, S_A, for Thermoplastic Materials (Cont'd)

Line No.	Nominal Composition	Product Form	ASME Spec. No.	Type/Grade	Construction Code Notes	Minimum Yield Strength, ksi	Maximum Temperature Limit, °F	Design Factor	Notes
127	Polyethylene	Extruded pipe	SD-2239	PE4710	...	3.0	140	D01	M05, M11
128	Polyethylene	Extruded pipe	SD-2239	PE4710	...	3.0	140	D01	M05, M11
129	Polyethylene	Extruded pipe	SD-2239	PE4710	...	3.0	140	D01	M05, M11
130	Polyethylene	Extruded pipe	SD-2239	PE4710	...	3.0	140	D01	M05, M11
131	Polyethylene	Extruded pipe	SD-2239	PE4710	...	3.0	140	D01	M05, M11
132	Polyethylene	Extruded pipe	SD-2239	PE4710	...	3.0	140	D01	M05, M11
133	Polyethylene	Extruded pipe	SD-2239	PE4710	...	3.0	140	D01	M05, M12
134	Polyethylene	Extruded pipe	SD-2239	PE4710	...	3.0	140	D01	M05, M12
135	Polyethylene	Extruded pipe	SD-2239	PE4710	...	3.0	140	D01	M05, M12
136	Polyethylene	Extruded pipe	SD-2239	PE4710	...	3.0	140	D01	M05, M12
137	Polyethylene	Extruded pipe	SD-2239	PE4710	...	3.0	140	D01	M05, M12
138	Polyethylene	Extruded pipe	SD-2239	PE4710	...	3.0	140	D01	M05, M12
139	Polyethylene	Extruded pipe	SD-2239	PE4710	...	3.0	180	D01	M05, M13
140	Polyethylene	Extruded pipe	SD-2239	PE4710	...	3.0	180	D01	M05, M13
141	Polyethylene	Extruded pipe	SD-2239	PE4710	...	3.0	180	D01	M05, M13
142	Polyethylene	Extruded pipe	SD-2239	PE4710	...	3.0	180	D01	M05, M13
143	Polyethylene	Extruded pipe	SD-2239	PE4710	...	3.0	180	D01	M05, M13
144	Polyethylene	Extruded pipe	SD-2239	PE4710	...	3.0	180	D01	M05, M13
145	Polyethylene	Extruded pipe	SD-2513	PE4710	...	3.0	140	D01	M08, M11
146	Polyethylene	Extruded pipe	SD-2513	PE4710	...	3.0	140	D01	M08, M11
147	Polyethylene	Extruded pipe	SD-2513	PE4710	...	3.0	140	D01	M08, M11
148	Polyethylene	Extruded pipe	SD-2513	PE4710	...	3.0	140	D01	M08, M11
149	Polyethylene	Extruded pipe	SD-2513	PE4710	...	3.0	140	D01	M08, M11
150	Polyethylene	Extruded pipe	SD-2513	PE4710	...	3.0	140	D01	M08, M11
151	Polyethylene	Extruded pipe	SD-2513	PE4710	...	3.0	140	D01	M08, M12
152	Polyethylene	Extruded pipe	SD-2513	PE4710	...	3.0	140	D01	M08, M12
153	Polyethylene	Extruded pipe	SD-2513	PE4710	...	3.0	140	D01	M08, M12
154	Polyethylene	Extruded pipe	SD-2513	PE4710	...	3.0	140	D01	M08, M12
155	Polyethylene	Extruded pipe	SD-2513	PE4710	...	3.0	140	D01	M08, M12
156	Polyethylene	Extruded pipe	SD-2513	PE4710	...	3.0	140	D01	M08, M12
157	Polyethylene	Extruded pipe	SD-2513	PE4710	...	3.0	180	D01	M08, M13
158	Polyethylene	Extruded pipe	SD-2513	PE4710	...	3.0	180	D01	M08, M13
159	Polyethylene	Extruded pipe	SD-2513	PE4710	...	3.0	180	D01	M08, M13
160	Polyethylene	Extruded pipe	SD-2513	PE4710	...	3.0	180	D01	M08, M13
161	Polyethylene	Extruded pipe	SD-2513	PE4710	...	3.0	180	D01	M08, M13
162	Polyethylene	Extruded pipe	SD-2513	PE4710	...	3.0	180	D01	M08, M13
163	Polyethylene	Extruded tube	SD-2737	PE3608	...	3.0	140	D01	M05, M09
164	Polyethylene	Extruded tube	SD-2737	PE3608	...	3.0	140	D01	M05, M09
165	Polyethylene	Extruded tube	SD-2737	PE3608	...	3.0	140	D01	M05, M09
166	Polyethylene	Extruded tube	SD-2737	PE3608	...	3.0	140	D01	M05, M09
167	Polyethylene	Extruded tube	SD-2737	PE3608	...	3.0	140	D01	M05, M09
168	Polyethylene	Extruded tube	SD-2737	PE3608	...	3.0	140	D01	M05, M09

Table 1-1-3 Maximum Allowable Secondary Stress Range Values, S_A, for Thermoplastic Materials (Cont'd)

Line No.	Number of Equivalent Thermal Cycles, N	Maximum Allowable Secondary Stress Range, ksi [Note (1)], for Material Temperature, °F, Not Exceeding													
		73	80	90	100	110	120	130	140	150	160	170	180	190	200
127	$N \le 1{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
128	$1{,}000 < N \le 10{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
129	$10{,}000 < N \le 25{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
130	$25{,}000 < N \le 50{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
131	$50{,}000 < N \le 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
132	$N > 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
133	$N \le 1{,}000$	3.88	3.77	3.61	3.44	3.28	3.11	2.93	2.76	...	...	...	...	...	...
134	$1{,}000 < N \le 10{,}000$	2.57	2.50	2.40	2.30	2.19	2.08	1.97	1.86	...	...	...	...	...	...
135	$10{,}000 < N \le 25{,}000$	2.18	2.12	2.04	1.95	1.87	1.78	1.69	1.59	...	...	...	...	...	...
136	$25{,}000 < N \le 50{,}000$	1.92	1.87	1.80	1.73	1.65	1.58	1.50	1.42	...	...	...	...	...	...
137	$50{,}000 < N \le 75{,}000$	1.78	1.74	1.68	1.61	1.54	1.47	1.40	1.32	...	...	...	...	...	...
138	$N > 75{,}000$	1.70	1.66	1.59	1.53	1.47	1.40	1.33	1.26	...	...	...	...	...	...
139	$N \le 1{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
140	$1{,}000 < N \le 10{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
141	$10{,}000 < N \le 25{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
142	$25{,}000 < N \le 50{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
143	$50{,}000 < N \le 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
144	$N > 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
145	$N \le 1{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
146	$1{,}000 < N \le 10{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
147	$10{,}000 < N \le 25{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
148	$25{,}000 < N \le 50{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
149	$50{,}000 < N \le 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
150	$N > 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
151	$N \le 1{,}000$	3.88	3.77	3.61	3.44	3.28	3.11	2.93	2.76	...	...	...	...	...	...
152	$1{,}000 < N \le 10{,}000$	2.57	2.50	2.40	2.30	2.19	2.08	1.97	1.86	...	...	...	...	...	...
153	$10{,}000 < N \le 25{,}000$	2.18	2.12	2.04	1.95	1.87	1.78	1.69	1.59	...	...	...	...	...	...
154	$25{,}000 < N \le 50{,}000$	1.92	1.87	1.80	1.73	1.65	1.58	1.50	1.42	...	...	...	...	...	...
155	$50{,}000 < N \le 75{,}000$	1.78	1.74	1.68	1.61	1.54	1.47	1.40	1.32	...	...	...	...	...	...
156	$N > 75{,}000$	1.70	1.66	1.59	1.53	1.47	1.40	1.33	1.26	...	...	...	...	...	...
157	$N \le 1{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
158	$1{,}000 < N \le 10{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
159	$10{,}000 < N \le 25{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
160	$25{,}000 < N \le 50{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
161	$50{,}000 < N \le 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
162	$N > 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
163	$N \le 1{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
164	$1{,}000 < N \le 10{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
165	$10{,}000 < N \le 25{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
166	$25{,}000 < N \le 50{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
167	$50{,}000 < N \le 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
168	$N > 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1-1-3 Maximum Allowable Secondary Stress Range Values, S_A, for Thermoplastic Materials (Cont'd)

Line No.	Nominal Composition	Product Form	ASME Spec. No.	Type/Grade	Construction Code Notes	Minimum Yield Strength, ksi	Maximum Temperature Limit, °F	Design Factor	Notes
169	Polyethylene	Extruded tube	SD-2737	PE3608	...	3.0	140	D01	M05, M10
170	Polyethylene	Extruded tube	SD-2737	PE3608	...	3.0	140	D01	M05, M10
171	Polyethylene	Extruded tube	SD-2737	PE3608	...	3.0	140	D01	M05, M10
172	Polyethylene	Extruded tube	SD-2737	PE3608	...	3.0	140	D01	M05, M10
173	Polyethylene	Extruded tube	SD-2737	PE3608	...	3.0	140	D01	M05, M10
174	Polyethylene	Extruded tube	SD-2737	PE3608	...	3.0	140	D01	M05, M10
175	Polyethylene	Extruded tube	SD-2737	PE4608	...	3.0	140	D01	M05, M10
176	Polyethylene	Extruded tube	SD-2737	PE4608	...	3.0	140	D01	M05, M10
177	Polyethylene	Extruded tube	SD-2737	PE4608	...	3.0	140	D01	M05, M10
178	Polyethylene	Extruded tube	SD-2737	PE4608	...	3.0	140	D01	M05, M10
179	Polyethylene	Extruded tube	SD-2737	PE4608	...	3.0	140	D01	M05, M10
180	Polyethylene	Extruded tube	SD-2737	PE4608	...	3.0	140	D01	M05, M10
181	Polyethylene	Extruded tube	SD-2737	PE4710	...	3.0	140	D01	M05, M11
182	Polyethylene	Extruded tube	SD-2737	PE4710	...	3.0	140	D01	M05, M11
183	Polyethylene	Extruded tube	SD-2737	PE4710	...	3.0	140	D01	M05, M11
184	Polyethylene	Extruded tube	SD-2737	PE4710	...	3.0	140	D01	M05, M11
185	Polyethylene	Extruded tube	SD-2737	PE4710	...	3.0	140	D01	M05, M11
186	Polyethylene	Extruded tube	SD-2737	PE4710	...	3.0	140	D01	M05, M11
187	Polyethylene	Extruded tube	SD-2737	PE4710	...	3.0	140	D01	M05, M12
188	Polyethylene	Extruded tube	SD-2737	PE4710	...	3.0	140	D01	M05, M12
189	Polyethylene	Extruded tube	SD-2737	PE4710	...	3.0	140	D01	M05, M12
190	Polyethylene	Extruded tube	SD-2737	PE4710	...	3.0	140	D01	M05, M12
191	Polyethylene	Extruded tube	SD-2737	PE4710	...	3.0	140	D01	M05, M12
192	Polyethylene	Extruded tube	SD-2737	PE4710	...	3.0	140	D01	M05, M12
193	Polyethylene	Extruded tube	SD-2737	PE4710	...	3.0	180	D01	M05, M13
194	Polyethylene	Extruded tube	SD-2737	PE4710	...	3.0	180	D01	M05, M13
195	Polyethylene	Extruded tube	SD-2737	PE4710	...	3.0	180	D01	M05, M13
196	Polyethylene	Extruded tube	SD-2737	PE4710	...	3.0	180	D01	M05, M13
197	Polyethylene	Extruded tube	SD-2737	PE4710	...	3.0	180	D01	M05, M13
198	Polyethylene	Extruded tube	SD-2737	PE4710	...	3.0	180	D01	M05, M13
199	Polyethylene	Extruded pipe	SD-3035	PE3608	...	3.0	140	D01	M05, M09
200	Polyethylene	Extruded pipe	SD-3035	PE3608	...	3.0	140	D01	M05, M09
201	Polyethylene	Extruded pipe	SD-3035	PE3608	...	3.0	140	D01	M05, M09
202	Polyethylene	Extruded pipe	SD-3035	PE3608	...	3.0	140	D01	M05, M09
203	Polyethylene	Extruded pipe	SD-3035	PE3608	...	3.0	140	D01	M05, M09
204	Polyethylene	Extruded pipe	SD-3035	PE3608	...	3.0	140	D01	M05, M09
205	Polyethylene	Extruded pipe	SD-3035	PE3608	...	3.0	140	D01	M05, M10
206	Polyethylene	Extruded pipe	SD-3035	PE3608	...	3.0	140	D01	M05, M10
207	Polyethylene	Extruded pipe	SD-3035	PE3608	...	3.0	140	D01	M05, M10
208	Polyethylene	Extruded pipe	SD-3035	PE3608	...	3.0	140	D01	M05, M10
209	Polyethylene	Extruded pipe	SD-3035	PE3608	...	3.0	140	D01	M05, M10
210	Polyethylene	Extruded pipe	SD-3035	PE3608	...	3.0	140	D01	M05, M10

Table 1-1-3 Maximum Allowable Secondary Stress Range Values, S_A, for Thermoplastic Materials (Cont'd)

Line No.	Number of Equivalent Thermal Cycles, N	Maximum Allowable Secondary Stress Range, ksi [Note (1)], for Material Temperature, °F, Not Exceeding													
		73	80	90	100	110	120	130	140	150	160	170	180	190	200
169	$N \le 1{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
170	$1{,}000 < N \le 10{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
171	$10{,}000 < N \le 25{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
172	$25{,}000 < N \le 50{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
173	$50{,}000 < N \le 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
174	$N > 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
175	$N \le 1{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
176	$1{,}000 < N \le 10{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
177	$10{,}000 < N \le 25{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
178	$25{,}000 < N \le 50{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
179	$50{,}000 < N \le 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
180	$N > 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
181	$N \le 1{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
182	$1{,}000 < N \le 10{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
183	$10{,}000 < N \le 25{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
184	$25{,}000 < N \le 50{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
185	$50{,}000 < N \le 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
186	$N > 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
187	$N \le 1{,}000$	3.88	3.77	3.61	3.44	3.28	3.11	2.93	2.76	...	...	...	...	...	...
188	$1{,}000 < N \le 10{,}000$	2.57	2.50	2.40	2.30	2.19	2.08	1.97	1.86	...	...	...	...	...	...
189	$10{,}000 < N \le 25{,}000$	2.18	2.12	2.04	1.95	1.87	1.78	1.69	1.59	...	...	...	...	...	...
190	$25{,}000 < N \le 50{,}000$	1.92	1.87	1.80	1.73	1.65	1.58	1.50	1.42	...	...	...	...	...	...
191	$50{,}000 < N \le 75{,}000$	1.78	1.74	1.68	1.61	1.54	1.47	1.40	1.32	...	...	...	...	...	...
192	$N > 75{,}000$	1.70	1.66	1.59	1.53	1.47	1.40	1.33	1.26	...	...	...	...	...	...
193	$N \le 1{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
194	$1{,}000 < N \le 10{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
195	$10{,}000 < N \le 25{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
196	$25{,}000 < N \le 50{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
197	$50{,}000 < N \le 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
198	$N > 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
199	$N \le 1{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
200	$1{,}000 < N \le 10{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
201	$10{,}000 < N \le 25{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
202	$25{,}000 < N \le 50{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
203	$50{,}000 < N \le 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
204	$N > 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
205	$N \le 1{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
206	$1{,}000 < N \le 10{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
207	$10{,}000 < N \le 25{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
208	$25{,}000 < N \le 50{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
209	$50{,}000 < N \le 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
210	$N > 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1-1-3 Maximum Allowable Secondary Stress Range Values, S_A, for Thermoplastic Materials (Cont'd)

Line No.	Nominal Composition	Product Form	ASME Spec. No.	Type/Grade	Construction Code Notes	Minimum Yield Strength, ksi	Maximum Temperature Limit, °F	Design Factor	Notes
211	Polyethylene	Extruded pipe	SD-3035	PE4608	...	3.0	140	D01	M05, M10
212	Polyethylene	Extruded pipe	SD-3035	PE4608	...	3.0	140	D01	M05, M10
213	Polyethylene	Extruded pipe	SD-3035	PE4608	...	3.0	140	D01	M05, M10
214	Polyethylene	Extruded pipe	SD-3035	PE4608	...	3.0	140	D01	M05, M10
215	Polyethylene	Extruded pipe	SD-3035	PE4608	...	3.0	140	D01	M05, M10
216	Polyethylene	Extruded pipe	SD-3035	PE4608	...	3.0	140	D01	M05, M10
217	Polyethylene	Extruded pipe	SD-3035	PE4710	...	3.0	140	D01	M05, M11
218	Polyethylene	Extruded pipe	SD-3035	PE4710	...	3.0	140	D01	M05, M11
219	Polyethylene	Extruded pipe	SD-3035	PE4710	...	3.0	140	D01	M05, M11
220	Polyethylene	Extruded pipe	SD-3035	PE4710	...	3.0	140	D01	M05, M11
221	Polyethylene	Extruded pipe	SD-3035	PE4710	...	3.0	140	D01	M05, M11
222	Polyethylene	Extruded pipe	SD-3035	PE4710	...	3.0	140	D01	M05, M11
223	Polyethylene	Extruded pipe	SD-3035	PE4710	...	3.0	140	D01	M05, M12
224	Polyethylene	Extruded pipe	SD-3035	PE4710	...	3.0	140	D01	M05, M12
225	Polyethylene	Extruded pipe	SD-3035	PE4710	...	3.0	140	D01	M05, M12
226	Polyethylene	Extruded pipe	SD-3035	PE4710	...	3.0	140	D01	M05, M12
227	Polyethylene	Extruded pipe	SD-3035	PE4710	...	3.0	140	D01	M05, M12
228	Polyethylene	Extruded pipe	SD-3035	PE4710	...	3.0	140	D01	M05, M12
229	Polyethylene	Extruded pipe	SD-3035	PE4710	...	3.0	180	D01	M05, M13
230	Polyethylene	Extruded pipe	SD-3035	PE4710	...	3.0	180	D01	M05, M13
231	Polyethylene	Extruded pipe	SD-3035	PE4710	...	3.0	180	D01	M05, M13
232	Polyethylene	Extruded pipe	SD-3035	PE4710	...	3.0	180	D01	M05, M13
233	Polyethylene	Extruded pipe	SD-3035	PE4710	...	3.0	180	D01	M05, M13
234	Polyethylene	Extruded pipe	SD-3035	PE4710	...	3.0	180	D01	M05, M13
235	Polyethylene	Extruded pipe	SF-714	PE3608	...	3.0	140	D01	M08, M09
236	Polyethylene	Extruded pipe	SF-714	PE3608	...	3.0	140	D01	M08, M09
237	Polyethylene	Extruded pipe	SF-714	PE3608	...	3.0	140	D01	M08, M09
238	Polyethylene	Extruded pipe	SF-714	PE3608	...	3.0	140	D01	M08, M09
239	Polyethylene	Extruded pipe	SF-714	PE3608	...	3.0	140	D01	M08, M09
240	Polyethylene	Extruded pipe	SF-714	PE3608	...	3.0	140	D01	M08, M09
241	Polyethylene	Extruded pipe	SF-714	PE3608	...	3.0	140	D01	M08, M10
242	Polyethylene	Extruded pipe	SF-714	PE3608	...	3.0	140	D01	M08, M10
243	Polyethylene	Extruded pipe	SF-714	PE3608	...	3.0	140	D01	M08, M10
244	Polyethylene	Extruded pipe	SF-714	PE3608	...	3.0	140	D01	M08, M10
245	Polyethylene	Extruded pipe	SF-714	PE3608	...	3.0	140	D01	M08, M10
246	Polyethylene	Extruded pipe	SF-714	PE3608	...	3.0	140	D01	M08, M10
247	Polyethylene	Extruded pipe	SF-714	PE4608	...	3.0	140	D01	M08, M10
248	Polyethylene	Extruded pipe	SF-714	PE4608	...	3.0	140	D01	M08, M10
249	Polyethylene	Extruded pipe	SF-714	PE4608	...	3.0	140	D01	M08, M10
250	Polyethylene	Extruded pipe	SF-714	PE4608	...	3.0	140	D01	M08, M10
251	Polyethylene	Extruded pipe	SF-714	PE4608	...	3.0	140	D01	M08, M10
252	Polyethylene	Extruded pipe	SF-714	PE4608	...	3.0	140	D01	M08, M10

Table 1-1-3 Maximum Allowable Secondary Stress Range Values, S_A, for Thermoplastic Materials (Cont'd)

Line No.	Number of Equivalent Thermal Cycles, N	Maximum Allowable Secondary Stress Range, ksi [Note (1)], for Material Temperature, °F, Not Exceeding													
		73	80	90	100	110	120	130	140	150	160	170	180	190	200
211	$N \le 1{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
212	$1{,}000 < N \le 10{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
213	$10{,}000 < N \le 25{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
214	$25{,}000 < N \le 50{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
215	$50{,}000 < N \le 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
216	$N > 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
217	$N \le 1{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
218	$1{,}000 < N \le 10{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
219	$10{,}000 < N \le 25{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
220	$25{,}000 < N \le 50{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
221	$50{,}000 < N \le 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
222	$N > 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
223	$N \le 1{,}000$	3.88	3.77	3.61	3.44	3.28	3.11	2.93	2.76	...	...	...	...	...	...
224	$1{,}000 < N \le 10{,}000$	2.57	2.50	2.40	2.30	2.19	2.08	1.97	1.86	...	...	...	...	...	...
225	$10{,}000 < N \le 25{,}000$	2.18	2.12	2.04	1.95	1.87	1.78	1.69	1.59	...	...	...	...	...	...
226	$25{,}000 < N \le 50{,}000$	1.92	1.87	1.80	1.73	1.65	1.58	1.50	1.42	...	...	...	...	...	...
227	$50{,}000 < N \le 75{,}000$	1.78	1.74	1.68	1.61	1.54	1.47	1.40	1.32	...	...	...	...	...	...
228	$N > 75{,}000$	1.70	1.66	1.59	1.53	1.47	1.40	1.33	1.26	...	...	...	...	...	...
229	$N \le 1{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
230	$1{,}000 < N \le 10{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
231	$10{,}000 < N \le 25{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
232	$25{,}000 < N \le 50{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
233	$50{,}000 < N \le 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
234	$N > 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
235	$N \le 1{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
236	$1{,}000 < N \le 10{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
237	$10{,}000 < N \le 25{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
238	$25{,}000 < N \le 50{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
239	$50{,}000 < N \le 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
240	$N > 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
241	$N \le 1{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
242	$1{,}000 < N \le 10{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
243	$10{,}000 < N \le 25{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
244	$25{,}000 < N \le 50{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
245	$50{,}000 < N \le 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
246	$N > 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
247	$N \le 1{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
248	$1{,}000 < N \le 10{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
249	$10{,}000 < N \le 25{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
250	$25{,}000 < N \le 50{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
251	$50{,}000 < N \le 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
252	$N > 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1-1-3 Maximum Allowable Secondary Stress Range Values, S_A, for Thermoplastic Materials (Cont'd)

Line No.	Nominal Composition	Product Form	ASME Spec. No.	Type/Grade	Construction Code Notes	Minimum Yield Strength, ksi	Maximum Temperature Limit, °F	Design Factor	Notes
253	Polyethylene	Extruded pipe	SF-714	PE4710	...	3.0	140	D01	M08, M11
254	Polyethylene	Extruded pipe	SF-714	PE4710	...	3.0	140	D01	M08, M11
255	Polyethylene	Extruded pipe	SF-714	PE4710	...	3.0	140	D01	M08, M11
256	Polyethylene	Extruded pipe	SF-714	PE4710	...	3.0	140	D01	M08, M11
257	Polyethylene	Extruded pipe	SF-714	PE4710	...	3.0	140	D01	M08, M11
258	Polyethylene	Extruded pipe	SF-714	PE4710	...	3.0	140	D01	M08, M11
259	Polyethylene	Extruded pipe	SF-714	PE4710	...	3.0	140	D01	M08, M12
260	Polyethylene	Extruded pipe	SF-714	PE4710	...	3.0	140	D01	M08, M12
261	Polyethylene	Extruded pipe	SF-714	PE4710	...	3.0	140	D01	M08, M12
262	Polyethylene	Extruded pipe	SF-714	PE4710	...	3.0	140	D01	M08, M12
263	Polyethylene	Extruded pipe	SF-714	PE4710	...	3.0	140	D01	M08, M12
264	Polyethylene	Extruded pipe	SF-714	PE4710	...	3.0	140	D01	M08, M12
265	Polyethylene	Extruded pipe	SF-714	PE4710	...	3.0	180	D01	M08, M13
266	Polyethylene	Extruded pipe	SF-714	PE4710	...	3.0	180	D01	M08, M13
267	Polyethylene	Extruded pipe	SF-714	PE4710	...	3.0	180	D01	M08, M13
268	Polyethylene	Extruded pipe	SF-714	PE4710	...	3.0	180	D01	M08, M13
269	Polyethylene	Extruded pipe	SF-714	PE4710	...	3.0	180	D01	M08, M13
270	Polyethylene	Extruded pipe	SF-714	PE4710	...	3.0	180	D01	M08, M13
271	Polyethylene	Extruded pipe	SF-2619	PE3608	...	3.0	140	D01	M09, M14
272	Polyethylene	Extruded pipe	SF-2619	PE3608	...	3.0	140	D01	M09, M14
273	Polyethylene	Extruded pipe	SF-2619	PE3608	...	3.0	140	D01	M09, M14
274	Polyethylene	Extruded pipe	SF-2619	PE3608	...	3.0	140	D01	M09, M14
275	Polyethylene	Extruded pipe	SF-2619	PE3608	...	3.0	140	D01	M09, M14
276	Polyethylene	Extruded pipe	SF-2619	PE3608	...	3.0	140	D01	M09, M14
277	Polyethylene	Extruded pipe	SF-2619	PE3608	...	3.0	140	D01	M10, M14
278	Polyethylene	Extruded pipe	SF-2619	PE3608	...	3.0	140	D01	M10, M14
279	Polyethylene	Extruded pipe	SF-2619	PE3608	...	3.0	140	D01	M10, M14
280	Polyethylene	Extruded pipe	SF-2619	PE3608	...	3.0	140	D01	M10, M14
281	Polyethylene	Extruded pipe	SF-2619	PE3608	...	3.0	140	D01	M10, M14
282	Polyethylene	Extruded pipe	SF-2619	PE3608	...	3.0	140	D01	M10, M14
283	Polyethylene	Extruded pipe	SF-2619	PE4710	...	3.0	140	D01	M11, M14
284	Polyethylene	Extruded pipe	SF-2619	PE4710	...	3.0	140	D01	M11, M14
285	Polyethylene	Extruded pipe	SF-2619	PE4710	...	3.0	140	D01	M11, M14
286	Polyethylene	Extruded pipe	SF-2619	PE4710	...	3.0	140	D01	M11, M14
287	Polyethylene	Extruded pipe	SF-2619	PE4710	...	3.0	140	D01	M11, M14
288	Polyethylene	Extruded pipe	SF-2619	PE4710	...	3.0	140	D01	M11, M14
289	Polyethylene	Extruded pipe	SF-2619	PE4710	...	3.0	140	D01	M12, M14
290	Polyethylene	Extruded pipe	SF-2619	PE4710	...	3.0	140	D01	M12, M14
291	Polyethylene	Extruded pipe	SF-2619	PE4710	...	3.0	140	D01	M12, M14
292	Polyethylene	Extruded pipe	SF-2619	PE4710	...	3.0	140	D01	M12, M14
293	Polyethylene	Extruded pipe	SF-2619	PE4710	...	3.0	140	D01	M12, M14
294	Polyethylene	Extruded pipe	SF-2619	PE4710	...	3.0	140	D01	M12, M14

Table 1-1-3 Maximum Allowable Secondary Stress Range Values, S_A, for Thermoplastic Materials (Cont'd)

Line No.	Number of Equivalent Thermal Cycles, N	Maximum Allowable Secondary Stress Range, ksi [Note (1)], for Material Temperature, °F, Not Exceeding													
		73	80	90	100	110	120	130	140	150	160	170	180	190	200
253	$N \le 1{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
254	$1{,}000 < N \le 10{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
255	$10{,}000 < N \le 25{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
256	$25{,}000 < N \le 50{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
257	$50{,}000 < N \le 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
258	$N > 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
259	$N \le 1{,}000$	3.88	3.77	3.61	3.44	3.28	3.11	2.93	2.76	...	...	...	...	...	...
260	$1{,}000 < N \le 10{,}000$	2.57	2.50	2.40	2.30	2.19	2.08	1.97	1.86	...	...	...	...	...	...
261	$10{,}000 < N \le 25{,}000$	2.18	2.12	2.04	1.95	1.87	1.78	1.69	1.59	...	...	...	...	...	...
262	$25{,}000 < N \le 50{,}000$	1.92	1.87	1.80	1.73	1.65	1.58	1.50	1.42	...	...	...	...	...	...
263	$50{,}000 < N \le 75{,}000$	1.78	1.74	1.68	1.61	1.54	1.47	1.40	1.32	...	...	...	...	...	...
264	$N > 75{,}000$	1.70	1.66	1.59	1.53	1.47	1.40	1.33	1.26	...	...	...	...	...	...
265	$N \le 1{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
266	$1{,}000 < N \le 10{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
267	$10{,}000 < N \le 25{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
268	$25{,}000 < N \le 50{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
269	$50{,}000 < N \le 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
270	$N > 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
271	$N \le 1{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
272	$1{,}000 < N \le 10{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
273	$10{,}000 < N \le 25{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
274	$25{,}000 < N \le 50{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
275	$50{,}000 < N \le 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
276	$N > 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
277	$N \le 1{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
278	$1{,}000 < N \le 10{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
279	$10{,}000 < N \le 25{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
280	$25{,}000 < N \le 50{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
281	$50{,}000 < N \le 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
282	$N > 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
283	$N \le 1{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
284	$1{,}000 < N \le 10{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
285	$10{,}000 < N \le 25{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
286	$25{,}000 < N \le 50{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
287	$50{,}000 < N \le 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
288	$N > 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
289	$N \le 1{,}000$	3.88	3.77	3.61	3.44	3.28	3.11	2.93	2.76	...	...	...	...	...	...
290	$1{,}000 < N \le 10{,}000$	2.57	2.50	2.40	2.30	2.19	2.08	1.97	1.86	...	...	...	...	...	...
291	$10{,}000 < N \le 25{,}000$	2.18	2.12	2.04	1.95	1.87	1.78	1.69	1.59	...	...	...	...	...	...
292	$25{,}000 < N \le 50{,}000$	1.92	1.87	1.80	1.73	1.65	1.58	1.50	1.42	...	...	...	...	...	...
293	$50{,}000 < N \le 75{,}000$	1.78	1.74	1.68	1.61	1.54	1.47	1.40	1.32	...	...	...	...	...	...
294	$N > 75{,}000$	1.70	1.66	1.59	1.53	1.47	1.40	1.33	1.26	...	...	...	...	...	...

Table 1-1-3 Maximum Allowable Secondary Stress Range Values, S_A, for Thermoplastic Materials (Cont'd)

Line No.	Nominal Composition	Product Form	ASME Spec. No.	Type/Grade	Construction Code Notes	Minimum Yield Strength, ksi	Maximum Temperature Limit, °F	Design Factor	Notes
295	Polyethylene	Extruded pipe	SF-2619	PE4710	...	3.0	180	D01	M13, M14
296	Polyethylene	Extruded pipe	SF-2619	PE4710	...	3.0	180	D01	M13, M14
297	Polyethylene	Extruded pipe	SF-2619	PE4710	...	3.0	180	D01	M13, M14
298	Polyethylene	Extruded pipe	SF-2619	PE4710	...	3.0	180	D01	M13, M14
299	Polyethylene	Extruded pipe	SF-2619	PE4710	...	3.0	180	D01	M13, M14
300	Polyethylene	Extruded pipe	SF-2619	PE4710	...	3.0	180	D01	M13, M14
301	PVC	Extruded pipe	SD-1785	PVC2110	C01	6.0	140	D01	M15
302	PVC	Extruded pipe	SD-1785	PVC2110	C01	6.0	140	D01	M15
303	PVC	Extruded pipe	SD-1785	PVC2110	C01	6.0	140	D01	M15
304	PVC	Extruded pipe	SD-1785	PVC2110	C01	6.0	140	D01	M15
305	PVC	Extruded pipe	SD-1785	PVC2110	C01	6.0	140	D01	M15
306	PVC	Extruded pipe	SD-1785	PVC2110	C01	6.0	140	D01	M15
307	PVC	Extruded pipe	SD-1785	PVC2112	C01	6.0	140	D01	M16
308	PVC	Extruded pipe	SD-1785	PVC2112	C01	6.0	140	D01	M16
309	PVC	Extruded pipe	SD-1785	PVC2112	C01	6.0	140	D01	M16
310	PVC	Extruded pipe	SD-1785	PVC2112	C01	6.0	140	D01	M16
311	PVC	Extruded pipe	SD-1785	PVC2112	C01	6.0	140	D01	M16
312	PVC	Extruded pipe	SD-1785	PVC2112	C01	6.0	140	D01	M16
313	PVC	Extruded pipe	SD-1785	PVC2116	C01	6.0	140	D01	M17
314	PVC	Extruded pipe	SD-1785	PVC2116	C01	6.0	140	D01	M17
315	PVC	Extruded pipe	SD-1785	PVC2116	C01	6.0	140	D01	M17
316	PVC	Extruded pipe	SD-1785	PVC2116	C01	6.0	140	D01	M17
317	PVC	Extruded pipe	SD-1785	PVC2116	C01	6.0	140	D01	M17
318	PVC	Extruded pipe	SD-1785	PVC2116	C01	6.0	140	D01	M17
319	PVC	Extruded pipe	SD-1785	PVC2120	C01	6.0	140	D01	M18
320	PVC	Extruded pipe	SD-1785	PVC2120	C01	6.0	140	D01	M18
321	PVC	Extruded pipe	SD-1785	PVC2120	C01	6.0	140	D01	M18
322	PVC	Extruded pipe	SD-1785	PVC2120	C01	6.0	140	D01	M18
323	PVC	Extruded pipe	SD-1785	PVC2120	C01	6.0	140	D01	M18
324	PVC	Extruded pipe	SD-1785	PVC2120	C01	6.0	140	D01	M18
325	PVC	Extruded tube	SD-2241	PVC2110	C01	6.0	140	D01	M15
326	PVC	Extruded tube	SD-2241	PVC2110	C01	6.0	140	D01	M15
327	PVC	Extruded tube	SD-2241	PVC2110	C01	6.0	140	D01	M15
328	PVC	Extruded tube	SD-2241	PVC2110	C01	6.0	140	D01	M15
329	PVC	Extruded tube	SD-2241	PVC2110	C01	6.0	140	D01	M15
330	PVC	Extruded tube	SD-2241	PVC2110	C01	6.0	140	D01	M15
331	PVC	Extruded tube	SD-2241	PVC2112	C01	6.0	140	D01	M16
332	PVC	Extruded tube	SD-2241	PVC2112	C01	6.0	140	D01	M16
333	PVC	Extruded tube	SD-2241	PVC2112	C01	6.0	140	D01	M16
334	PVC	Extruded tube	SD-2241	PVC2112	C01	6.0	140	D01	M16
335	PVC	Extruded tube	SD-2241	PVC2112	C01	6.0	140	D01	M16
336	PVC	Extruded tube	SD-2241	PVC2112	C01	6.0	140	D01	M16

Table 1-1-3 Maximum Allowable Secondary Stress Range Values, S_A, for Thermoplastic Materials (Cont'd)

Line No.	Number of Equivalent Thermal Cycles, N	Maximum Allowable Secondary Stress Range, ksi [Note (1)], for Material Temperature, °F, Not Exceeding													
		73	80	90	100	110	120	130	140	150	160	170	180	190	200
295	$N \le 1{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
296	$1{,}000 < N \le 10{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
297	$10{,}000 < N \le 25{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
298	$25{,}000 < N \le 50{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
299	$50{,}000 < N \le 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
300	$N > 75{,}000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...
301	$N \le 1{,}000$	3.10	2.94	2.69	2.45	2.20	1.95	1.70	1.46	...	...	...	...	...	...
302	$1{,}000 < N \le 10{,}000$	1.85	1.76	1.61	1.46	1.31	1.17	1.02	0.870	...	...	...	...	...	...
303	$10{,}000 < N \le 25{,}000$	1.52	1.44	1.32	1.20	1.08	0.955	0.834	0.712	...	...	...	...	...	...
304	$25{,}000 < N \le 50{,}000$	1.30	1.24	1.13	1.03	0.924	0.820	0.716	0.612	...	...	...	...	...	...
305	$50{,}000 < N \le 75{,}000$	1.19	1.13	1.03	0.940	0.844	0.749	0.654	0.559	...	...	...	...	...	...
306	$75{,}000 < N \le 100{,}000$	1.11	1.06	0.970	0.881	0.791	0.702	0.613	0.524	...	...	...	...	...	...
307	$N \le 1{,}000$	3.10	2.94	2.69	2.45	2.20	1.95	1.70	1.46	...	...	...	...	...	...
308	$1{,}000 < N \le 10{,}000$	1.85	1.76	1.61	1.46	1.31	1.17	1.02	0.870	...	...	...	...	...	...
309	$10{,}000 < N \le 25{,}000$	1.52	1.44	1.32	1.20	1.08	0.955	0.834	0.712	...	...	...	...	...	...
310	$25{,}000 < N \le 50{,}000$	1.30	1.24	1.13	1.03	0.924	0.820	0.716	0.612	...	...	...	...	...	...
311	$50{,}000 < N \le 75{,}000$	1.19	1.13	1.03	0.940	0.844	0.749	0.654	0.559	...	...	...	...	...	...
312	$75{,}000 < N \le 100{,}000$	1.11	1.06	0.970	0.881	0.791	0.702	0.613	0.524	...	...	...	...	...	...
313	$N \le 1{,}000$	3.10	2.94	2.69	2.45	2.20	1.95	1.70	1.46	...	...	...	...	...	...
314	$1{,}000 < N \le 10{,}000$	1.85	1.76	1.61	1.46	1.31	1.17	1.02	0.870	...	...	...	...	...	...
315	$10{,}000 < N \le 25{,}000$	1.52	1.44	1.32	1.20	1.08	0.955	0.834	0.712	...	...	...	...	...	...
316	$25{,}000 < N \le 50{,}000$	1.30	1.24	1.13	1.03	0.924	0.820	0.716	0.612	...	...	...	...	...	...
317	$50{,}000 < N \le 75{,}000$	1.19	1.13	1.03	0.940	0.844	0.749	0.654	0.559	...	...	...	...	...	...
318	$75{,}000 < N \le 100{,}000$	1.11	1.06	0.970	0.881	0.791	0.702	0.613	0.524	...	...	...	...	...	...
319	$N \le 1{,}000$	3.10	2.94	2.69	2.45	2.20	1.95	1.70	1.46	...	...	...	...	...	...
320	$1{,}000 < N \le 10{,}000$	1.85	1.76	1.61	1.46	1.31	1.17	1.02	0.870	...	...	...	...	...	...
321	$10{,}000 < N \le 25{,}000$	1.52	1.44	1.32	1.20	1.08	0.955	0.834	0.712	...	...	...	...	...	...
322	$25{,}000 < N \le 50{,}000$	1.30	1.24	1.13	1.03	0.924	0.820	0.716	0.612	...	...	...	...	...	...
323	$50{,}000 < N \le 75{,}000$	1.19	1.13	1.03	0.940	0.844	0.749	0.654	0.559	...	...	...	...	...	...
324	$75{,}000 < N \le 100{,}000$	1.11	1.06	0.970	0.881	0.791	0.702	0.613	0.524	...	...	...	...	...	...
325	$N \le 1{,}000$	3.10	2.94	2.69	2.45	2.20	1.95	1.70	1.46	...	...	...	...	...	...
326	$1{,}000 < N \le 10{,}000$	1.85	1.76	1.61	1.46	1.31	1.17	1.02	0.870	...	...	...	...	...	...
327	$10{,}000 < N \le 25{,}000$	1.52	1.44	1.32	1.20	1.08	0.955	0.834	0.712	...	...	...	...	...	...
328	$25{,}000 < N \le 50{,}000$	1.30	1.24	1.13	1.03	0.924	0.820	0.716	0.612	...	...	...	...	...	...
329	$50{,}000 < N \le 75{,}000$	1.19	1.13	1.03	0.940	0.844	0.749	0.654	0.559	...	...	...	...	...	...
330	$75{,}000 < N \le 100{,}000$	1.11	1.06	0.970	0.881	0.791	0.702	0.613	0.524	...	...	...	...	...	...
331	$N \le 1{,}000$	3.10	2.94	2.69	2.45	2.20	1.95	1.70	1.46	...	...	...	...	...	...
332	$1{,}000 < N \le 10{,}000$	1.85	1.76	1.61	1.46	1.31	1.17	1.02	0.870	...	...	...	...	...	...
333	$10{,}000 < N \le 25{,}000$	1.52	1.44	1.32	1.20	1.08	0.955	0.834	0.712	...	...	...	...	...	...
334	$25{,}000 < N \le 50{,}000$	1.30	1.24	1.13	1.03	0.924	0.820	0.716	0.612	...	...	...	...	...	...
335	$50{,}000 < N \le 75{,}000$	1.19	1.13	1.03	0.940	0.844	0.749	0.654	0.559	...	...	...	...	...	...
336	$75{,}000 < N \le 100{,}000$	1.11	1.06	0.970	0.881	0.791	0.702	0.613	0.524	...	...	...	...	...	...

Table 1-1-3 Maximum Allowable Secondary Stress Range Values, S_A, for Thermoplastic Materials (Cont'd)

Line No.	Nominal Composition	Product Form	ASME Spec. No.	Type/Grade	Construction Code Notes	Minimum Yield Strength, ksi	Maximum Temperature Limit, °F	Design Factor	Notes
337	PVC	Extruded tube	SD-2241	PVC2116	C01	6.0	140	D01	M17
338	PVC	Extruded tube	SD-2241	PVC2116	C01	6.0	140	D01	M17
339	PVC	Extruded tube	SD-2241	PVC2116	C01	6.0	140	D01	M17
340	PVC	Extruded tube	SD-2241	PVC2116	C01	6.0	140	D01	M17
341	PVC	Extruded tube	SD-2241	PVC2116	C01	6.0	140	D01	M17
342	PVC	Extruded tube	SD-2241	PVC2116	C01	6.0	140	D01	M17
343	PVC	Extruded tube	SD-2241	PVC2120	C01	6.0	140	D01	M18
344	PVC	Extruded tube	SD-2241	PVC2120	C01	6.0	140	D01	M18
345	PVC	Extruded tube	SD-2241	PVC2120	C01	6.0	140	D01	M18
346	PVC	Extruded tube	SD-2241	PVC2120	C01	6.0	140	D01	M18
347	PVC	Extruded tube	SD-2241	PVC2120	C01	6.0	140	D01	M18
348	PVC	Extruded tube	SD-2241	PVC2120	C01	6.0	140	D01	M18
349	PVC	Extruded pipe	SD-1785	PVC1120	C01	7.0	140	D01	M19
350	PVC	Extruded pipe	SD-1785	PVC1120	C01	7.0	140	D01	M19
351	PVC	Extruded pipe	SD-1785	PVC1120	C01	7.0	140	D01	M19
352	PVC	Extruded pipe	SD-1785	PVC1120	C01	7.0	140	D01	M19
353	PVC	Extruded pipe	SD-1785	PVC1120	C01	7.0	140	D01	M19
354	PVC	Extruded pipe	SD-1785	PVC1120	C01	7.0	140	D01	M19
355	PVC	Extruded pipe	SD-1785	PVC1220	C01	7.0	140	D01	M19
356	PVC	Extruded pipe	SD-1785	PVC1220	C01	7.0	140	D01	M19
357	PVC	Extruded pipe	SD-1785	PVC1220	C01	7.0	140	D01	M19
358	PVC	Extruded pipe	SD-1785	PVC1220	C01	7.0	140	D01	M19
359	PVC	Extruded pipe	SD-1785	PVC1220	C01	7.0	140	D01	M19
360	PVC	Extruded pipe	SD-1785	PVC1220	C01	7.0	140	D01	M19
361	PVC	Extruded pipe	SD-2241	PVC1120	C01	7.0	140	D01	M19
362	PVC	Extruded pipe	SD-2241	PVC1120	C01	7.0	140	D01	M19
363	PVC	Extruded pipe	SD-2241	PVC1120	C01	7.0	140	D01	M19
364	PVC	Extruded pipe	SD-2241	PVC1120	C01	7.0	140	D01	M19
365	PVC	Extruded pipe	SD-2241	PVC1120	C01	7.0	140	D01	M19
366	PVC	Extruded pipe	SD-2241	PVC1120	C01	7.0	140	D01	M19
367	PVC	Extruded pipe	SD-2241	PVC1220	C01	7.0	140	D01	M19
368	PVC	Extruded pipe	SD-2241	PVC1220	C01	7.0	140	D01	M19
369	PVC	Extruded pipe	SD-2241	PVC1220	C01	7.0	140	D01	M19
370	PVC	Extruded pipe	SD-2241	PVC1220	C01	7.0	140	D01	M19
371	PVC	Extruded pipe	SD-2241	PVC1220	C01	7.0	140	D01	M19
372	PVC	Extruded pipe	SD-2241	PVC1220	C01	7.0	140	D01	M19
373	PVC	Extruded pipe	SF-1483	PVCO 1135	C01	7.0	130	D01	M20, M21
374	PVC	Extruded pipe	SF-1483	PVCO 1135	C01	7.0	130	D01	M20, M21
375	PVC	Extruded pipe	SF-1483	PVCO 1135	C01	7.0	130	D01	M20, M21
376	PVC	Extruded pipe	SF-1483	PVCO 1135	C01	7.0	130	D01	M20, M21
377	PVC	Extruded pipe	SF-1483	PVCO 1135	C01	7.0	130	D01	M20, M21
378	PVC	Extruded pipe	SF-1483	PVCO 1135	C01	7.0	130	D01	M20, M21

Table 1-1-3 Maximum Allowable Secondary Stress Range Values, S_A, for Thermoplastic Materials (Cont'd)

Line No.	Number of Equivalent Thermal Cycles, N	Maximum Allowable Secondary Stress Range, ksi [Note (1)], for Material Temperature, °F, Not Exceeding													
		73	80	90	100	110	120	130	140	150	160	170	180	190	200
337	$N \le 1{,}000$	3.10	2.94	2.69	2.45	2.20	1.95	1.70	1.46	...	...	...	...	...	...
338	$1{,}000 < N \le 10{,}000$	1.85	1.76	1.61	1.46	1.31	1.17	1.02	0.870	...	...	...	...	...	...
339	$10{,}000 < N \le 25{,}000$	1.52	1.44	1.32	1.20	1.08	0.955	0.834	0.712	...	...	...	...	...	...
340	$25{,}000 < N \le 50{,}000$	1.30	1.24	1.13	1.03	0.924	0.820	0.716	0.612	...	...	...	...	...	...
341	$50{,}000 < N \le 75{,}000$	1.19	1.13	1.03	0.940	0.844	0.749	0.654	0.559	...	...	...	...	...	...
342	$75{,}000 < N \le 100{,}000$	1.11	1.06	0.970	0.881	0.791	0.702	0.613	0.524	...	...	...	...	...	...
343	$N \le 1{,}000$	3.10	2.94	2.69	2.45	2.20	1.95	1.70	1.46	...	...	...	...	...	...
344	$1{,}000 < N \le 10{,}000$	1.85	1.76	1.61	1.46	1.31	1.17	1.02	0.870	...	...	...	...	...	...
345	$10{,}000 < N \le 25{,}000$	1.52	1.44	1.32	1.20	1.08	0.955	0.834	0.712	...	...	...	...	...	...
346	$25{,}000 < N \le 50{,}000$	1.30	1.24	1.13	1.03	0.924	0.820	0.716	0.612	...	...	...	...	...	...
347	$50{,}000 < N \le 75{,}000$	1.19	1.13	1.03	0.940	0.844	0.749	0.654	0.559	...	...	...	...	...	...
348	$75{,}000 < N \le 100{,}000$	1.11	1.06	0.970	0.881	0.791	0.702	0.613	0.524	...	...	...	...	...	...
349	$N \le 1{,}000$	3.10	2.94	2.69	2.45	2.20	1.95	1.70	1.46	...	...	...	...	...	...
350	$1{,}000 < N \le 10{,}000$	1.85	1.76	1.61	1.46	1.31	1.17	1.02	0.870	...	...	...	...	...	...
351	$10{,}000 < N \le 25{,}000$	1.52	1.44	1.32	1.20	1.08	0.955	0.834	0.712	...	...	...	...	...	...
352	$25{,}000 < N \le 50{,}000$	1.30	1.24	1.13	1.03	0.924	0.820	0.716	0.612	...	...	...	...	...	...
353	$50{,}000 < N \le 75{,}000$	1.19	1.13	1.03	0.940	0.844	0.749	0.654	0.559	...	...	...	...	...	...
354	$75{,}000 < N \le 100{,}000$	1.11	1.06	0.970	0.881	0.791	0.702	0.613	0.524	...	...	...	...	...	...
355	$N \le 1{,}000$	3.10	2.94	2.69	2.45	2.20	1.95	1.70	1.46	...	...	...	...	...	...
356	$1{,}000 < N \le 10{,}000$	1.85	1.76	1.61	1.46	1.31	1.17	1.02	0.870	...	...	...	...	...	...
357	$10{,}000 < N \le 25{,}000$	1.52	1.44	1.32	1.20	1.08	0.955	0.834	0.712	...	...	...	...	...	...
358	$25{,}000 < N \le 50{,}000$	1.30	1.24	1.13	1.03	0.924	0.820	0.716	0.612	...	...	...	...	...	...
359	$50{,}000 < N \le 75{,}000$	1.19	1.13	1.03	0.940	0.844	0.749	0.654	0.559	...	...	...	...	...	...
360	$75{,}000 < N \le 100{,}000$	1.11	1.06	0.970	0.881	0.791	0.702	0.613	0.524	...	...	...	...	...	...
361	$N \le 1{,}000$	3.10	2.94	2.69	2.45	2.20	1.95	1.70	1.46	...	...	...	...	...	...
362	$1{,}000 < N \le 10{,}000$	1.85	1.76	1.61	1.46	1.31	1.17	1.02	0.870	...	...	...	...	...	...
363	$10{,}000 < N \le 25{,}000$	1.52	1.44	1.32	1.20	1.08	0.955	0.834	0.712	...	...	...	...	...	...
364	$25{,}000 < N \le 50{,}000$	1.30	1.24	1.13	1.03	0.924	0.820	0.716	0.612	...	...	...	...	...	...
365	$50{,}000 < N \le 75{,}000$	1.19	1.13	1.03	0.940	0.844	0.749	0.654	0.559	...	...	...	...	...	...
366	$75{,}000 < N \le 100{,}000$	1.11	1.06	0.970	0.881	0.791	0.702	0.613	0.524	...	...	...	...	...	...
367	$N \le 1{,}000$	3.10	2.94	2.69	2.45	2.20	1.95	1.70	1.46	...	...	...	...	...	...
368	$1{,}000 < N \le 10{,}000$	1.85	1.76	1.61	1.46	1.31	1.17	1.02	0.870	...	...	...	...	...	...
369	$10{,}000 < N \le 25{,}000$	1.52	1.44	1.32	1.20	1.08	0.955	0.834	0.712	...	...	...	...	...	...
370	$25{,}000 < N \le 50{,}000$	1.30	1.24	1.13	1.03	0.924	0.820	0.716	0.612	...	...	...	...	...	...
371	$50{,}000 < N \le 75{,}000$	1.19	1.13	1.03	0.940	0.844	0.749	0.654	0.559	...	...	...	...	...	...
372	$75{,}000 < N \le 100{,}000$	1.11	1.06	0.970	0.881	0.791	0.702	0.613	0.524	...	...	...	...	...	...
373	$N \le 1{,}000$	3.10	2.94	2.69	2.45	2.20	1.95	1.70	...	...	...	...	...	...	...
374	$1{,}000 < N \le 10{,}000$	1.85	1.76	1.61	1.46	1.31	1.17	1.02	...	...	...	...	...	...	...
375	$10{,}000 < N \le 25{,}000$	1.52	1.44	1.32	1.20	1.08	0.955	0.834	...	...	...	...	...	...	...
376	$25{,}000 < N \le 50{,}000$	1.30	1.24	1.13	1.03	0.924	0.820	0.716	...	...	...	...	...	...	...
377	$50{,}000 < N \le 75{,}000$	1.19	1.13	1.03	0.940	0.844	0.749	0.654	...	...	...	...	...	...	...
378	$75{,}000 < N \le 100{,}000$	1.11	1.06	0.970	0.881	0.791	0.702	0.613	...	...	...	...	...	...	...

Table 1-1-3 Maximum Allowable Secondary Stress Range Values, S_A, for Thermoplastic Materials (Cont'd)

Line No.	Nominal Composition	Product Form	ASME Spec. No.	Type/Grade	Construction Code Notes	Minimum Yield Strength, ksi	Maximum Temperature Limit, °F	Design Factor	Notes
379	PVDF	Extruded pipe	SF-1673	PVDF 2020	...	6.5	200	D01	M22
380	PVDF	Extruded pipe	SF-1673	PVDF 2020	...	6.5	200	D01	M22
381	PVDF	Extruded pipe	SF-1673	PVDF 2020	...	6.5	200	D01	M22
382	PVDF	Extruded pipe	SF-1673	PVDF 2020	...	6.5	200	D01	M22
383	PVDF	Extruded pipe	SF-1673	PVDF 2020	...	6.5	200	D01	M22
384	PVDF	Extruded pipe	SF-1673	PVDF 2020	...	6.5	200	D01	M22
385	PVDF	Extruded pipe	SF-1673	PVDF 2025	...	7.7	200	D01	M23
386	PVDF	Extruded pipe	SF-1673	PVDF 2025	...	7.7	200	D01	M23
387	PVDF	Extruded pipe	SF-1673	PVDF 2025	...	7.7	200	D01	M23
388	PVDF	Extruded pipe	SF-1673	PVDF 2025	...	7.7	200	D01	M23
389	PVDF	Extruded pipe	SF-1673	PVDF 2025	...	7.7	200	D01	M23
390	PVDF	Extruded pipe	SF-1673	PVDF 2025	...	7.7	200	D01	M23

Table 1-1-3 Maximum Allowable Secondary Stress Range Values, S_A, for Thermoplastic Materials (Cont'd)

Line No.	Number of Equivalent Thermal Cycles, N	Maximum Allowable Secondary Stress Range, ksi [Note (1)], for Material Temperature, °F, Not Exceeding													
		73	80	90	100	110	120	130	140	150	160	170	180	190	200
379	$N \le 1{,}000$	6.63	6.43	6.14	5.86	5.58	5.29	5.01	4.72	4.45	4.18	3.91	3.65	3.38	3.11
380	$1{,}000 < N \le 10{,}000$	6.32	6.14	5.88	5.62	5.36	5.10	4.84	4.58	4.32	4.05	3.79	3.53	3.26	3.00
381	$10{,}000 < N \le 25{,}000$	6.20	6.03	5.78	5.53	5.28	5.03	4.78	4.52	4.26	4.00	3.74	3.48	3.22	2.95
382	$25{,}000 < N \le 50{,}000$	6.11	5.94	5.70	5.45	5.21	4.97	4.73	4.48	4.22	3.96	3.70	3.44	3.18	2.92
383	$50{,}000 < N \le 75{,}000$	6.05	5.89	5.65	5.41	5.17	4.93	4.70	4.46	4.20	3.94	3.68	3.42	3.16	2.90
384	$75{,}000 < N \le 100{,}000$	6.02	5.85	5.62	5.38	5.15	4.91	4.68	4.44	4.18	3.92	3.66	3.40	3.15	2.89
385	$N \le 1{,}000$	7.84	7.60	7.27	6.93	6.59	6.25	5.92	5.58	5.26	4.95	4.63	4.31	3.99	3.68
386	$1{,}000 < N \le 10{,}000$	7.48	7.26	6.95	6.65	6.34	6.03	5.72	5.42	5.10	4.79	4.48	4.17	3.86	3.54
387	$10{,}000 < N \le 25{,}000$	7.33	7.12	6.83	6.53	6.24	5.94	5.65	5.35	5.04	4.73	4.42	4.11	3.80	3.49
388	$25{,}000 < N \le 50{,}000$	7.22	7.02	6.73	6.45	6.16	5.87	5.59	5.30	4.99	4.68	4.38	4.07	3.76	3.45
389	$50{,}000 < N \le 75{,}000$	7.16	6.96	6.68	6.40	6.12	5.83	5.55	5.27	4.96	4.66	4.35	4.04	3.74	3.43
390	$75{,}000 < N \le 100{,}000$	7.11	6.92	6.64	6.36	6.08	5.81	5.53	5.25	4.94	4.64	4.33	4.03	3.72	3.41

Table 1-1-3 Maximum Allowable Secondary Stress Range Values, S_A, for Thermoplastic Materials (Cont'd)

GENERAL NOTES:

(a) The stress values in this Table may be interpolated to determine values for intermediate temperatures. The values at intermediate temperatures shall be rounded to the same number of decimal places as the value at the higher temperature between which values are being interpolated. The rounding rule is: when the next digit beyond the last place to be retained is less than 5, retain unchanged the digit in the last place retained; when the digit next beyond the last place to be retained is 5 or greater, increase by 1 the digit in the last place retained.

(b) The following abbreviations are used: CPVC, chlorinated poly(vinyl chloride); PVC, poly(vinyl chloride); and PVDF, poly(vinylidene fluoride).

NOTE: (1) Multiply ksi by 1,000 to obtain psi.

CONSTRUCTION CODE NOTE (ASME NM.1):

C01 Compounding ingredients may vary between material manufacturers for the same grade of CPVC or PVC. While these different ingredients do not impact the allowable stress values provided in this Table, they can influence the acceptability of the various joining methods allowed by ASME NM.1. In addition to the material and joining requirements set forth in ASME NM.1, the joining method to be used shall be approved by the piping component manufacturer.

DESIGN FACTOR NOTE (ASME NM.1):

D01 Allowable stress range values are based on a design factor (DF) of 0.50.

MATERIAL NOTES — CHLORINATED POLY(VINYL CHLORIDE):

M01 Material shall have a
- *(a)* minimum impact resistance of 1.5 ft-lb/in. of notch at 73°F in accordance with ASTM D256
- *(b)* minimum modulus of elasticity in tension of 360,000 psi at 73°F in accordance with ASTM D638
- *(c)* minimum deflection temperature under load of 212°F at a load of 264 psi in accordance with ASTM D648
- *(d)* average extent of burning of under 25 mm and an average time of burning of under 10 sec in accordance with ASTM D635
- *(e)* hydrostatic design basis (HDB) of 4,000 psi at 73°F and 1,000 psi at 180°F in accordance with ASTM D2837
- *(f)* hydrostatic design stress (HDS) of 2,000 psi at 73°F and 500 psi at 180°F in accordance with ASTM D2837

M02 Material shall have a
- *(a)* minimum impact resistance of 1.5 ft-lb/in. of notch at 73°F in accordance with ASTM D256
- *(b)* minimum modulus of elasticity in tension of 360,000 psi at 73°F in accordance with ASTM D638
- *(c)* minimum deflection temperature under load of 212°F at a load of 264 psi in accordance with ASTM D648
- *(d)* average extent of burning of under 25 mm and an average time of burning of under 10 sec in accordance with ASTM D635
- *(e)* hydrostatic design basis (HDB) of 4,000 psi at 73°F and 1,250 psi at 180°F in accordance with ASTM D2837
- *(f)* hydrostatic design stress (HDS) of 2,000 psi at 73°F and 625 psi at 180°F in accordance with ASTM D2837

MATERIAL NOTES — POLYAMIDE:

M03 Material shall have a
- *(a)* classification of Group 03, Class 2, and Grade 3 in accordance with ASTM D4066.
- *(b)* minimum elongation at break of 200% in accordance with ASTM D638, using a 3.2 mm ± 0.4 mm thick test specimen. The speed of testing shall be 50 mm/min ±10% at 23°C ± 2°C and 50% ± 5% relative humidity.
- *(c)* minimum flexural modulus of 900 MPa in accordance with ASTM D790, Procedure A using a 3.2 mm × 12.7 mm × 127 mm test specimen. The testing shall be performed with a crosshead speed of 1.3 mm/min (±50%) at 23°C ± 2°C and 50% ± 5% relative humidity.
- *(d)* minimum izod impact resistance of 55 J/m in accordance with ASTM D256, using a test specimen with a 12.7-mm depth, a 3.17-mm width, and a notch radius of 0.25 mm.
- *(e)* minimum deflection temperature of 40°C at 1.82 MPa in accordance with ASTM D648, using an unannealed test specimen 3.17 mm in width.
- *(f)* hydrostatic design basis (HDB) of 2,500 psi at 73°F, 1,600 psi at 140°F, and 1,250 psi at 180°F in accordance with ASTM D2837.
- *(g)* hydrostatic design stress (HDS) of 1,250 psi at 73°F, 800 psi at 140°F, and 625 psi at 180°F in accordance with ASTM D2837.

M04 Material shall have a
- *(a)* classification of Group 03, Class 2, and Grade 3 in accordance with ASTM D4066.
- *(b)* minimum elongation at break of 200% in accordance with ASTM D638, using a 3.2 mm ± 0.4 mm thick test specimen. The speed of testing shall be 50 mm/min ±10% at 23°C ± 2°C and 50% ± 5% relative humidity.
- *(c)* minimum flexural modulus of 900 MPa in accordance with ASTM D790, Procedure A using a 3.2 mm × 12.7 mm × 127 mm test specimen. The testing shall be performed with a crosshead speed of 1.3 mm/min (±50%) at 23°C ± 2°C and 50% ± 5% relative humidity.
- *(d)* minimum izod impact resistance of 55 J/m in accordance with ASTM D256, using a test specimen with a 12.7-mm depth, a 3.17-mm width, and a notch radius of 0.25 mm.
- *(e)* minimum deflection temperature of 40°C at 1.82 MPa in accordance with ASTM D648, using an unannealed test specimen 3.17 mm in width.
- *(f)* hydrostatic design basis (HDB) of 3,150 psi at 73°F and 1,600 psi at 180°F in accordance with ASTM D2837.
- *(g)* hydrostatic design stress (HDS) of 1,600 psi at 73°F and 800 psi at 180°F in accordance with ASTM D2837.

MATERIAL NOTES — POLYETHYLENE:

M05 Material shall have a carbon black percentage of 2% to 3% in accordance with ASTM D4218 or ASTM D1603, natural with UV stabilizer, or colored with UV stabilizer.

M06 Material shall have a
- *(a)* thermal stability of over 428°F in accordance with ASTM D3350
- *(b)* maximum brittleness temperature of –76°F in accordance with ASTM D746
- *(c)* minimum tensile elongation at break of 400% in accordance with ASTM D638, using a Type IV tensile bar at 2 in./min at 73°F

Table 1-1-3 Maximum Allowable Secondary Stress Range Values, S_A, for Thermoplastic Materials (Cont'd)

MATERIAL NOTES — POLYETHYLENE: (Cont'd):
(d) slow crack growth resistance of over 500 hr in accordance with ASTM F1473 at 2.4 MPa and 80°C in air
(e) hydrostatic design basis (HDB) of 1,250 psi at 73°F and 1,000 psi at 140°F in accordance with ASTM D2837, PPI TR-3, and PPI TR-4
(f) hydrostatic design stress (HDS) of 800 psi at 73°F in accordance with ASTM D2837, PPI TR-3, and PPI TR-4.

M07 Material shall have a
(a) thermal stability of over 428°F in accordance with ASTM D3350
(b) maximum brittleness temperature of –76°F in accordance with ASTM D746
(c) minimum tensile elongation at break of 400% in accordance with ASTM D638, using a Type IV tensile bar at 2 in./min at 73°F
(d) slow crack growth resistance of over 500 hr in accordance with ASTM F1473 at 2.4 MPa and 80°C in air
(e) hydrostatic design basis (HDB) of 1,250 psi at 73°F and 630 psi at 180°F in accordance with ASTM D2837, PPI TR-3, and PPI TR-4
(f) hydrostatic design stress (HDS) of 800 psi at 73°F in accordance with ASTM D2837, PPI TR-3, and PPI TR-4

M08 Material shall have a carbon black percentage of 2% to 3% in accordance with ASTM D4218 or ASTM D1603, or colored with UV stabilizer.

M09 Material shall have a
(a) thermal stability of over 428°F in accordance with ASTM D3350
(b) maximum brittleness temperature of –76°F in accordance with ASTM D746
(c) minimum tensile elongation at break of 400% in accordance with ASTM D638, using a Type IV tensile bar at 2 in./min at 73°F
(d) slow crack growth resistance of over 100 hr in accordance with ASTM F1473 at 2.4 MPa and 80°C in air
(e) hydrostatic design basis (HDB) of 1,600 psi at 73°F and 800 psi at 140°F in accordance with ASTM D2837, PPI TR-3, and PPI TR-4
(f) hydrostatic design stress (HDS) of 800 psi at 73°F in accordance with ASTM D2837, PPI TR-3, and PPI TR-4

M10 Material shall have a
(a) thermal stability of over 428°F in accordance with ASTM D3350
(b) maximum brittleness temperature of –76°F in accordance with ASTM D746
(c) minimum tensile elongation at break of 400% in accordance with ASTM D638, using a Type IV tensile bar at 2 in./min at 73°F
(d) slow crack growth resistance of over 100 hr in accordance with ASTM F1473 at 2.4 MPa and 80°C in air
(e) hydrostatic design basis (HDB) of 1,600 psi at 73°F and 1,000 psi at 140°F in accordance with ASTM D2837, PPI TR-3, and PPI TR-4
(f) hydrostatic design stress (HDS) of 800 psi at 73°F in accordance with ASTM D2837, PPI TR-3, and PPI TR-4

M11 Material shall have a
(a) thermal stability of over 428°F in accordance with ASTM D3350
(b) maximum brittleness temperature of –76°F in accordance with ASTM D746
(c) minimum tensile elongation at break of 400% in accordance with ASTM D638, using a Type IV tensile bar at 2 in./min at 73°F
(d) slow crack growth resistance of over 500 hr in accordance with ASTM F1473 at 2.4 MPa and 80°C in air
(e) hydrostatic design basis (HDB) of 1,600 psi at 73°F and 800 psi at 140°F in accordance with ASTM D2837, PPI TR-3, and PPI TR-4
(f) hydrostatic design stress (HDS) of 1,000 psi at 73°F in accordance with ASTM D2837, PPI TR-3, and PPI TR-4

M12 Material shall have a
(a) thermal stability of over 428°F in accordance with ASTM D3350
(b) maximum brittleness temperature of –76°F in accordance with ASTM D746
(c) minimum tensile elongation at break of 400% in accordance with ASTM D638, using a Type IV tensile bar at 2 in./min at 73°F
(d) slow crack growth resistance of over 500 hr in accordance with ASTM F1473 at 2.4 MPa and 80°C in air
(e) hydrostatic design basis (HDB) of 1,600 psi at 73°F and 1,000 psi at 140°F in accordance with ASTM D2837, PPI TR-3, and PPI TR-4
(f) hydrostatic design stress (HDS) of 1,000 psi at 73°F in accordance with ASTM D2837, PPI TR-3, and PPI TR-4

M13 Material shall have a
(a) thermal stability of over 428°F in accordance with ASTM D3350
(b) maximum brittleness temperature of –76°F in accordance with ASTM D746
(c) minimum tensile elongation at break of 400% in accordance with ASTM D638, using a Type IV tensile bar at 2 in./min at 73°F
(d) slow crack growth resistance of over 500 hr in accordance with ASTM F1473 at 2.4 MPa and 80°C in air
(e) hydrostatic design basis (HDB) of 1,600 psi at 73°F and 800 psi at 180°F in accordance with ASTM D2837, PPI TR-3, and PPI TR-4
(f) hydrostatic design stress (HDS) of 1,000 psi at 73°F in accordance with ASTM D2837, PPI TR-3, and PPI TR-4

M14 Material shall have a carbon black percentage of 2% to 3% in accordance with ASTM D4218 or ASTM D1603.

MATERIAL NOTES — POLY(VINYL CHLORIDE):

M15 Material shall have a
(a) minimum impact resistance of 5.0 ft-lb/in. of notch at 73°F in accordance with ASTM D256
(b) minimum modulus of elasticity in tension of 320,000 psi at 73°F in accordance with ASTM D638
(c) minimum deflection temperature under load of 140°F at a load of 264 psi in accordance with ASTM D648
(d) average extent of burning of under 25 mm and an average time of burning of under 10 sec in accordance with ASTM D635
(e) hydrostatic design basis (HDB) of 2,000 psi at 73°F in accordance with ASTM D2837
(f) hydrostatic design stress (HDS) of 1,000 psi at 73°F in accordance with ASTM D2837

M16 Material shall have a
(a) minimum impact resistance of 5.0 ft-lb/in. of notch at 73°F in accordance with ASTM D256
(b) minimum modulus of elasticity in tension of 320,000 psi at 73°F in accordance with ASTM D638
(c) minimum deflection temperature under load of 140°F at a load of 264 psi in accordance with ASTM D648
(d) average extent of burning of under 25 mm and an average time of burning of under 10 sec in accordance with ASTM D635
(e) hydrostatic design basis (HDB) of 2500 psi at 73°F in accordance with ASTM D2837
(f) hydrostatic design stress (HDS) of 1250 psi at 73°F in accordance with ASTM D2837

M17 Material shall have a
(a) minimum impact resistance of 5.0 ft-lb/in. of notch at 73°F in accordance with ASTM D256
(b) minimum modulus of elasticity in tension of 320,000 psi at 73°F in accordance with ASTM D638
(c) minimum deflection temperature under load of 140°F at a load of 264 psi in accordance with ASTM D648

Table 1-1-3 Maximum Allowable Secondary Stress Range Values, S_A, for Thermoplastic Materials (Cont'd)

MATERIAL NOTES — POLY(VINYL CHLORIDE): (Cont'd):

(d) average extent of burning of under 25 mm and an average time of burning of under 10 sec in accordance with ASTM D635
(e) hydrostatic design basis (HDB) of 3,200 psi at 73°F in accordance with ASTM D2837
(f) hydrostatic design stress (HDS) of 1,600 psi at 73°F in accordance with ASTM D2837

M18 Material shall have a

(a) minimum impact resistance of 5.0 ft-lb/in. of notch at 73°F in accordance with ASTM D256
(b) minimum modulus of elasticity in tension of 320,000 psi at 73°F in accordance with ASTM D638
(c) minimum deflection temperature under load of 140°F at a load of 264 psi in accordance with ASTM D648
(d) average extent of burning of under 25 mm and an average time of burning of under 10 sec in accordance with ASTM D635
(e) hydrostatic design basis (HDB) of 4,000 psi at 73°F in accordance with ASTM D2837
(f) hydrostatic design stress (HDS) of 2,000 psi at 73°F in accordance with ASTM D2837

M19 Material shall have a

(a) minimum impact resistance of 0.65 ft-lb/in. of notch at 73°F in accordance with ASTM D256
(b) minimum modulus of elasticity in tension of 400,000 psi at 73°F in accordance with ASTM D638
(c) minimum deflection temperature under load of 158°F at a load of 264 psi in accordance with ASTM D648
(d) average extent of burning of under 25 mm and an average time of burning of under 10 sec in accordance with ASTM D635
(e) hydrostatic design basis (HDB) of 4,000 psi at 73°F in accordance with ASTM D2837
(f) hydrostatic design stress (HDS) of 2,000 psi at 73°F in accordance with ASTM D2837

M20 Material shall have a

(a) minimum impact resistance of 5.0 ft-lb/in. of notch at 73°F in accordance with ASTM D256
(b) minimum modulus of elasticity in tension of 320,000 psi at 73°F in accordance with ASTM D638
(c) minimum deflection temperature under load of 140°F at a load of 264 psi in accordance with ASTM D648
(d) average extent of burning of under 25 mm and an average time of burning of under 10 sec in accordance with ASTM D635
(e) hydrostatic design basis (HDB) of 7,100 psi at 73°F in accordance with ASTM D2837
(f) hydrostatic design stress (HDS) of 3,550 psi at 73°F in accordance with ASTM D2837

M21 Allowable stress values apply to both the oriented and unoriented directions.

MATERIAL NOTES — POLY(VINYLIDENE FLUORIDE):

M22 Material shall have a

(a) classification of Type I in accordance with ASME SD-3222
(b) minimum impact resistance of 1.5 ft-lb/in. of notch at 73°F in accordance with ASTM D256
(c) minimum flexural modulus of 190,000 psi at 73°F in accordance with ASTM D790, using Method I
(d) minimum tensile elongation at break of 10% in accordance with ASTM D638, using a Type I tensile bar at 2 in./min at 73°F
(e) hydrostatic design basis (HDB) of 4,000 psi at 73°F and 1,250 psi at 200°F in accordance with ASTM D2837
(f) hydrostatic design stress (HDS) of 2,000 psi at 73°F and 625 psi at 200°F in accordance with ASTM D2837

M23 Material shall have a

(a) classification of Type II in accordance with ASME SD-3222
(b) minimum flexural modulus of 190,000 psi at 73°F in accordance with ASTM D790, using Method I
(c) minimum tensile elongation at break of 10% in accordance with ASTM D638, using a Type I tensile bar at 2 in./min at 73°F
(d) hydrostatic design basis (HDB) of 5,000 psi at 73°F and 1,250 psi at 248°F in accordance with ASTM D2837
(e) hydrostatic design stress (HDS) of 2,500 psi at 73°F and 625 psi at 248°F in accordance with ASTM D2837

TABLE STARTS ON NEXT PAGE

Table 1-1-Y Yield Strength Values, S_y, for Thermoplastic Materials

Line No.	Nominal Composition	Product Form	ASME Spec. No.	Type/Grade	Minimum Yield Strength, ksi	Notes
1	CPVC	Extruded pipe	SD-2846	CPVC 4120-05	7.0	M01
2	CPVC	Extruded pipe	SD-2846	CPVC 4120-06	7.0	M01
3	CPVC	Extruded pipe	SF-441	CPVC 4120-05	7.0	M01
4	CPVC	Extruded pipe	SF-441	CPVC 4120-06	7.0	M01
5	CPVC	Extruded pipe	SF-442	CPVC 4120-05	7.0	M01
6	CPVC	Extruded pipe	SF-442	CPVC 4120-06	7.0	M01
7	Polyamide	Extruded pipe	SF-2945	PA 32312	7.0	M02
8	Polyamide	Extruded pipe	SF-2945	PA 32316	7.0	M02
9	Polyethylene	Extruded pipe	SD-2239	PE2708	2.6	M03
10	Polyethylene	Extruded pipe	SD-2513	PE2708	2.6	M03
11	Polyethylene	Extruded tube	SD-2737	PE2708	2.6	M03
12	Polyethylene	Extruded pipe	SD-3035	PE2708	2.6	M03
13	Polyethylene	Extruded pipe	SF-714	PE2708	2.6	M03
14	Polyethylene	Extruded pipe	SD-2239	PE3608	3.0	M03
15	Polyethylene	Extruded pipe	SD-2239	PE4608	3.0	M03
16	Polyethylene	Extruded pipe	SD-2239	PE4710	3.0	M03
17	Polyethylene	Extruded pipe	SD-2513	PE4710	3.0	M03
18	Polyethylene	Extruded tube	SD-2737	PE3608	3.0	M03
19	Polyethylene	Extruded tube	SD-2737	PE4608	3.0	M03
20	Polyethylene	Extruded tube	SD-2737	PE4710	3.0	M03
21	Polyethylene	Extruded pipe	SD-3035	PE3608	3.0	M03
22	Polyethylene	Extruded pipe	SD-3035	PE4608	3.0	M03
23	Polyethylene	Extruded pipe	SD-3035	PE4710	3.0	M03
24	Polyethylene	Extruded pipe	SF-714	PE3608	3.0	M03
25	Polyethylene	Extruded pipe	SF-714	PE4608	3.0	M03
26	Polyethylene	Extruded pipe	SF-714	PE4710	3.0	M03
27	Polyethylene	Extruded pipe	SF-2619	PE3608	3.0	M03
28	Polyethylene	Extruded pipe	SF-2619	PE4710	3.0	M03
29	PVC	Extruded pipe	SD-1785	PVC2110	6.0	M01
30	PVC	Extruded pipe	SD-1785	PVC2112	6.0	M01
31	PVC	Extruded pipe	SD-1785	PVC2116	6.0	M01
32	PVC	Extruded pipe	SD-1785	PVC2120	6.0	M01
33	PVC	Extruded tube	SD-2241	PVC2110	6.0	M01
34	PVC	Extruded tube	SD-2241	PVC2112	6.0	M01
35	PVC	Extruded tube	SD-2241	PVC2116	6.0	M01
36	PVC	Extruded tube	SD-2241	PVC2120	6.0	M01

Table 1-1-Y Yield Strength Values, S_y, for Thermoplastic Materials

Line No.	Yield Strength, ksi [Note (1)], for Material Temperature, °F, Not Exceeding													
	73	80	90	100	110	120	130	140	150	160	170	180	190	200
1	7.00	6.79	6.51	6.16	5.88	5.53	5.25	4.97	4.62	4.34	3.99	3.71	3.43	3.08
2	7.00	6.79	6.51	6.16	5.88	5.53	5.25	4.97	4.62	4.34	3.99	3.71	3.43	3.08
3	7.00	6.79	6.51	6.16	5.88	5.53	5.25	4.97	4.62	4.34	3.99	3.71	3.43	3.08
4	7.00	6.79	6.51	6.16	5.88	5.53	5.25	4.97	4.62	4.34	3.99	3.71	3.43	3.08
5	7.00	6.79	6.51	6.16	5.88	5.53	5.25	4.97	4.62	4.34	3.99	3.71	3.43	3.08
6	7.00	6.79	6.51	6.16	5.88	5.53	5.25	4.97	4.62	4.34	3.99	3.71	3.43	3.08
7	6.96	6.53	5.95	5.43	4.97	4.55	4.19	3.88	3.63	3.43	3.28	3.19	...	...
8	6.96	6.53	5.95	5.43	4.97	4.55	4.19	3.88	3.63	3.43	3.28	3.19	...	...
9	2.60	...	...	...	...	...	...	...	...	...	...	...	...	...
10	2.60	...	...	...	...	...	...	...	...	...	...	...	...	...
11	2.60	...	...	...	...	...	...	...	...	...	...	...	...	...
12	2.60	...	...	...	...	...	...	...	...	...	...	...	...	...
13	2.60	...	...	...	...	...	...	...	...	...	...	...	...	...
14	3.00	2.84	2.62	2.39	2.17	1.94	1.72	1.49	1.27	1.04	...	...	...	...
15	3.00	2.84	2.61	2.39	2.16	1.94	1.71	1.48	1.26	1.03	0.80	0.58	...	...
16	3.00	2.84	2.61	2.39	2.16	1.94	1.71	1.48	1.26	1.03	0.80	0.58	...	...
17	3.00	2.84	2.61	2.39	2.16	1.94	1.71	1.48	1.26	1.03	0.80	0.58	...	...
18	3.00	2.84	2.62	2.39	2.17	1.94	1.72	1.49	1.27	1.04	...	...	...	...
19	3.00	2.84	2.61	2.39	2.16	1.94	1.71	1.48	1.26	1.03	0.80	0.58	...	...
20	3.00	2.84	2.61	2.39	2.16	1.94	1.71	1.48	1.26	1.03	0.80	0.58	...	...
21	3.00	2.84	2.62	2.39	2.17	1.94	1.72	1.49	1.27	1.04	...	...	...	...
22	3.00	2.84	2.61	2.39	2.16	1.94	1.71	1.48	1.26	1.03	0.80	0.58	...	...
23	3.00	2.84	2.61	2.39	2.16	1.94	1.71	1.48	1.26	1.03	0.80	0.58	...	...
24	3.00	2.84	2.62	2.39	2.17	1.94	1.72	1.49	1.27	1.04	...	...	...	...
25	3.00	2.84	2.61	2.39	2.16	1.94	1.71	1.48	1.26	1.03	0.80	0.58	...	...
26	3.00	2.84	2.61	2.39	2.16	1.94	1.71	1.48	1.26	1.03	0.80	0.58	...	...
27	3.00	2.84	2.62	2.39	2.17	1.94	1.72	1.49	1.27	1.04	...	...	...	...
28	3.00	2.84	2.61	2.39	2.16	1.94	1.71	1.48	1.26	1.03	0.80	0.58	...	...
29	6.00	5.70	5.22	4.74	4.26	3.78	3.30	2.82	...	...	...	...	...	...
30	6.00	5.70	5.22	4.74	4.26	3.78	3.30	2.82	...	...	...	...	...	...
31	6.00	5.70	5.22	4.74	4.26	3.78	3.30	2.82	...	...	...	...	...	...
32	6.00	5.70	5.22	4.74	4.26	3.78	3.30	2.82	...	...	...	...	...	...
33	6.00	5.70	5.22	4.74	4.26	3.78	3.30	2.82	...	...	...	...	...	...
34	6.00	5.70	5.22	4.74	4.26	3.78	3.30	2.82	...	...	...	...	...	...
35	6.00	5.70	5.22	4.74	4.26	3.78	3.30	2.82	...	...	...	...	...	...
36	6.00	5.70	5.22	4.74	4.26	3.78	3.30	2.82	...	...	...	...	...	...

Table 1-1-Y Yield Strength Values, S_y, for Thermoplastic Materials (Cont'd)

Line No.	Nominal Composition	Product Form	ASME Spec. No.	Type/Grade	Minimum Yield Strength, ksi	Notes
37	PVC	Extruded pipe	SD-1785	PVC1120	7.0	M01
38	PVC	Extruded pipe	SD-1785	PVC1220	7.0	M01
39	PVC	Extruded pipe	SD-2241	PVC1120	7.0	M01
40	PVC	Extruded pipe	SD-2241	PVC1220	7.0	M01
41	PVC	Extruded pipe	SF-1483	PVCO 1135	7.0	M01, M04
42	PVC	Extruded pipe	SF-1483	PVCO 1135	11.1	M01, M05
43	PVDF	Extruded pipe	SF-1673	PVDF 2020	6.5	M06
44	PVDF	Extruded pipe	SF-1673	PVDF 2025	7.7	M06

GENERAL NOTES:

(a) The tabulated values of yield strength are those that the Committee believes are suitable for use in design calculations. At temperatures above room temperature, the yield strength values correspond to the yield strength trend curve adjusted to the minimum specified room-temperature yield strength. The yield strength values do not correspond exactly to "minimum" or "average" as these terms are applied to a statistical treatment of a homogeneous set of data. Neither the ASME material specifications nor the rules of ASME NM.1 require elevated temperature testing for yield strengths of production material for use in Code components. It is not intended that results of such tests, if performed, be compared with these tabulated yield strength values for ASME Code acceptance/rejection purposes for materials. If some elevated temperature test results on production material appear lower than the tabulated values by a large amount (more than the typical variability of material and suggesting the possibility of some error), further investigation by retest or other means should be considered.

(b) Notes limiting applications of these materials appear in Tables 1-1-1, 1-1-2, and 1-1-3.

(c) The stress values in this Table may be interpolated to determine values for intermediate temperatures. The values at intermediate temperatures shall be rounded to the same number of decimal places as the value at the higher temperature between which values are being interpolated. The rounding rule is: when the next digit beyond the last place to be retained is less than 5, retain unchanged the digit in the last place retained; when the digit next beyond the last place to be retained is 5 or greater, increase by 1 the digit in the last place retained.

(d) The following abbreviations are used: CPVC, chlorinated poly(vinyl chloride); PVC, poly(vinyl chloride); and PVDF, poly(vinylidene fluoride).

(e) Chlorinated poly(vinyl chloride), polyamide, polyethylene, poly(vinyl chloride), and poly(vinylidene fluoride) are viscoelastic materials. The stress values in this Table are based on short-duration loads and are not appropriate for use as design stresses for long-term sustained loads.

NOTE: (1) Multiply ksi by 1,000 to obtain psi.

MATERIAL NOTES:

M01 The stress values for chlorinated poly(vinyl chloride) and poly(vinyl chloride) in this Table are based on tensile testing in accordance with ASTM D638 using a Type I tensile bar at 0.20 in./min at 73°F. At other strain rates, other values may apply.

M02 The stress values for polyamide in this Table are based on tensile testing in accordance with ASTM D638, using a 3.2 mm ± 0.4 mm thick test specimen. The speed of testing shall be 50 mm/min ±10% at 23°C ± 2°C and 50% ± 5% relative humidity. At other strain rates, other values may apply.

M03 The stress values for polyethylene in this Table are based on tensile testing in accordance with ASTM D638 using a Type IV tensile bar at 2 in./min at 73°F. At other strain rates, other values may apply.

M04 These stress values for oriented poly(vinyl chloride) apply to the unoriented directions only.

M05 These stress values for oriented poly(vinyl chloride) apply to the oriented direction only.

M06 The stress values for poly(vinylidene fluoride) in this Table are based on tensile testing in accordance with ASTM D638 using a Type I tensile bar at 2 in./min at 73°F. At other strain rates, other values may apply.

Table 1-1-Y Yield Strength Values, S_y, for Thermoplastic Materials (Cont'd)

Line No.	Yield Strength, ksi [Note (1)], for Material Temperature, °F, Not Exceeding													
	73	80	90	100	110	120	130	140	150	160	170	180	190	200
37	7.00	6.65	6.09	5.53	4.97	4.41	3.85	3.29	...	...	...	...	...	...
38	7.00	6.65	6.09	5.53	4.97	4.41	3.85	3.29	...	...	...	...	...	...
39	7.00	6.65	6.09	5.53	4.97	4.41	3.85	3.29	...	...	...	...	...	...
40	7.00	6.65	6.09	5.53	4.97	4.41	3.85	3.29	...	...	...	...	...	...
41	7.00	6.65	6.09	5.53	4.97	4.41	3.85	...	...	...	...	...	...	...
42	11.10	10.55	9.66	8.77	7.88	6.99	6.11	...	...	...	...	...	...	...
43	6.50	6.31	6.05	5.78	5.52	5.25	4.98	4.72	4.45	4.19	3.92	3.65	3.39	3.12
44	7.69	7.39	6.99	6.63	6.30	5.99	5.69	5.41	5.14	4.87	4.60	4.34	4.07	3.81

Table 1-2.1-1 Data Sheet for Fiberglass Unsaturated Polyester Resin Type I (SC-582)

Description and Service Limits	
Reinforcement material:	Fiberglass (Type E or ECR glass)
Resin material:	Unsaturated polyester resin
Reinforcement pattern:	Random glass
Structural wall thickness range, in.:	0.1 to 0.7
Liner thickness, in.:	0.1

Modulus Data [Notes (1), (2), and (3)]

			Modulus of Elasticity for Total Wall Thickness, in. (Including 0.1–in. Liner), and Temperature, °F											
			Up to and Including 77°F				150°F				200°F			
Property	Symbol	ASTM Test Method	0.2	0.4	0.6	0.8 and Over	0.2	0.4	0.6	0.8 and Over	0.2	0.4	0.6	0.8 and Over
Axial tensile, psi	E_{AT}	D638, D1599, or D2105	1.12E+06	1.13E+06	1.13E+06	1.13E+06	9.92E+05	1.00E+06	1.01E+06	1.01E+06	8.69E+05	8.78E+05	8.82E+05	8.84E+05
Axial compressive, psi	E_{AC}	D695	1.12E+06	1.13E+06	1.13E+06	1.13E+06	9.92E+05	1.00E+06	1.01E+06	1.01E+06	8.69E+05	8.78E+05	8.82E+05	8.84E+05
Axial flexural, psi	E_{AF}	D790 or D2925	1.08E+06	1.10E+06	1.12E+06	1.12E+06	9.56E+05	9.80E+05	9.91E+05	9.97E+05	8.34E+05	8.58E+05	8.69E+05	8.74E+05
Hoop tensile, psi	E_{HT}	D638, D1599, or D2290	1.12E+06	1.13E+06	1.13E+06	1.13E+06	9.92E+05	1.00E+06	1.01E+06	1.01E+06	8.69E+05	8.78E+05	8.82E+05	8.84E+05
Hoop flexural, psi	E_{HF}	D790 or D2412	1.08E+06	1.10E+06	1.12E+06	1.12E+06	9.56E+05	9.80E+06	9.91E+05	9.97E+06	8.34E+05	8.58E+05	8.69E+05	8.74E+05
In–plane shear, psi	G	D4255	4.18E+05	4.21E+05	4.23E+05	4.23E+05	3.71E+05	3.74E+05	3.76E+05	3.77E+05	3.25E+05	3.29E+05	3.30E+05	3.31E+05

Other Property Data [Notes (1), (2), and (3)]

Property	Symbol	Test Method	Value for 0.2-in. Thickness
Poisson's ratio: hoop–axial tensile	ν_{HAT}	...	0.34
Poisson's ratio: axial–hoop tensile	ν_{AHT}	...	0.34
Coefficient of thermal expansion, in./in./°F: axial	α_A	D696	2.11E–05
Coefficient of thermal expansion, in./in./°F: hoop	α_H	...	2.11E–05
Density, lbm/in.^{3}	ρ	D792	0.051
Thermal conductivity, Btu-in./(hr-ft^2-°F)	k	C1045	1.2654

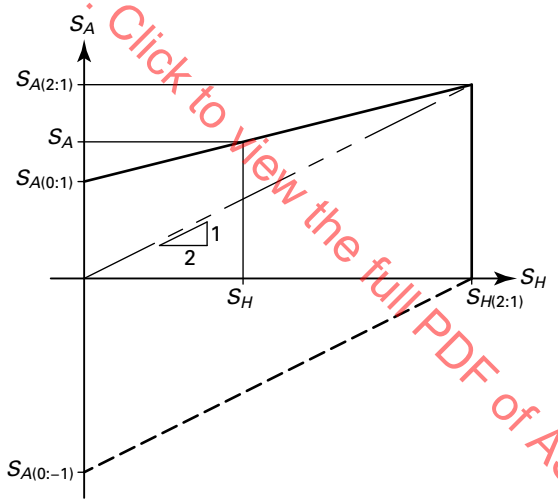
Allowable Stress Data [Note (4)]

Property	Symbol	ASTM Test Method	77°F	150°F	200°F
Axial tensile, psi	$S_{A(0:1)}$	D638 or D2105	1.13E+03	1.00E+03	8.78E+02
Axial flexural, psi	$S_{Af(0:1)}$	D790 or D2925	1.66E+03	1.47E+03	1.29E+03
Axial compressive, psi	$S_{A(0:-1)}$	D695	1.13E+03	1.00E+03	8.78E+02
Axial 2 × 1 biaxial tensile, psi	$S_{A(2:1)}$	D1599	1.13E+03	1.00E+03	8.78E+02
Hoop 2 × 1 biaxial tensile, psi	$S_{H(2:1)}$	D1599	1.13E+03	1.00E+03	8.78E+02
Hoop tensile, psi	$S_{H(1:0)}$	D638, D1599, or D2290	1.13E+03	1.00E+03	8.78E+02
In–plane shear, psi	τ	D4255	4.21E+02	3.74E+02	3.29E+02

Table 1-2.1-1 Data Sheet for Fiberglass Unsaturated Polyester Resin Type I (SC-582) (Cont'd)

Ultimate Stress Data [Note (4)]

Property	Symbol	ASTM Test Method	77°F	150°F	200°F
Axial tensile, psi	$S_{A(0:1)}$	D638 or D2105	1.13E+04	1.00E+04	8.78E+03
Axial flexural, psi	$S_{Af(0:1)}$	D790 or D2925	1.66E+04	1.47E+04	1.29E+04
Axial compressive, psi	$S_{A(0:-1)}$	D695	1.13E+04	1.00E+04	8.78E+03
Axial 2 × 1 biaxial tensile, psi	$S_{A(2:1)}$	D1599	1.13E+04	1.00E+04	8.78E+03
Hoop 2 × 1 biaxial tensile, psi	$S_{H(2:1)}$	D1599	1.13E+04	1.00E+04	8.78E+03
Hoop tensile, psi	$S_{H(1:0)}$	D638, D1599, or D2290	1.13E+04	1.00E+04	8.78E+03
In–plane shear, psi	τ	D4255	4.21E+03	3.74E+03	3.29E+03



Allowable Stress Envelope

GENERAL NOTES:

(a) The values in these tables may be interpolated to determine values for intermediate temperatures and thicknesses.

(b) Refer to ASME NM.2, Table 3-3.1-1 for limitations on service based on temperature.

(c) The maximum allowable design stress value shall be 1,800 psi for flanges constructed of Type I laminates.

NOTES:

(1) Elastic properties apply to total wall, not just to structural wall. This is to ensure that the loads on the piping, the supports, and the connected equipment, as calculated in the pipe stress analysis, are not understated.

(2) For modulus values of the structural wall only, or for pipe for which the liner thickness is 0.0 in., it is permissible to use the modulus values applicable to a total wall thickness of 0.80 in. and over.

(3) Elastic properties may also be determined in accordance with ASME NM.2, Mandatory Appendix II.

(4) Allowable and ultimate stress values apply to the structural wall only, not the total wall thickness.

Table 1-2.1-2 Data Sheet for Fiberglass Unsaturated Polyester Resin Type II (SC-582)

Description and Service Limits	
Reinforcement material:	Fiberglass (Type E or ECR glass)
Resin material:	Unsaturated polyester resin
Reinforcement pattern:	Random glass/WR (0/90)
Structural wall thickness range, in.:	0.1 to 0.7
Liner thickness, in.:	0.1

Modulus Data [Notes (1), (2), and (3)]

			Modulus of Elasticity for Total Wall Thickness, in. (Including 0.1-in. Liner), and Temperature, °F											
			Up to and Including 77°F				150°F				200°F			
Property	Symbol	ASTM Test Method	0.2	0.4	0.6	0.8 and Over	0.2	0.4	0.6	0.8 and Over	0.2	0.4	0.6	0.8 and Over
Axial tensile, psi	E_{AT}	D638, D1599, or D2105	1.32E+06	1.51E+06	1.65E+06	1.67E+06	1.19E+06	1.38E+06	1.51E+06	1.53E+06	1.06E+06	1.25E+06	1.38E+06	1.40E+06
Axial compressive, psi	E_{AC}	D695	1.32E+06	1.51E+06	1.65E+06	1.67E+06	1.19E+06	1.38E+06	1.51E+06	1.53E+06	1.06E+06	1.25E+06	1.38E+06	1.40E+06
Axial flexural, psi	E_{AF}	D790 or D2925	1.18E+06	1.23E+06	1.44E+06	1.44E+06	1.05E+06	1.10E+06	1.31E+06	1.31E+06	9.21E+05	9.77E+05	1.18E+06	1.19E+06
Hoop tensile, psi	E_{HT}	D638, D1599, or D2290	1.33E+06	1.51E+06	1.65E+06	1.67E+06	1.19E+06	1.38E+06	1.51E+06	1.53E+06	1.06E+06	1.25E+06	1.38E+06	1.40E+06
Hoop flexural, psi	E_{HF}	D790 or D2412	1.18E+06	1.23E+06	1.44E+06	1.44E+06	1.10E+06	1.10E+06	1.31E+06	1.31E+06	9.14E+05	9.74E+06	1.18E+06	1.19E+06
In-plane shear, psi	G	D4255	4.10E+05	4.10E+05	4.07E+05	4.07E+05	3.59E+05	3.56E+05	3.50E+05	3.51E+05	3.09E+05	3.03E+05	2.94E+05	2.94E+05

Other Property Data [Notes (1), (2), and (3)]

Property	Symbol	Test Method	Value for 0.2-in. Thickness
Poisson's ratio: hoop–axial tensile	ν_{HAT}	...	0.29
Poisson's ratio: axial–hoop tensile	ν_{AHT}	...	0.29
Coefficient of thermal expansion, in./in./°F: axial	α_A	D696	3.47E-05
Coefficient of thermal expansion, in./in./°F: hoop	α_H	...	3.47E-05
Density, lbm/in.^{3}	ρ	D792	0.053
Thermal conductivity, Btu-in./(hr-ft^2-°F)	k	C1045	0.2533219

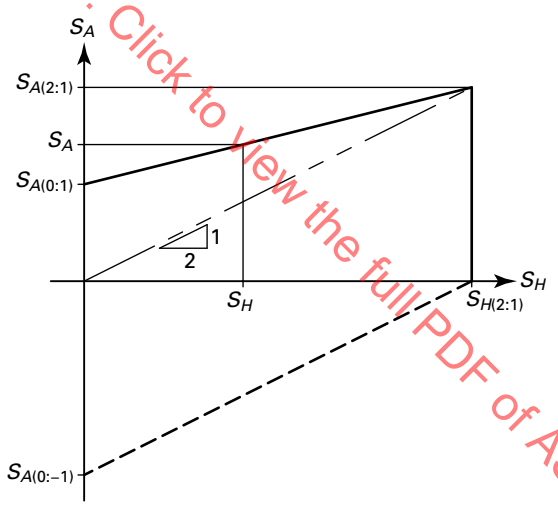
Allowable Stress Data [Note (4)]

Property	Symbol	ASTM Test Method	77°F	150°F	200°F
Axial tensile, psi	$S_{A(0:1)}$	D638 or D2105	1.96E+03	1.79E+03	1.62E+03
Axial flexural, psi	$S_{Af(0:1)}$	D790 or D2925	2.46E+03	2.20E+03	1.95E+03
Axial compressive, psi	$S_{A(0:-1)}$	D695	1.96E+03	1.79E+03	1.62E+03
Axial 2 × 1 biaxial tensile, psi	$S_{A(2:1)}$	D1599	1.97E+03	1.79E+03	1.62E+03
Hoop 2 × 1 biaxial tensile, psi	$S_{H(2:1)}$	D1599	1.97E+03	1.79E+03	1.62E+03
Hoop tensile, psi	$S_{H(1:0)}$	D638, D1599, or D2290	1.97E+03	1.79E+03	1.62E+03
In-plane shear, psi	τ	D4255	4.10E+02	3.56E+02	3.03E+02

Table 1-2.1-2 Data Sheet for Fiberglass Unsaturated Polyester Resin Type II (SC-582) (Cont'd)

Ultimate Stress Data [Note (4)]

Property	Symbol	ASTM Test Method	77°F	150°F	200°F
Axial tensile, psi	$S_{A(0:1)}$	D638 or D2105	1.96E+04	1.79E+04	1.62E+04
Axial flexural, psi	$S_{Af(0:1)}$	D790 or D2925	2.46E+04	2.20E+04	1.95E+04
Axial compressive, psi	$S_{A(0:-1)}$	D695	1.96E+04	1.79E+04	1.62E+04
Axial 2 × 1 biaxial tensile, psi	$S_{A(2:1)}$	D1599	1.97E+04	1.79E+04	1.62E+04
Hoop 2 × 1 biaxial tensile, psi	$S_{H(2:1)}$	D1599	1.97E+04	1.79E+04	1.62E+04
Hoop tensile, psi	$S_{H(1:0)}$	D638, D1599, or D2290	1.97E+04	1.79E+04	1.62E+04
In–plane shear, psi	τ	D4255	4.10E+03	3.56E+03	3.03E+03



Allowable Stress Envelope

GENERAL NOTES:
(a) The values in these tables may be interpolated to determine values for intermediate temperatures and thicknesses.
(b) Refer to ASME NM.2, Table 3-3.1-1 for limitations on service based on temperature.
(c) The maximum allowable design stress value shall be 3,000 psi for flanges constructed of Type II laminates.

NOTES:
(1) Elastic properties apply to total wall, not just to structural wall. This is to ensure that the loads on the piping, the supports, and the connected equipment, as calculated in the pipe stress analysis, are not understated.
(2) For modulus values of the structural wall only, or for pipe for which the liner thickness is 0.0 in., it is permissible to use the modulus values applicable to a total wall thickness of 0.80 in. and over.
(3) Elastic properties may also be determined in accordance with ASME NM.2, Mandatory Appendix II.
(4) Allowable and ultimate stress values apply to the structural wall only, not the total wall thickness.

Table 1-2.1-3 Data Sheet for Fiberglass Unsaturated Polyester Resin Type III (55-deg Filament Wound; ASME NM.2, Mandatory Appendix IV)

Description and Service Limits

Reinforcement material:	Fiberglass (Type E or ECR glass)
Resin material:	Unsaturated polyester resin
Reinforcement pattern:	FW (±55)
Structural wall thickness range, in.:	0.1 to 0.7
Liner thickness, in.:	0.1

Modulus Data [Notes (1), (2), and (3)]

			Modulus of Elasticity for Total Wall Thickness, in. (Including 0.1-in. Liner), and Temperature, °F											
			Up to and Including 77°F				150°F				200°F			
Property	Symbol	ASTM Test Method	0.2	0.4	0.6	0.8 and Over	0.2	0.4	0.6	0.8 and Over	0.2	0.4	0.6	0.8 and Over
Axial tensile, psi	E_{AT}	D638, D1599, or D2105	1.19E+06	1.26E+06	1.28E+06	1.29E+06	1.01E+06	1.04E+06	1.04E+06	1.05E+06	8.20E+05	8.08E+05	8.03E+05	8.01E+06
Axial compressive, psi	E_{AC}	D695	1.19E+06	1.26E+06	1.28E+06	1.29E+06	1.01E+06	1.04E+06	1.04E+06	1.05E+06	8.20E+05	8.08E+05	8.03E+05	8.01E+06
Axial flexural, psi	E_{AF}	D790 or D2925	1.11E+06	1.19E+06	1.22E+06	1.24E+06	9.40E+06	9.94E+05	1.02E+06	1.03E+06	7.62E+05	7.98E+05	8.04E+05	8.05E+06
Hoop tensile, psi	E_{HT}	D638, D1599, or D2290	1.51E+06	1.87E+06	1.99E+06	2.04E+06	1.33E+06	1.65E+06	1.76E+06	1.80E+06	1.16E+06	1.42E+06	1.50E+06	1.54E+06
Hoop flexural, psi	E_{HF}	D790 or D2412	1.27E+06	1.59E+06	1.76E+06	1.86E+06	1.10E+06	1.41E+05	1.56E+06	1.65E+06	9.32E+05	1.22E+06	1.35E+06	1.42E+06
In-plane shear, psi	G	D4255	6.86E+05	1.02E+06	1.15E+06	1.21E+06	6.26E+05	9.62E+05	1.09E+06	1.15E+06	5.65E+05	9.03E+05	1.03E+06	1.09E+06

Other Property Data [Notes (1), (2), and (3)]

Property	Symbol	Test Method	Value for 0.2-in. Thickness
Poisson's ratio: hoop–axial tensile	ν_{HAT}	...	0.52
Poisson's ratio: axial–hoop tensile	ν_{AHT}	...	0.39
Coefficient of thermal expansion, in./in./°F: axial	α_A	D696	1.98E-05
Coefficient of thermal expansion, in./in./°F: hoop	α_H	...	1.04E-05
Density, lbm/in.^{3}	ρ	D792	0.059
Thermal conductivity, Btu-in./(hr-ft^2-°F)	k	C1045	1.76

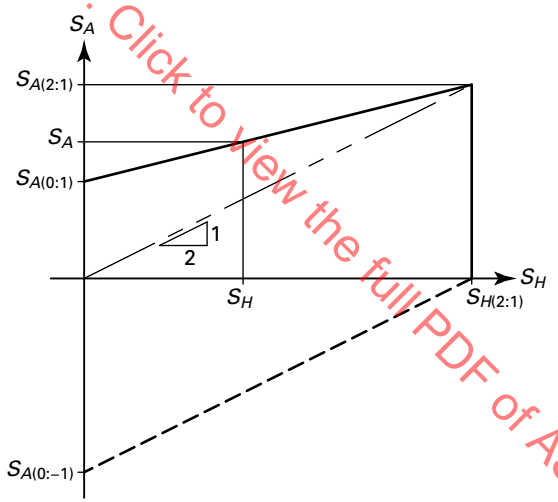
Allowable Stress Data [Note (4)]

Property	Symbol	ASTM Test Method	77°F	150°F	200°F
Axial tensile, psi	$S_{A(0:1)}$	D638 or D2105	8.17E+02	8.08E+02	6.46E+02
Axial flexural, psi	$S_{Af(0:1)}$	D790 or D2925	1.78E+03	1.49E+03	1.20E+03
Axial compressive, psi	$S_{A(0:-1)}$	D695	1.63E+03	1.35E+03	1.05E+03
Axial 2 × 1 biaxial tensile, psi	$S_{A(2:1)}$	D1599	1.87E+03	1.82E+03	1.05E+03
Hoop 2 × 1 biaxial tensile, psi	$S_{H(2:1)}$	D1599	2.42E+03	2.15E+03	1.50E+03
Hoop tensile, psi	$S_{H(1:0)}$	D638, D1599, or D2290	2.42E+03	2.15E+03	1.50E+03
In-plane shear, psi	τ	D4255	1.02E+03	9.62E+02	9.03E+02

Table 1-2.1-3 Data Sheet for Fiberglass Unsaturated Polyester Resin Type III (55-deg Filament Wound; ASME NM.2, Mandatory Appendix IV) (Cont'd)

Ultimate Stress Data [Note (4)]

Property	Symbol	ASTM Test Method	77°F	150°F	200°F
Axial tensile, psi	$S_{A(0:1)}$	D638 or D2105	8.17E+03	8.08E+03	6.46E+03
Axial flexural, psi	$S_{Af(0:1)}$	D790 or D2925	1.78E+04	1.49E+04	1.20E+04
Axial compressive, psi	$S_{A(0:-1)}$	D695	1.63E+04	1.35E+04	1.05E+04
Axial 2 × 1 biaxial tensile, psi	$S_{A(2:1)}$	D1599	1.87E+04	1.82E+04	1.05E+04
Hoop 2 × 1 biaxial tensile, psi	$S_{H(2:1)}$	D1599	2.42E+04	2.15E+04	1.50E+04
Hoop tensile, psi	$S_{H(1:0)}$	D638, D1599, or D2290	2.42E+04	2.15E+04	1.50E+04
In-plane shear, psi	τ	D4255	1.02E+04	9.62E+03	9.03E+03



Allowable Stress Envelope

GENERAL NOTES:

(a) The values in these tables may be interpolated to determine values for intermediate temperatures and thicknesses.

(b) Refer to ASME NM.2, Table 3-3.1-1 for limitations on service based on temperature.

(c) The Type III laminate values are based on 60% to 65% glass content; slight variations on thermal expansion can be expected if the glass content of the laminate is greater than 65%.

NOTES:

(1) Elastic properties apply to total wall, not just to structural wall. This is to ensure that the loads on the piping, the supports, and the connected equipment, as calculated in the pipe stress analysis, are not understated.

(2) For modulus values of the structural wall only, or for pipe for which the liner thickness is 0.0 in., it is permissible to use the modulus values applicable to a total wall thickness of 0.80 in. and over.

(3) Elastic properties may also be determined in accordance with ASME NM.2, Mandatory Appendix II.

(4) Allowable and ultimate stress values apply to the structural wall only, not the total wall thickness.

Table 1-2.2-1 Data Sheet for Vinyl Ester Resin Type I (SC-582)

Description and Service Limits	
Reinforcement material:	Fiberglass (Type E or ECR glass)
Resin material:	Vinyl ester resin
Reinforcement pattern:	Random glass
Structural wall thickness range, in.:	0.1 to 0.7
Liner thickness, in.:	0.1

Modulus Data [Notes (1), (2), and (3)]

			Modulus of Elasticity for Total Wall Thickness, in. (Including 0.1-in. Liner), and Temperature, °F											
			Up to and Including 77°F				150°F				200°F			
Property	Symbol	ASTM Test Method	0.2	0.4	0.6	0.8 and Over	0.2	0.4	0.6	0.8 and Over	0.2	0.4	0.6	0.8 and Over
Axial tensile, psi	E_{AT}	D638, D1599, or D2105	1.10E+06	1.11E+06	1.12E+06	1.12E+06	1.08E+06	1.09E+06	1.09E+06	1.12E+06	9.09E+05	9.19E+05	9.23E+05	9.25E+05
Axial compressive, psi	E_{AC}	D695	1.10E+06	1.11E+06	1.12E+06	1.12E+06	1.08E+06	1.09E+06	1.09E+06	1.12E+06	9.09E+05	9.19E+05	9.23E+05	9.25E+05
Axial flexural, psi	E_{AF}	D790 or D2925	1.06E+06	1.09E+06	1.10E+06	1.11E+06	1.04E+06	1.06E+06	1.08E+06	1.11E+06	8.75E+05	8.98E+05	9.09E+05	9.14E+05
Hoop tensile, psi	E_{HT}	D638, D1599, or D2290	1.10E+06	1.11E+06	1.12E+06	1.12E+06	1.08E+06	1.09E+06	1.09E+06	1.12E+06	9.09E+05	9.19E+05	9.23E+05	9.25E+05
Hoop flexural, psi	E_{HF}	D790 or D2412	1.06E+06	1.09E+06	1.10E+06	1.11E+06	1.04E+06	1.06E+06	1.08E+06	1.11E+06	8.75E+05	8.98E+05	9.09E+05	9.14E+05
In–plane shear, psi	G	D4255	4.11E+05	4.17E+05	4.18E+05	4.19E+05	4.02E+05	4.06E+05	4.08E+05	4.19E+05	3.40E+05	3.44E+05	3.45E+05	3.46E+05

Other Property Data [Notes (1), (2), and (3)]

Property	Symbol	Test Method	Value for 0.2-in. Thickness
Poisson's ratio: hoop–axial tensile	ν_{HAT}	...	0.34
Poisson's ratio: axial–hoop tensile	ν_{AHT}	...	0.34
Coefficient of thermal expansion, in./in./°F: axial	α_A	D696	1.855E–05
Coefficient of thermal expansion, in./in./°F: hoop	α_H	...	1.855E–05
Density, lbm/in.^{3}	ρ	D792	0.049
Thermal conductivity, Btu-in./(hr-ft^2-°F)	k	C1045	1.547

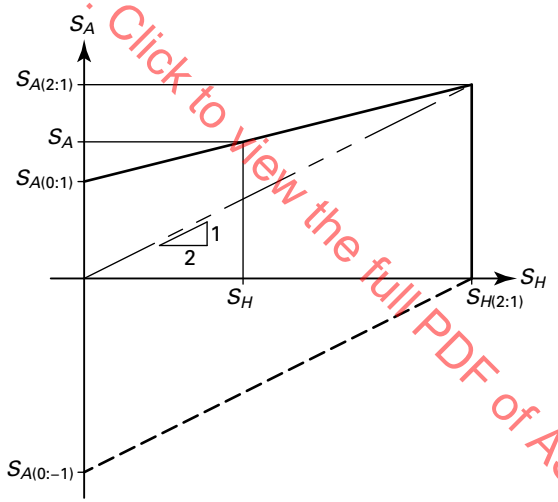
Allowable Stress Data [Note (4)]

Property	Symbol	ASTM Test Method	77°F	150°F	200°F
Axial tensile, psi	$S_{A(0:1)}$	D638 or D2105	1.11E+03	1.09E+03	9.19E+02
Axial flexural, psi	$S_{Af(0:1)}$	D790 or D2925	1.64E+03	1.60E+03	1.35E+03
Axial compressive, psi	$S_{A(0:-1)}$	D695	1.11E+03	1.09E+03	9.19E+02
Axial 2 × 1 biaxial tensile, psi	$S_{A(2:1)}$	D1599	1.11E+03	1.09E+03	9.19E+02
Hoop 2 × 1 biaxial tensile, psi	$S_{H(2:1)}$	D1599	1.11E+03	1.09E+03	9.19E+02
Hoop tensile, psi	$S_{H(1:0)}$	D638, D1599, or D2290	1.11E+03	1.09E+03	9.19E+02
In–plane shear, psi	τ	D4255	4.17E+02	4.06E+02	3.44E+02

Table 1-2.2-1 Data Sheet for Vinyl Ester Resin Type I (SC-582) (Cont'd)

Ultimate Stress Data [Note (4)]

Property	Symbol	ASTM Test Method	77°F	150°F	200°F
Axial tensile, psi	$S_{A(0:1)}$	D638 or D2105	1.11E+04	1.09E+04	9.19E+03
Axial flexural, psi	$S_{Af(0:1)}$	D790 or D2925	1.64E+04	1.60E+04	1.35E+04
Axial compressive, psi	$S_{A(0:-1)}$	D695	1.11E+04	1.09E+04	9.19E+03
Axial 2 × 1 biaxial tensile, psi	$S_{A(2:1)}$	D1599	1.11E+04	1.09E+04	9.19E+03
Hoop 2 × 1 biaxial tensile, psi	$S_{H(2:1)}$	D1599	1.11E+04	1.09E+04	9.19E+03
Hoop tensile, psi	$S_{H(1:0)}$	D638, D1599, or D2290	1.11E+04	1.09E+04	9.19E+03
In–plane shear, psi	τ	D4255	4.17E+03	4.06E+03	3.44E+03



Allowable Stress Envelope

GENERAL NOTES:

(a) The values in these tables may be interpolated to determine values for intermediate temperatures and thicknesses.

(b) Refer to ASME NM.2, Table 3-3.1-1 for limitations on service based on temperature.

(c) The maximum allowable design stress value shall be 1,800 psi for flanges constructed of Type I laminates.

NOTES:

(1) Elastic properties apply to total wall, not just to structural wall. This is to ensure that the loads on the piping, the supports, and the connected equipment, as calculated in the pipe stress analysis, are not understated.

(2) For modulus values of the structural wall only, or for pipe for which the liner thickness is 0.0 in., it is permissible to use the modulus values applicable to a total wall thickness of 0.80 in. and over.

(3) Elastic properties may also be determined in accordance with ASME NM.2, Mandatory Appendix II.

(4) Allowable and ultimate stress values apply to the structural wall only, not the total wall thickness.

Table 1-2.2-2 Data Sheet for Vinyl Ester Resin Type II (SC-582)

Description and Service Limits	
Reinforcement material:	Fiberglass (Type E or ECR glass)
Resin material:	Vinyl ester resin
Reinforcement pattern:	Random glass/WR (0/90)
Structural wall thickness range, in.:	0.1 to 0.7
Liner thickness, in.:	0.1

Modulus Data [Notes (1), (2), and (3)]

			Modulus of Elasticity for Total Wall Thickness, in. (Including 0.1-in. Liner), and Temperature, °F											
			Up to and Including 77°F				150°F				200°F			
Property	Symbol	ASTM Test Method	0.2	0.4	0.6	0.8 and Over	0.2	0.4	0.6	0.8 and Over	0.2	0.4	0.6	0.8 and Over
Axial tensile, psi	E_{AT}	D638, D1599, or D2105	1.31E+06	1.44E+06	1.59E+06	1.66E+06	1.28E+06	1.47E+06	1.61E+06	1.62E+06	1.11E+06	1.29E+06	1.38E+06	1.40E+06
Axial compressive, psi	E_{AC}	D695	1.31E+06	1.44E+06	1.59E+06	1.66E+06	1.28E+06	1.47E+06	1.61E+06	1.62E+06	1.11E+06	1.29E+06	1.38E+06	1.40E+06
Axial flexural, psi	E_{AF}	D790 or D2925	1.17E+06	1.19E+06	1.39E+06	1.48E+06	1.14E+06	1.19E+06	1.40E+06	1.40E+06	9.64E+05	1.02E+06	1.18E+06	1.19E+06
Hoop tensile, psi	E_{HT}	D638, D1599, or D2290	1.31E+06	1.50E+06	1.64E+06	1.70E+06	1.28E+06	1.47E+06	1.61E+06	1.63E+06	1.06E+06	1.29E+06	1.38E+06	1.40E+06
Hoop flexural, psi	E_{HF}	D790 or D2412	1.16E+06	1.21E+06	1.44E+06	1.53E+06	1.14E+06	1.18E+06	1.40E+06	1.40E+06	9.14E+05	1.01E+06	1.18E+06	1.19E+06
In–plane shear, psi	G	D4255	4.05E+05	4.05E+05	4.02E+05	4.01E+05	3.94E+05	3.92E+05	3.88E+05	3.89E+05	3.09E+05	3.20E+05	2.94E+05	2.94E+05

Other Property Data [Notes (1), (2), and (3)]

Property	Symbol	Test Method	Value for 0.2-in. Thickness
Poisson's ratio: hoop–axial tensile	ν_{HAT}	...	0.29
Poisson's ratio: axial–hoop tensile	ν_{AHT}	...	0.29
Coefficient of thermal expansion, in./in./°F: axial	α_A	D696	1.66E-05
Coefficient of thermal expansion, in./in./°F: hoop	α_H	...	1.66E-05
Density, lbm/in.^{3}	ρ	D792	0.050
Thermal conductivity, Btu-in./(hr-ft^2-°F)	k	C1045	1.3694

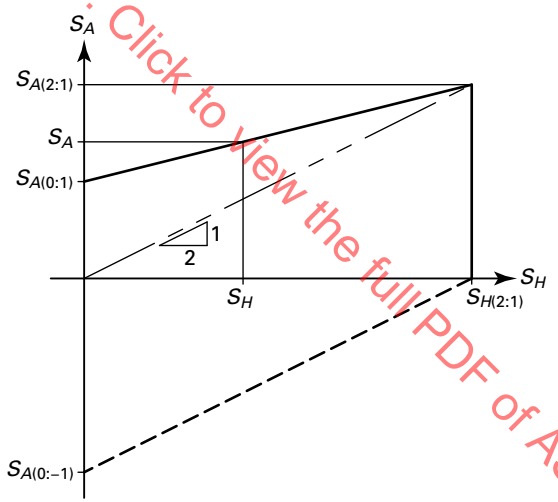
Allowable Stress Data [Note (4)]

Property	Symbol	ASTM Test Method	77°F	150°F	200°F
Axial tensile, psi	$S_{A(0:1)}$	D638 or D2105	1.87E+03	1.91E+03	1.68E+03
Axial flexural, psi	$S_{Af(0:1)}$	D790 or D2925	2.38E+03	2.37E+03	2.04E+03
Axial compressive, psi	$S_{A(0:-1)}$	D695	1.95E+03	1.91E+03	1.68E+03
Axial 2 × 1 biaxial tensile, psi	$S_{A(2:1)}$	D1599	1.95E+03	1.91E+03	1.68E+03
Hoop 2 × 1 biaxial tensile, psi	$S_{H(2:1)}$	D1599	1.95E+03	1.91E+03	1.68E+03
Hoop tensile, psi	$S_{H(1:0)}$	D638, D1599, or D2290	1.95E+03	1.91E+03	1.68E+03
In-plane shear, psi	τ	D4255	4.05E+02	3.92E+02	3.20E+02

Table 1-2.2-2 Data Sheet for Vinyl Ester Resin Type II (SC-582) (Cont'd)

Ultimate Stress Data [Note (4)]

Property	Symbol	ASTM Test Method	77°F	150°F	200°F
Axial tensile, psi	$S_{A(0:1)}$	D638 or D2105	1.87E+04	1.91E+04	1.68E+04
Axial flexural, psi	$S_{Af(0:1)}$	D790 or D2925	2.38E+04	2.37E+04	2.04E+04
Axial compressive, psi	$S_{A(0:-1)}$	D695	1.95E+04	1.91E+04	1.68E+04
Axial 2 × 1 biaxial tensile, psi	$S_{A(2:1)}$	D1599	1.95E+04	1.91E+04	1.68E+04
Hoop 2 × 1 biaxial tensile, psi	$S_{H(2:1)}$	D1599	1.95E+04	1.91E+04	1.68E+04
Hoop tensile, psi	$S_{H(1:0)}$	D638, D1599, or D2290	1.95E+04	1.91E+04	1.68E+04
In-plane shear, psi	τ	D4255	4.05E+03	3.92E+03	3.20E+03



Allowable Stress Envelope

GENERAL NOTES:
(a) The values in these tables may be interpolated to determine values for intermediate temperatures and thicknesses.
(b) Refer to ASME NM.2, Table 3-3.1-1 for limitations on service based on temperature.
(c) The maximum allowable design stress value shall be 3,000 psi for flanges constructed of Type II laminates.

NOTES:
(1) Elastic properties apply to total wall, not just to structural wall. This is to ensure that the loads on the piping, the supports, and the connected equipment, as calculated in the pipe stress analysis, are not understated.
(2) For modulus values of the structural wall only, or for pipe for which the liner thickness is 0.0 in., it is permissible to use the modulus values applicable to a total wall thickness of 0.80 in. and over.
(3) Elastic properties may also be determined in accordance with ASME NM.2, Mandatory Appendix II.
(4) Allowable and ultimate stress values apply to the structural wall only, not the total wall thickness.

Table 1-2.2-3 Data Sheet for Vinyl Ester Resin Type III (55-deg Filament Wound; ASME NM.2, Mandatory Appendix IV)

Description and Service Limits	
Reinforcement material:	Fiberglass (Type E or ECR glass)
Resin material:	Vinyl ester resin
Reinforcement pattern:	FW (±55)
Structural wall thickness range, in.:	0.1 to 0.7
Liner thickness, in.:	0.1

Modulus Data [Notes (1), (2), and (3)]

			Modulus of Elasticity for Total Wall Thickness, in. (Including 0.1-in. Liner), and Temperature, °F											
			Up to and Including 77°F				150°F				200°F			
Property	Symbol	ASTM Test Method	0.2	0.4	0.6	0.8 and Over	0.2	0.4	0.6	0.8 and Over	0.2	0.4	0.6	0.8 and Over
Axial tensile, psi	E_{AT}	D638, D1599, or D2105	1.18E+06	1.24E+06	1.26E+06	1.27E+06	1.15E+06	1.19E+06	1.21E+06	1.21E+06	8.84E+05	8.84E+05	8.84E+05	8.84E+05
Axial compressive, psi	E_{AC}	D695	1.18E+06	1.24E+06	1.26E+06	1.27E+06	1.15E+06	1.19E+06	1.21E+06	1.21E+06	8.84E+05	8.84E+05	8.84E+05	8.84E+05
Axial flexural, psi	E_{AF}	D790 or D2925	1.10E+06	1.17E+06	1.14E+06	1.22E+06	1.08E+06	1.14E+06	1.16E+06	1.18E+06	8.22E+05	8.64E+05	8.75E+05	8.79E+05
Hoop tensile, psi	E_{HT}	D638, D1599, or D2290	1.49E+06	1.85E+06	1.97E+06	2.02E+06	1.47E+06	1.81E+06	1.92E+06	1.97E+06	1.22E+06	1.50E+06	1.59E+06	1.63E+06
Hoop flexural, psi	E_{HF}	D790 or D2412	1.25E+06	1.57E+06	1.76E+06	1.84E+06	1.24E+06	1.54E+06	1.71E+06	1.80E+06	9.90E+05	1.28E+06	1.43E+06	1.50E+06
In-plane shear, psi	G	D4255	6.80E+05	1.01E+06	1.14E+06	1.20E+06	6.74E+05	1.00E+06	1.13E+06	1.19E+06	5.86E+05	9.23E+05	1.05E+06	1.11E+06

Other Property Data [Notes (1), (2), and (3)]

Property	Symbol	Test Method	Value for 0.2-in. Thickness
Poisson's ratio: hoop–axial tensile	ν_{HAT}	...	0.49
Poisson's ratio: axial–hoop tensile	ν_{AHT}	...	0.39
Coefficient of thermal expansion, in./in./°F: axial	α_A	D696	1.831E–05
Coefficient of thermal expansion, in./in./°F: hoop	α_H	...	1.067E–05
Density, lbm/in.^{3}	ρ	D792	0.057
Thermal conductivity, Btu-in./(hr-ft^2-°F)	k	C1045	1.74

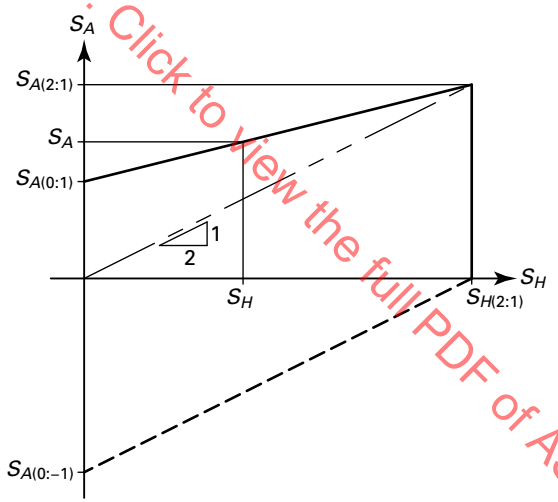
Allowable Stress Data [Note (4)]

Property	Symbol	ASTM Test Method	77°F	150°F	200°F
Axial tensile, psi	$S_{A(0:1)}$	D638 or D2105	1.24E+03	1.19E+03	8.84E+02
Axial flexural, psi	$S_{Af(0:1)}$	D790 or D2925	1.74E+03	1.70E+03	1.50E+03
Axial compressive, psi	$S_{A(0:-1)}$	D695	1.61E+03	1.55E+03	1.15E+03
Axial 2 × 1 biaxial tensile, psi	$S_{A(2:1)}$	D1599	1.85E+03	1.81E+03	1.50E+03
Hoop 2 × 1 biaxial tensile, psi	$S_{H(2:1)}$	D1599	2.40E+03	2.35E+03	1.95E+03
Hoop tensile, psi	$S_{H(1:0)}$	D638, D1599, or D2290	2.40E+03	2.35E+03	1.95E+03
In-plane shear, psi	τ	D4255	1.01E+03	1.00E+03	9.23E+02

Table 1-2.2-3 Data Sheet for Vinyl Ester Resin Type III (55-deg Filament Wound; ASME NM.2, Mandatory Appendix IV) (Cont'd)

Ultimate Stress Data [Note (4)]

Property	Symbol	ASTM Test Method	77°F	150°F	200°F
Axial tensile, psi	$S_{A(0:1)}$	D638 or D2105	1.24E+04	1.19E+04	8.84E+03
Axial flexural, psi	$S_{Af(0:1)}$	D790 or D2925	1.74E+04	1.70E+04	1.50E+04
Axial compressive, psi	$S_{A(0:-1)}$	D695	1.61E+04	1.55E+04	1.15E+04
Axial 2 × 1 biaxial tensile, psi	$S_{A(2:1)}$	D1599	1.85E+04	1.81E+04	1.50E+04
Hoop 2 × 1 biaxial tensile, psi	$S_{H(2:1)}$	D1599	2.40E+04	2.35E+04	1.95E+04
Hoop tensile, psi	$S_{H(1:0)}$	D638, D1599, or D2290	2.40E+04	2.35E+04	1.95E+04
In-plane shear, psi	τ	D4255	1.01E+04	1.00E+04	9.23E+03



Allowable Stress Envelope

GENERAL NOTES:

(a) The values in these tables may be interpolated to determine values for intermediate temperatures and thicknesses.

(b) Refer to ASME NM.2, Table 3-3.1-1 for limitations on service based on temperature.

(c) The Type III laminate values are based on 60% to 65% glass content; slight variations on thermal expansion can be expected if the glass content of the laminate is greater than 65%.

NOTES:

(1) Elastic properties apply to total wall, not just to structural wall. This is to ensure that the loads on the piping, the supports, and the connected equipment, as calculated in the pipe stress analysis, are not understated.

(2) For modulus values of the structural wall only, or for pipe for which the liner thickness is 0.0 in., it is permissible to use the modulus values applicable to a total wall thickness of 0.80 in. and over.

(3) Elastic properties may also be determined in accordance with ASME NM.2, Mandatory Appendix II.

(4) Allowable and ultimate stress values apply to the structural wall only, not the total wall thickness.

Table 1-1-1M Maximum Allowable Stress Values, *S*, for Thermoplastic Materials

Line No.	Nominal Composition	Product Form	ASME Spec. No.	Type/Grade	Construction Code Notes	Minimum Yield Strength, MPa	Maximum Temperature Limit, °C	Design Factor	Notes
1	CPVC	Extruded pipe	SD-2846	CPVC 4120-05	C01	48.3	93.3	D01	M01
2	CPVC	Extruded pipe	SD-2846	CPVC 4120-05	C01	48.3	93.3	D02	M01
3	CPVC	Extruded pipe	SD-2846	CPVC 4120-05	C01	48.3	93.3	D03	M01
4	CPVC	Extruded pipe	SD-2846	CPVC 4120-06	C01	48.3	93.3	D01	M02
5	CPVC	Extruded pipe	SD-2846	CPVC 4120-06	C01	48.3	93.3	D02	M02
6	CPVC	Extruded pipe	SD-2846	CPVC 4120-06	C01	48.3	93.3	D03	M02
7	CPVC	Extruded pipe	SF-441	CPVC 4120-05	C01	48.3	93.3	D01	M01
8	CPVC	Extruded pipe	SF-441	CPVC 4120-05	C01	48.3	93.3	D02	M01
9	CPVC	Extruded pipe	SF-441	CPVC 4120-05	C01	48.3	93.3	D03	M01
10	CPVC	Extruded pipe	SF-441	CPVC 4120-06	C01	48.3	93.3	D01	M02
11	CPVC	Extruded pipe	SF-441	CPVC 4120-06	C01	48.3	93.3	D02	M02
12	CPVC	Extruded pipe	SF-441	CPVC 4120-06	C01	48.3	93.3	D03	M02
13	CPVC	Extruded pipe	SF-442	CPVC 4120-05	C01	48.3	93.3	D01	M01
14	CPVC	Extruded pipe	SF-442	CPVC 4120-05	C01	48.3	93.3	D02	M01
15	CPVC	Extruded pipe	SF-442	CPVC 4120-05	C01	48.3	93.3	D03	M01
16	CPVC	Extruded pipe	SF-442	CPVC 4120-06	C01	48.3	93.3	D01	M02
17	CPVC	Extruded pipe	SF-442	CPVC 4120-06	C01	48.3	93.3	D02	M02
18	CPVC	Extruded pipe	SF-442	CPVC 4120-06	C01	48.3	93.3	D03	M02
19	Polyamide	Extruded pipe	SF-2945	PA 32312	...	48.0	82.2	D01	M03
20	Polyamide	Extruded pipe	SF-2945	PA 32312	...	48.0	82.2	D02	M03
21	Polyamide	Extruded pipe	SF-2945	PA 32312	...	48.0	82.2	D03	M03
22	Polyamide	Extruded pipe	SF-2945	PA 32316	...	48.0	82.2	D01	M04
23	Polyamide	Extruded pipe	SF-2945	PA 32316	...	48.0	82.2	D02	M04
24	Polyamide	Extruded pipe	SF-2945	PA 32316	...	48.0	82.2	D03	M04
25	Polyethylene	Extruded pipe	SD-2239	PE2708	...	17.9	60.0	D04	M05, M06
26	Polyethylene	Extruded pipe	SD-2239	PE2708	...	17.9	60.0	D05	M05, M06
27	Polyethylene	Extruded pipe	SD-2239	PE2708	...	17.9	60.0	D07	M05, M06
28	Polyethylene	Extruded pipe	SD-2239	PE2708	...	17.9	60.0	D08	M05, M06
29	Polyethylene	Extruded pipe	SD-2239	PE2708	...	17.9	82.2	D04	M05, M07
30	Polyethylene	Extruded pipe	SD-2239	PE2708	...	17.9	82.2	D05	M05, M07
31	Polyethylene	Extruded pipe	SD-2239	PE2708	...	17.9	82.2	D07	M05, M07
32	Polyethylene	Extruded pipe	SD-2239	PE2708	...	17.9	82.2	D08	M05, M07
33	Polyethylene	Extruded pipe	SD-2513	PE2708	...	17.9	60.0	D04	M06, M08
34	Polyethylene	Extruded pipe	SD-2513	PE2708	...	17.9	60.0	D05	M06, M08
35	Polyethylene	Extruded pipe	SD-2513	PE2708	...	17.9	60.0	D07	M06, M08
36	Polyethylene	Extruded pipe	SD-2513	PE2708	...	17.9	60.0	D08	M06, M08

Table 1-1-1M Maximum Allowable Stress Values, *S*, for Thermoplastic Materials

Line No.	Maximum Allowable Stress, MPa [Note (1)], for Material Temperature, °C, Not Exceeding															
	23	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95
1	11.0	10.7	9.89	9.10	8.34	7.60	6.88	6.19	5.52	4.87	4.23	3.62	3.02	2.44	1.87	1.32
2	13.8	13.4	12.4	11.4	10.4	9.50	8.60	7.74	6.90	6.08	5.29	4.52	3.77	3.05	2.34	1.65
3	27.6	26.8	24.7	22.8	20.8	19.0	17.2	15.5	13.8	12.2	10.6	9.04	7.55	6.09	4.68	3.30
4	11.0	10.7	9.98	9.26	8.56	7.88	7.23	6.59	5.98	5.38	4.80	4.23	3.69	3.15	2.64	2.13
5	13.8	13.4	12.5	11.6	10.7	9.86	9.04	8.24	7.47	6.72	6.00	5.29	4.61	3.94	3.29	2.66
6	27.6	26.8	25.0	23.2	21.4	19.7	18.1	16.5	14.9	13.5	12.0	10.6	9.22	7.88	6.59	5.33
7	11.0	10.7	9.89	9.10	8.34	7.60	6.88	6.19	5.52	4.87	4.23	3.62	3.02	2.44	1.87	1.32
8	13.8	13.4	12.4	11.4	10.4	9.50	8.60	7.74	6.90	6.08	5.29	4.52	3.77	3.05	2.34	1.65
9	27.6	26.8	24.7	22.8	20.8	19.0	17.2	15.5	13.8	12.2	10.6	9.04	7.55	6.09	4.68	3.30
10	11.0	10.7	9.98	9.26	8.56	7.88	7.23	6.59	5.98	5.38	4.80	4.23	3.69	3.15	2.64	2.13
11	13.8	13.4	12.5	11.6	10.7	9.86	9.04	8.24	7.47	6.72	6.00	5.29	4.61	3.94	3.29	2.66
12	27.6	26.8	25.0	23.2	21.4	19.7	18.1	16.5	14.9	13.5	12.0	10.6	9.22	7.88	6.59	5.33
13	11.0	10.7	9.89	9.10	8.34	7.60	6.88	6.19	5.52	4.87	4.23	3.62	3.02	2.44	1.87	1.32
14	13.8	13.4	12.4	11.4	10.4	9.50	8.60	7.74	6.90	6.08	5.29	4.52	3.77	3.05	2.34	1.65
15	27.6	26.8	24.7	22.8	20.8	19.0	17.2	15.5	13.8	12.2	10.6	9.04	7.55	6.09	4.68	3.30
16	11.0	10.7	9.98	9.26	8.56	7.88	7.23	6.59	5.98	5.38	4.80	4.23	3.69	3.15	2.64	2.13
17	13.8	13.4	12.5	11.6	10.7	9.86	9.04	8.24	7.47	6.72	6.00	5.29	4.61	3.94	3.29	2.66
18	27.6	26.8	25.0	23.2	21.4	19.7	18.1	16.5	14.9	13.5	12.0	10.6	9.22	7.88	6.59	5.33
19	6.89	6.74	6.38	6.02	5.68	5.35	5.03	4.72	4.41	4.18	3.96	3.75	3.54	3.34	...	...
20	8.62	8.43	7.97	7.53	7.10	6.69	6.28	5.89	5.52	5.23	4.95	4.68	4.42	4.17	...	...
21	17.2	16.9	16.0	15.1	14.2	13.4	12.6	11.8	11.0	10.5	9.91	9.37	8.85	8.34	...	...
22	8.69	8.52	8.10	7.69	7.29	6.91	6.54	6.19	5.84	5.50	5.17	4.86	4.55	4.25	...	...
23	10.9	10.6	10.1	9.61	9.12	8.64	8.18	7.73	7.30	6.88	6.47	6.07	5.68	5.31	...	...
24	21.7	21.3	20.2	19.2	18.2	17.3	16.4	15.5	14.6	13.8	12.9	12.1	11.4	10.6	...	...
25	2.76	2.72	2.64	2.56	2.49	2.41	2.34	2.27	2.21	...	...	...	...	...	...	...
26	3.45	3.41	3.30	3.21	3.11	3.02	2.93	2.84	2.76	...	...	...	...	...	...	...
27	5.43	5.36	5.20	5.05	4.90	4.75	4.61	4.48	4.34	...	...	...	...	...	...	...
28	8.62	8.51	8.26	8.01	7.78	7.55	7.32	7.10	6.89	...	...	...	...	...	...	...
29	2.76	2.70	2.57	2.44	2.31	2.19	2.07	1.96	1.85	1.74	1.63	1.53	1.43	...	...	...
30	3.45	3.38	3.21	3.05	2.89	2.74	2.59	2.45	2.31	2.17	2.04	1.91	1.79	...	...	...
31	5.43	5.32	5.06	4.80	4.55	4.31	4.08	3.85	3.63	3.42	3.22	3.02	2.82	...	...	...
32	8.62	8.45	8.03	7.62	7.23	6.84	6.48	6.12	5.77	5.43	5.11	4.79	4.48	...	...	...
33	2.76	2.72	2.64	2.56	2.49	2.41	2.34	2.27	2.21	...	...	...	...	...	...	...
34	3.45	3.41	3.30	3.21	3.11	3.02	2.93	2.84	2.76	...	...	...	...	...	...	...
35	5.43	5.36	5.20	5.05	4.90	4.75	4.61	4.48	4.34	...	...	...	...	...	...	...
36	8.62	8.51	8.26	8.01	7.78	7.55	7.32	7.10	6.89	...	...	...	...	...	...	...

Table 1-1-1M Maximum Allowable Stress Values, *S*, for Thermoplastic Materials (Cont'd)

Line No.	Nominal Composition	Product Form	ASME Spec. No.	Type/Grade	Construction Code Notes	Minimum Yield Strength, MPa	Maximum Temperature Limit, °C	Design Factor	Notes
37	Polyethylene	Extruded pipe	SD-2513	PE2708	...	17.9	82.2	D04	M07, M08
38	Polyethylene	Extruded pipe	SD-2513	PE2708	...	17.9	82.2	D05	M07, M08
39	Polyethylene	Extruded pipe	SD-2513	PE2708	...	17.9	82.2	D07	M07, M08
40	Polyethylene	Extruded pipe	SD-2513	PE2708	...	17.9	82.2	D08	M07, M08
41	Polyethylene	Extruded tube	SD-2737	PE2708	...	17.9	60.0	D04	M05, M06
42	Polyethylene	Extruded tube	SD-2737	PE2708	...	17.9	60.0	D05	M05, M06
43	Polyethylene	Extruded tube	SD-2737	PE2708	...	17.9	60.0	D07	M05, M06
44	Polyethylene	Extruded tube	SD-2737	PE2708	...	17.9	60.0	D08	M05, M06
45	Polyethylene	Extruded tube	SD-2737	PE2708	...	17.9	82.2	D04	M05, M07
46	Polyethylene	Extruded tube	SD-2737	PE2708	...	17.9	82.2	D05	M05, M07
47	Polyethylene	Extruded tube	SD-2737	PE2708	...	17.9	82.2	D07	M05, M07
48	Polyethylene	Extruded tube	SD-2737	PE2708	...	17.9	82.2	D08	M05, M07
49	Polyethylene	Extruded pipe	SD-3035	PE2708	...	17.9	60.0	D04	M05, M06
50	Polyethylene	Extruded pipe	SD-3035	PE2708	...	17.9	60.0	D05	M05, M06
51	Polyethylene	Extruded pipe	SD-3035	PE2708	...	17.9	60.0	D07	M05, M06
52	Polyethylene	Extruded pipe	SD-3035	PE2708	...	17.9	60.0	D08	M05, M06
53	Polyethylene	Extruded pipe	SD-3035	PE2708	...	17.9	82.2	D04	M05, M07
54	Polyethylene	Extruded pipe	SD-3035	PE2708	...	17.9	82.2	D05	M05, M07
55	Polyethylene	Extruded pipe	SD-3035	PE2708	...	17.9	82.2	D07	M05, M07
56	Polyethylene	Extruded pipe	SD-3035	PE2708	...	17.9	82.2	D08	M05, M07
57	Polyethylene	Extruded pipe	SF-714	PE2708	...	17.9	60.0	D04	M06, M08
58	Polyethylene	Extruded pipe	SF-714	PE2708	...	17.9	60.0	D05	M06, M08
59	Polyethylene	Extruded pipe	SF-714	PE2708	...	17.9	60.0	D07	M06, M08
60	Polyethylene	Extruded pipe	SF-714	PE2708	...	17.9	60.0	D08	M06, M08
61	Polyethylene	Extruded pipe	SF-714	PE2708	...	17.9	82.2	D04	M07, M08
62	Polyethylene	Extruded pipe	SF-714	PE2708	...	17.9	82.2	D05	M07, M08
63	Polyethylene	Extruded pipe	SF-714	PE2708	...	17.9	82.2	D07	M07, M08
64	Polyethylene	Extruded pipe	SF-714	PE2708	...	17.9	82.2	D08	M07, M08
65	Polyethylene	Extruded pipe	SD-2239	PE3608	...	20.7	60.0	D04	M05, M09
66	Polyethylene	Extruded pipe	SD-2239	PE3608	...	20.7	60.0	D05	M05, M09
67	Polyethylene	Extruded pipe	SD-2239	PE3608	...	20.7	60.0	D06	M05, M09
68	Polyethylene	Extruded pipe	SD-2239	PE3608	...	20.7	60.0	D08	M05, M09
69	Polyethylene	Extruded pipe	SD-2239	PE3608	...	20.7	60.0	D04	M05, M10
70	Polyethylene	Extruded pipe	SD-2239	PE3608	...	20.7	60.0	D05	M05, M10
71	Polyethylene	Extruded pipe	SD-2239	PE3608	...	20.7	60.0	D06	M05, M10
72	Polyethylene	Extruded pipe	SD-2239	PE3608	...	20.7	60.0	D08	M05, M10
73	Polyethylene	Extruded pipe	SD-2239	PE4608	...	20.7	60.0	D04	M05, M10
74	Polyethylene	Extruded pipe	SD-2239	PE4608	...	20.7	60.0	D05	M05, M10
75	Polyethylene	Extruded pipe	SD-2239	PE4608	...	20.7	60.0	D06	M05, M10
76	Polyethylene	Extruded pipe	SD-2239	PE4608	...	20.7	60.0	D08	M05, M10

Table 1-1-1M Maximum Allowable Stress Values, *S*, for Thermoplastic Materials (Cont'd)

Line No.	Maximum Allowable Stress, MPa [Note (1)], for Material Temperature, °C, Not Exceeding															
	23	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95
37	2.76	2.70	2.57	2.44	2.31	2.19	2.07	1.96	1.85	1.74	1.63	1.53	1.43	...	...	...
38	3.45	3.38	3.21	3.05	2.89	2.74	2.59	2.45	2.31	2.17	2.04	1.91	1.79	...	...	...
39	5.43	5.32	5.06	4.80	4.55	4.31	4.08	3.85	3.63	3.42	3.22	3.02	2.82	...	...	...
40	8.62	8.45	8.03	7.62	7.23	6.84	6.48	6.12	5.77	5.43	5.11	4.79	4.48	...	...	...
41	2.76	2.72	2.64	2.56	2.49	2.41	2.34	2.27	2.21	...	...	...	...	...	...	...
42	3.45	3.41	3.30	3.21	3.11	3.02	2.93	2.84	2.76	...	...	...	...	...	...	...
43	5.43	5.36	5.20	5.05	4.90	4.75	4.61	4.48	4.34	...	...	...	...	...	...	...
44	8.62	8.51	8.26	8.01	7.78	7.55	7.32	7.10	6.89	...	...	...	...	...	...	...
45	2.76	2.70	2.57	2.44	2.31	2.19	2.07	1.96	1.85	1.74	1.63	1.53	1.43	...	...	...
46	3.45	3.38	3.21	3.05	2.89	2.74	2.59	2.45	2.31	2.17	2.04	1.91	1.79	...	...	...
47	5.43	5.32	5.06	4.80	4.55	4.31	4.08	3.85	3.63	3.42	3.22	3.02	2.82	...	...	...
48	8.62	8.45	8.03	7.62	7.23	6.84	6.48	6.12	5.77	5.43	5.11	4.79	4.48	...	...	...
49	2.76	2.72	2.64	2.56	2.49	2.41	2.34	2.27	2.21	...	...	...	...	...	...	...
50	3.45	3.41	3.30	3.21	3.11	3.02	2.93	2.84	2.76	...	...	...	...	...	...	...
51	5.43	5.36	5.20	5.05	4.90	4.75	4.61	4.48	4.34	...	...	...	...	...	...	...
52	8.62	8.51	8.26	8.01	7.78	7.55	7.32	7.10	6.89	...	...	...	...	...	...	...
53	2.76	2.70	2.57	2.44	2.31	2.19	2.07	1.96	1.85	1.74	1.63	1.53	1.43	...	...	...
54	3.45	3.38	3.21	3.05	2.89	2.74	2.59	2.45	2.31	2.17	2.04	1.91	1.79	...	...	...
55	5.43	5.32	5.06	4.80	4.55	4.31	4.08	3.85	3.63	3.42	3.22	3.02	2.82	...	...	...
56	8.62	8.45	8.03	7.62	7.23	6.84	6.48	6.12	5.77	5.43	5.11	4.79	4.48	...	...	...
57	2.76	2.72	2.64	2.56	2.49	2.41	2.34	2.27	2.21	...	...	...	...	...	...	...
58	3.45	3.41	3.30	3.21	3.11	3.02	2.93	2.84	2.76	...	...	...	...	...	...	...
59	5.43	5.36	5.20	5.05	4.90	4.75	4.61	4.48	4.34	...	...	...	...	...	...	...
60	8.62	8.51	8.26	8.01	7.78	7.55	7.32	7.10	6.89	...	...	...	...	...	...	...
61	2.76	2.70	2.57	2.44	2.31	2.19	2.07	1.96	1.85	1.74	1.63	1.53	1.43	...	...	...
62	3.45	3.38	3.21	3.05	2.89	2.74	2.59	2.45	2.31	2.17	2.04	1.91	1.79	...	...	...
63	5.43	5.32	5.06	4.80	4.55	4.31	4.08	3.85	3.63	3.42	3.22	3.02	2.82	...	...	...
64	8.62	8.45	8.03	7.62	7.23	6.84	6.48	6.12	5.77	5.43	5.11	4.79	4.48	...	...	...
65	3.53	3.42	3.16	2.91	2.67	2.43	2.20	1.98	1.77	...	...	...	...	...	...	...
66	4.41	4.28	3.95	3.64	3.33	3.04	2.75	2.48	2.21	...	...	...	...	...	...	...
67	5.52	5.35	4.94	4.55	4.17	3.80	3.44	3.09	2.76	...	...	...	...	...	...	...
68	11.0	10.7	9.88	9.10	8.34	7.60	6.88	6.19	5.52	...	...	...	...	...	...	...
69	3.53	3.45	3.25	3.07	2.88	2.71	2.53	2.37	2.21	...	...	...	...	...	...	...
70	4.41	4.31	4.07	3.83	3.60	3.38	3.17	2.96	2.76	...	...	...	...	...	...	...
71	5.52	5.39	5.09	4.79	4.50	4.23	3.96	3.70	3.45	...	...	...	...	...	...	...
72	11.0	10.8	10.2	9.58	9.01	8.46	7.92	7.40	6.89	...	...	...	...	...	...	...
73	3.53	3.45	3.25	3.07	2.88	2.71	2.53	2.37	2.21	...	...	...	...	...	...	...
74	4.41	4.31	4.07	3.83	3.60	3.38	3.17	2.96	2.76	...	...	...	...	...	...	...
75	5.52	5.39	5.09	4.79	4.50	4.23	3.96	3.70	3.45	...	...	...	...	...	...	...
76	11.0	10.8	10.2	9.58	9.01	8.46	7.92	7.40	6.89	...	...	...	...	...	...	...

Table 1-1-1M Maximum Allowable Stress Values, *S*, for Thermoplastic Materials (Cont'd)

Line No.	Nominal Composition	Product Form	ASME Spec. No.	Type/Grade	Construction Code Notes	Minimum Yield Strength, MPa	Maximum Temperature Limit, °C	Design Factor	Notes
77	Polyethylene	Extruded pipe	SD-2239	PE4710	...	20.7	60.0	D04	M05, M11
78	Polyethylene	Extruded pipe	SD-2239	PE4710	...	20.7	60.0	D05	M05, M11
79	Polyethylene	Extruded pipe	SD-2239	PE4710	...	20.7	60.0	D07	M05, M11
80	Polyethylene	Extruded pipe	SD-2239	PE4710	...	20.7	60.0	D08	M05, M11
81	Polyethylene	Extruded pipe	SD-2239	PE4710	...	20.7	60.0	D04	M05, M12
82	Polyethylene	Extruded pipe	SD-2239	PE4710	...	20.7	60.0	D05	M05, M12
83	Polyethylene	Extruded pipe	SD-2239	PE4710	...	20.7	60.0	D07	M05, M12
84	Polyethylene	Extruded pipe	SD-2239	PE4710	...	20.7	60.0	D08	M05, M12
85	Polyethylene	Extruded pipe	SD-2239	PE4710	...	20.7	82.2	D04	M05, M13
86	Polyethylene	Extruded pipe	SD-2239	PE4710	...	20.7	82.2	D05	M05, M13
87	Polyethylene	Extruded pipe	SD-2239	PE4710	...	20.7	82.2	D07	M05, M13
88	Polyethylene	Extruded pipe	SD-2239	PE4710	...	20.7	82.2	D08	M05, M13
89	Polyethylene	Extruded pipe	SD-2513	PE4710	...	20.7	60.0	D04	M08, M11
90	Polyethylene	Extruded pipe	SD-2513	PE4710	...	20.7	60.0	D05	M08, M11
91	Polyethylene	Extruded pipe	SD-2513	PE4710	...	20.7	60.0	D07	M08, M11
92	Polyethylene	Extruded pipe	SD-2513	PE4710	...	20.7	60.0	D08	M08, M11
93	Polyethylene	Extruded pipe	SD-2513	PE4710	...	20.7	60.0	D04	M08, M12
94	Polyethylene	Extruded pipe	SD-2513	PE4710	...	20.7	60.0	D05	M08, M12
95	Polyethylene	Extruded pipe	SD-2513	PE4710	...	20.7	60.0	D07	M08, M12
96	Polyethylene	Extruded pipe	SD-2513	PE4710	...	20.7	60.0	D08	M08, M12
97	Polyethylene	Extruded pipe	SD-2513	PE4710	...	20.7	82.2	D04	M08, M13
98	Polyethylene	Extruded pipe	SD-2513	PE4710	...	20.7	82.2	D05	M08, M13
99	Polyethylene	Extruded pipe	SD-2513	PE4710	...	20.7	82.2	D07	M08, M13
100	Polyethylene	Extruded pipe	SD-2513	PE4710	...	20.7	82.2	D08	M08, M13
101	Polyethylene	Extruded tube	SD-2737	PE3608	...	20.7	60.0	D04	M05, M09
102	Polyethylene	Extruded tube	SD-2737	PE3608	...	20.7	60.0	D05	M05, M09
103	Polyethylene	Extruded tube	SD-2737	PE3608	...	20.7	60.0	D06	M05, M09
104	Polyethylene	Extruded tube	SD-2737	PE3608	...	20.7	60.0	D08	M05, M09
105	Polyethylene	Extruded tube	SD-2737	PE3608	...	20.7	60.0	D04	M05, M10
106	Polyethylene	Extruded tube	SD-2737	PE3608	...	20.7	60.0	D05	M05, M10
107	Polyethylene	Extruded tube	SD-2737	PE3608	...	20.7	60.0	D06	M05, M10
108	Polyethylene	Extruded tube	SD-2737	PE3608	...	20.7	60.0	D08	M05, M10
109	Polyethylene	Extruded tube	SD-2737	PE4608	...	20.7	60.0	D04	M05, M10
110	Polyethylene	Extruded tube	SD-2737	PE4608	...	20.7	60.0	D05	M05, M10
111	Polyethylene	Extruded tube	SD-2737	PE4608	...	20.7	60.0	D06	M05, M10
112	Polyethylene	Extruded tube	SD-2737	PE4608	...	20.7	60.0	D08	M05, M10
113	Polyethylene	Extruded tube	SD-2737	PE4710	...	20.7	60.0	D04	M05, M11
114	Polyethylene	Extruded tube	SD-2737	PE4710	...	20.7	60.0	D05	M05, M11
115	Polyethylene	Extruded tube	SD-2737	PE4710	...	20.7	60.0	D07	M05, M11
116	Polyethylene	Extruded tube	SD-2737	PE4710	...	20.7	60.0	D08	M05, M11

Table 1-1-1M Maximum Allowable Stress Values, *S*, for Thermoplastic Materials (Cont'd)

Line No.	Maximum Allowable Stress, MPa [Note (1)], for Material Temperature, °C, Not Exceeding															
	23	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95
77	3.53	3.42	3.16	2.91	2.67	2.43	2.20	1.98	1.77	...	...	...	...	...	...	...
78	4.41	4.28	3.95	3.64	3.33	3.04	2.75	2.48	2.21	...	...	...	...	...	...	...
79	6.95	6.74	6.23	5.73	5.25	4.79	4.34	3.90	3.47	...	...	...	...	...	...	...
80	11.0	10.7	9.88	9.10	8.34	7.60	6.88	6.19	5.52	...	...	...	...	...	...	...
81	3.53	3.45	3.25	3.07	2.88	2.71	2.53	2.37	2.21	...	...	...	...	...	...	...
82	4.41	4.31	4.07	3.83	3.60	3.38	3.17	2.96	2.76	...	...	...	...	...	...	...
83	6.95	6.79	6.41	6.04	5.68	5.33	4.99	4.66	4.34	...	...	...	...	...	...	...
84	11.0	10.8	10.2	9.58	9.01	8.46	7.92	7.40	6.89	...	...	...	...	...	...	...
85	3.53	3.46	3.29	3.12	2.96	2.80	2.65	2.50	2.35	2.21	2.08	1.95	1.82	...	...	...
86	4.41	4.32	4.11	3.90	3.69	3.50	3.31	3.12	2.94	2.77	2.60	2.44	2.28	...	...	...
87	6.95	6.81	6.47	6.14	5.82	5.51	5.21	4.92	4.63	4.36	4.09	3.84	3.58	...	...	...
88	11.0	10.8	10.3	9.74	9.23	8.74	8.27	7.80	7.36	6.92	6.50	6.09	5.69	...	...	...
89	3.53	3.42	3.16	2.91	2.67	2.43	2.20	1.98	1.77	...	...	...	...	...	...	...
90	4.41	4.28	3.95	3.64	3.33	3.04	2.75	2.48	2.21	...	...	...	...	...	...	...
91	6.95	6.74	6.23	5.73	5.25	4.79	4.34	3.90	3.47	...	...	...	...	...	...	...
92	11.0	10.7	9.88	9.10	8.34	7.60	6.88	6.19	5.52	...	...	...	...	...	...	...
93	3.53	3.45	3.25	3.07	2.88	2.71	2.53	2.37	2.21	...	...	...	...	...	...	...
94	4.41	4.31	4.07	3.83	3.60	3.38	3.17	2.96	2.76	...	...	...	...	...	...	...
95	6.95	6.79	6.41	6.04	5.68	5.33	4.99	4.66	4.34	...	...	...	...	...	...	...
96	11.0	10.8	10.2	9.58	9.01	8.46	7.92	7.40	6.89	...	...	...	...	...	...	...
97	3.53	3.46	3.29	3.12	2.96	2.80	2.65	2.50	2.35	2.21	2.08	1.95	1.82	...	...	...
98	4.41	4.32	4.11	3.90	3.69	3.50	3.31	3.12	2.94	2.77	2.60	2.44	2.28	...	...	...
99	6.95	6.81	6.47	6.14	5.82	5.51	5.21	4.92	4.63	4.36	4.09	3.84	3.58	...	...	...
100	11.0	10.8	10.3	9.74	9.23	8.74	8.27	7.80	7.36	6.92	6.50	6.09	5.69	...	...	...
101	3.53	3.42	3.16	2.91	2.67	2.43	2.20	1.98	1.77	...	...	...	...	...	...	...
102	4.41	4.28	3.95	3.64	3.33	3.04	2.75	2.48	2.21	...	...	...	...	...	...	...
103	5.52	5.35	4.94	4.55	4.17	3.80	3.44	3.09	2.76	...	...	...	...	...	...	...
104	11.0	10.7	9.88	9.10	8.34	7.60	6.88	6.19	5.52	...	...	...	...	...	...	...
105	3.53	3.45	3.25	3.07	2.88	2.71	2.53	2.37	2.21	...	...	...	...	...	...	...
106	4.41	4.31	4.07	3.83	3.60	3.38	3.17	2.96	2.76	...	...	...	...	...	...	...
107	5.52	5.39	5.09	4.79	4.50	4.23	3.96	3.70	3.45	...	...	...	...	...	...	...
108	11.0	10.8	10.2	9.58	9.01	8.46	7.92	7.40	6.89	...	...	...	...	...	...	...
109	3.53	3.45	3.25	3.07	2.88	2.71	2.53	2.37	2.21	...	...	...	...	...	...	...
110	4.41	4.31	4.07	3.83	3.60	3.38	3.17	2.96	2.76	...	...	...	...	...	...	...
111	5.52	5.39	5.09	4.79	4.50	4.23	3.96	3.70	3.45	...	...	...	...	...	...	...
112	11.0	10.8	10.2	9.58	9.01	8.46	7.92	7.40	6.89	...	...	...	...	...	...	...
113	3.53	3.42	3.16	2.91	2.67	2.43	2.20	1.98	1.77	...	...	...	...	...	...	...
114	4.41	4.28	3.95	3.64	3.33	3.04	2.75	2.48	2.21	...	...	...	...	...	...	...
115	6.95	6.74	6.23	5.73	5.25	4.79	4.34	3.90	3.47	...	...	...	...	...	...	...
116	11.0	10.7	9.88	9.10	8.34	7.60	6.88	6.19	5.52	...	...	...	...	...	...	...

Table 1-1-1M Maximum Allowable Stress Values, *S*, for Thermoplastic Materials (Cont'd)

Line No.	Nominal Composition	Product Form	ASME Spec. No.	Type/Grade	Construction Code Notes	Minimum Yield Strength, MPa	Maximum Temperature Limit, °C	Design Factor	Notes
117	Polyethylene	Extruded tube	SD-2737	PE4710	...	20.7	60.0	D04	M05, M12
118	Polyethylene	Extruded tube	SD-2737	PE4710	...	20.7	60.0	D05	M05, M12
119	Polyethylene	Extruded tube	SD-2737	PE4710	...	20.7	60.0	D07	M05, M12
120	Polyethylene	Extruded tube	SD-2737	PE4710	...	20.7	60.0	D08	M05, M12
121	Polyethylene	Extruded tube	SD-2737	PE4710	...	20.7	82.2	D04	M05, M13
122	Polyethylene	Extruded tube	SD-2737	PE4710	...	20.7	82.2	D05	M05, M13
123	Polyethylene	Extruded tube	SD-2737	PE4710	...	20.7	82.2	D07	M05, M13
124	Polyethylene	Extruded tube	SD-2737	PE4710	...	20.7	82.2	D08	M05, M13
125	Polyethylene	Extruded pipe	SD-3035	PE3608	...	20.7	60.0	D04	M05, M09
126	Polyethylene	Extruded pipe	SD-3035	PE3608	...	20.7	60.0	D05	M05, M09
127	Polyethylene	Extruded pipe	SD-3035	PE3608	...	20.7	60.0	D06	M05, M09
128	Polyethylene	Extruded pipe	SD-3035	PE3608	...	20.7	60.0	D08	M05, M09
129	Polyethylene	Extruded pipe	SD-3035	PE3608	...	20.7	60.0	D04	M05, M10
130	Polyethylene	Extruded pipe	SD-3035	PE3608	...	20.7	60.0	D05	M05, M10
131	Polyethylene	Extruded pipe	SD-3035	PE3608	...	20.7	60.0	D06	M05, M10
132	Polyethylene	Extruded pipe	SD-3035	PE3608	...	20.7	60.0	D08	M05, M10
133	Polyethylene	Extruded pipe	SD-3035	PE4608	...	20.7	60.0	D04	M05, M10
134	Polyethylene	Extruded pipe	SD-3035	PE4608	...	20.7	60.0	D05	M05, M10
135	Polyethylene	Extruded pipe	SD-3035	PE4608	...	20.7	60.0	D06	M05, M10
136	Polyethylene	Extruded pipe	SD-3035	PE4608	...	20.7	60.0	D08	M05, M10
137	Polyethylene	Extruded pipe	SD-3035	PE4710	...	20.7	60.0	D04	M05, M11
138	Polyethylene	Extruded pipe	SD-3035	PE4710	...	20.7	60.0	D05	M05, M11
139	Polyethylene	Extruded pipe	SD-3035	PE4710	...	20.7	60.0	D07	M05, M11
140	Polyethylene	Extruded pipe	SD-3035	PE4710	...	20.7	60.0	D08	M05, M11
141	Polyethylene	Extruded pipe	SD-3035	PE4710	...	20.7	60.0	D04	M05, M12
142	Polyethylene	Extruded pipe	SD-3035	PE4710	...	20.7	60.0	D05	M05, M12
143	Polyethylene	Extruded pipe	SD-3035	PE4710	...	20.7	60.0	D07	M05, M12
144	Polyethylene	Extruded pipe	SD-3035	PE4710	...	20.7	60.0	D08	M05, M12
145	Polyethylene	Extruded pipe	SD-3035	PE4710	...	20.7	82.2	D04	M05, M13
146	Polyethylene	Extruded pipe	SD-3035	PE4710	...	20.7	82.2	D05	M05, M13
147	Polyethylene	Extruded pipe	SD-3035	PE4710	...	20.7	82.2	D07	M05, M13
148	Polyethylene	Extruded pipe	SD-3035	PE4710	...	20.7	82.2	D08	M05, M13
149	Polyethylene	Extruded pipe	SF-714	PE3608	...	20.7	60.0	D04	M08, M09
150	Polyethylene	Extruded pipe	SF-714	PE3608	...	20.7	60.0	D05	M08, M09
151	Polyethylene	Extruded pipe	SF-714	PE3608	...	20.7	60.0	D06	M08, M09
152	Polyethylene	Extruded pipe	SF-714	PE3608	...	20.7	60.0	D08	M08, M09
153	Polyethylene	Extruded pipe	SF-714	PE3608	...	20.7	60.0	D04	M08, M10
154	Polyethylene	Extruded pipe	SF-714	PE3608	...	20.7	60.0	D05	M08, M10
155	Polyethylene	Extruded pipe	SF-714	PE3608	...	20.7	60.0	D06	M08, M10
156	Polyethylene	Extruded pipe	SF-714	PE3608	...	20.7	60.0	D08	M08, M10

Table 1-1-1M Maximum Allowable Stress Values, *S*, for Thermoplastic Materials (Cont'd)

Line No.	Maximum Allowable Stress, MPa [Note (1)], for Material Temperature, °C, Not Exceeding															
	23	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95
117	3.53	3.45	3.25	3.07	2.88	2.71	2.53	2.37	2.21	...	...	...	...	...	...	...
118	4.41	4.31	4.07	3.83	3.60	3.38	3.17	2.96	2.76	...	...	...	...	...	...	...
119	6.95	6.79	6.41	6.04	5.68	5.33	4.99	4.66	4.34	...	...	...	...	...	...	...
120	11.0	10.8	10.2	9.58	9.01	8.46	7.92	7.40	6.89	...	...	...	...	...	...	...
121	3.53	3.46	3.29	3.12	2.96	2.80	2.65	2.50	2.35	2.21	2.08	1.95	1.82	...	...	...
122	4.41	4.32	4.11	3.90	3.69	3.50	3.31	3.12	2.94	2.77	2.60	2.44	2.28	...	...	...
123	6.95	6.81	6.47	6.14	5.82	5.51	5.21	4.92	4.63	4.36	4.09	3.84	3.58	...	...	...
124	11.0	10.8	10.3	9.74	9.23	8.74	8.27	7.80	7.36	6.92	6.50	6.09	5.69	...	...	...
125	3.53	3.42	3.16	2.91	2.67	2.43	2.20	1.98	1.77	...	...	...	...	...	...	...
126	4.41	4.28	3.95	3.64	3.33	3.04	2.75	2.48	2.21	...	...	...	...	...	...	...
127	5.52	5.35	4.94	4.55	4.17	3.80	3.44	3.09	2.76	...	...	...	...	...	...	...
128	11.0	10.7	9.88	9.10	8.34	7.60	6.88	6.19	5.52	...	...	...	...	...	...	...
129	3.53	3.45	3.25	3.07	2.88	2.71	2.53	2.37	2.21	...	...	...	...	...	...	...
130	4.41	4.31	4.07	3.83	3.60	3.38	3.17	2.96	2.76	...	...	...	...	...	...	...
131	5.52	5.39	5.09	4.79	4.50	4.23	3.96	3.70	3.45	...	...	...	...	...	...	...
132	11.0	10.8	10.2	9.58	9.01	8.46	7.92	7.40	6.89	...	...	...	...	...	...	...
133	3.53	3.45	3.25	3.07	2.88	2.71	2.53	2.37	2.21	...	...	...	...	...	...	...
134	4.41	4.31	4.07	3.83	3.60	3.38	3.17	2.96	2.76	...	...	...	...	...	...	...
135	5.52	5.39	5.09	4.79	4.50	4.23	3.96	3.70	3.45	...	...	...	...	...	...	...
136	11.0	10.8	10.2	9.58	9.01	8.46	7.92	7.40	6.89	...	...	...	...	...	...	...
137	3.53	3.42	3.16	2.91	2.67	2.43	2.20	1.98	1.77	...	...	...	...	...	...	...
138	4.41	4.28	3.95	3.64	3.33	3.04	2.75	2.48	2.21	...	...	...	...	...	...	...
139	6.95	6.74	6.23	5.73	5.25	4.79	4.34	3.90	3.47	...	...	...	...	...	...	...
140	11.0	10.7	9.88	9.10	8.34	7.60	6.88	6.19	5.52	...	...	...	...	...	...	...
141	3.53	3.45	3.25	3.07	2.88	2.71	2.53	2.37	2.21	...	...	...	...	...	...	...
142	4.41	4.31	4.07	3.83	3.60	3.38	3.17	2.96	2.76	...	...	...	...	...	...	...
143	6.95	6.79	6.41	6.04	5.68	5.33	4.99	4.66	4.34	...	...	...	...	...	...	...
144	11.0	10.8	10.2	9.58	9.01	8.46	7.92	7.40	6.89	...	...	...	...	...	...	...
145	3.53	3.46	3.29	3.12	2.96	2.80	2.65	2.50	2.35	2.21	2.08	1.95	1.82	...	...	...
146	4.41	4.32	4.11	3.90	3.69	3.50	3.31	3.12	2.94	2.77	2.60	2.44	2.28	...	...	...
147	6.95	6.81	6.47	6.14	5.82	5.51	5.21	4.92	4.63	4.36	4.09	3.84	3.58	...	...	...
148	11.0	10.8	10.3	9.74	9.23	8.74	8.27	7.80	7.36	6.92	6.50	6.09	5.69	...	...	...
149	3.53	3.42	3.16	2.91	2.67	2.43	2.20	1.98	1.77	...	...	...	...	...	...	...
150	4.41	4.28	3.95	3.64	3.33	3.04	2.75	2.48	2.21	...	...	...	...	...	...	...
151	5.52	5.35	4.94	4.55	4.17	3.80	3.44	3.09	2.76	...	...	...	...	...	...	...
152	11.0	10.7	9.88	9.10	8.34	7.60	6.88	6.19	5.52	...	...	...	...	...	...	...
153	3.53	3.45	3.25	3.07	2.88	2.71	2.53	2.37	2.21	...	...	...	...	...	...	...
154	4.41	4.31	4.07	3.83	3.60	3.38	3.17	2.96	2.76	...	...	...	...	...	...	...
155	5.52	5.39	5.09	4.79	4.50	4.23	3.96	3.70	3.45	...	...	...	...	...	...	...
156	11.0	10.8	10.2	9.58	9.01	8.46	7.92	7.40	6.89	...	...	...	...	...	...	...

Table 1-1-1M Maximum Allowable Stress Values, *S*, for Thermoplastic Materials (Cont'd)

Line No.	Nominal Composition	Product Form	ASME Spec. No.	Type/Grade	Construction Code Notes	Minimum Yield Strength, MPa	Maximum Temperature Limit, °C	Design Factor	Notes
157	Polyethylene	Extruded pipe	SF-714	PE4608	...	20.7	60.0	D04	M08, M10
158	Polyethylene	Extruded pipe	SF-714	PE4608	...	20.7	60.0	D05	M08, M10
159	Polyethylene	Extruded pipe	SF-714	PE4608	...	20.7	60.0	D06	M08, M10
160	Polyethylene	Extruded pipe	SF-714	PE4608	...	20.7	60.0	D08	M08, M10
161	Polyethylene	Extruded pipe	SF-714	PE4710	...	20.7	60.0	D04	M08, M11
162	Polyethylene	Extruded pipe	SF-714	PE4710	...	20.7	60.0	D05	M08, M11
163	Polyethylene	Extruded pipe	SF-714	PE4710	...	20.7	60.0	D07	M08, M11
164	Polyethylene	Extruded pipe	SF-714	PE4710	...	20.7	60.0	D08	M08, M11
165	Polyethylene	Extruded pipe	SF-714	PE4710	...	20.7	60.0	D04	M08, M12
166	Polyethylene	Extruded pipe	SF-714	PE4710	...	20.7	60.0	D05	M08, M12
167	Polyethylene	Extruded pipe	SF-714	PE4710	...	20.7	60.0	D07	M08, M12
168	Polyethylene	Extruded pipe	SF-714	PE4710	...	20.7	60.0	D08	M08, M12
169	Polyethylene	Extruded pipe	SF-714	PE4710	...	20.7	82.2	D04	M08, M13
170	Polyethylene	Extruded pipe	SF-714	PE4710	...	20.7	82.2	D05	M08, M13
171	Polyethylene	Extruded pipe	SF-714	PE4710	...	20.7	82.2	D07	M08, M13
172	Polyethylene	Extruded pipe	SF-714	PE4710	...	20.7	82.2	D08	M08, M13
173	Polyethylene	Extruded pipe	SF-2619	PE3608	...	20.7	60.0	D04	M09, M14
174	Polyethylene	Extruded pipe	SF-2619	PE3608	...	20.7	60.0	D05	M09, M14
175	Polyethylene	Extruded pipe	SF-2619	PE3608	...	20.7	60.0	D06	M09, M14
176	Polyethylene	Extruded pipe	SF-2619	PE3608	...	20.7	60.0	D08	M09, M14
177	Polyethylene	Extruded pipe	SF-2619	PE3608	...	20.7	60.0	D04	M10, M14
178	Polyethylene	Extruded pipe	SF-2619	PE3608	...	20.7	60.0	D05	M10, M14
179	Polyethylene	Extruded pipe	SF-2619	PE3608	...	20.7	60.0	D06	M10, M14
180	Polyethylene	Extruded pipe	SF-2619	PE3608	...	20.7	60.0	D08	M10, M14
181	Polyethylene	Extruded pipe	SF-2619	PE4710	...	20.7	60.0	D04	M11, M14
182	Polyethylene	Extruded pipe	SF-2619	PE4710	...	20.7	60.0	D05	M11, M14
183	Polyethylene	Extruded pipe	SF-2619	PE4710	...	20.7	60.0	D07	M11, M14
184	Polyethylene	Extruded pipe	SF-2619	PE4710	...	20.7	60.0	D08	M11, M14
185	Polyethylene	Extruded pipe	SF-2619	PE4710	...	20.7	60.0	D04	M12, M14
186	Polyethylene	Extruded pipe	SF-2619	PE4710	...	20.7	60.0	D05	M12, M14
187	Polyethylene	Extruded pipe	SF-2619	PE4710	...	20.7	60.0	D07	M12, M14
188	Polyethylene	Extruded pipe	SF-2619	PE4710	...	20.7	60.0	D08	M12, M14
189	Polyethylene	Extruded pipe	SF-2619	PE4710	...	20.7	82.2	D04	M13, M14
190	Polyethylene	Extruded pipe	SF-2619	PE4710	...	20.7	82.2	D05	M13, M14
191	Polyethylene	Extruded pipe	SF-2619	PE4710	...	20.7	82.2	D07	M13, M14
192	Polyethylene	Extruded pipe	SF-2619	PE4710	...	20.7	82.2	D08	M13, M14
193	PVC	Extruded pipe	SD-1785	PVC2110	C01	41.4	60.0	D01	M15
194	PVC	Extruded pipe	SD-1785	PVC2110	C01	41.4	60.0	D02	M15
195	PVC	Extruded pipe	SD-1785	PVC2110	C01	41.4	60.0	D03	M15

Table 1-1-1M Maximum Allowable Stress Values, *S*, for Thermoplastic Materials (Cont'd)

Line No.	Maximum Allowable Stress, MPa [Note (1)], for Material Temperature, °C, Not Exceeding															
	23	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95
157	3.53	3.45	3.25	3.07	2.88	2.71	2.53	2.37	2.21	...	...	...	...	...	...	...
158	4.41	4.31	4.07	3.83	3.60	3.38	3.17	2.96	2.76	...	...	...	...	...	...	...
159	5.52	5.39	5.09	4.79	4.50	4.23	3.96	3.70	3.45	...	...	...	...	...	...	...
160	11.0	10.8	10.2	9.58	9.01	8.46	7.92	7.40	6.89	...	...	...	...	...	...	...
161	3.53	3.42	3.16	2.91	2.67	2.43	2.20	1.98	1.77	...	...	...	...	...	...	...
162	4.41	4.28	3.95	3.64	3.33	3.04	2.75	2.48	2.21	...	...	...	...	...	...	...
163	6.95	6.74	6.23	5.73	5.25	4.79	4.34	3.90	3.47	...	...	...	...	...	...	...
164	11.0	10.7	9.88	9.10	8.34	7.60	6.88	6.19	5.52	...	...	...	...	...	...	...
165	3.53	3.45	3.25	3.07	2.88	2.71	2.53	2.37	2.21	...	...	...	...	...	...	...
166	4.41	4.31	4.07	3.83	3.60	3.38	3.17	2.96	2.76	...	...	...	...	...	...	...
167	6.95	6.79	6.41	6.04	5.68	5.33	4.99	4.66	4.34	...	...	...	...	...	...	...
168	11.0	10.8	10.2	9.58	9.01	8.46	7.92	7.40	6.89	...	...	...	...	...	...	...
169	3.53	3.46	3.29	3.12	2.96	2.80	2.65	2.50	2.35	2.21	2.08	1.95	1.82	...	...	...
170	4.41	4.32	4.11	3.90	3.69	3.50	3.31	3.12	2.94	2.77	2.60	2.44	2.28	...	...	...
171	6.95	6.81	6.47	6.14	5.82	5.51	5.21	4.92	4.63	4.36	4.09	3.84	3.58	...	...	...
172	11.0	10.8	10.3	9.74	9.23	8.74	8.27	7.80	7.36	6.92	6.50	6.09	5.69	...	...	...
173	3.53	3.42	3.16	2.91	2.67	2.43	2.20	1.98	1.77	...	...	...	...	...	...	...
174	4.41	4.28	3.95	3.64	3.33	3.04	2.75	2.48	2.21	...	...	...	...	...	...	...
175	5.52	5.35	4.94	4.55	4.17	3.80	3.44	3.09	2.76	...	...	...	...	...	...	...
176	11.0	10.7	9.88	9.10	8.34	7.60	6.88	6.19	5.52	...	...	...	...	...	...	...
177	3.53	3.45	3.25	3.07	2.88	2.71	2.53	2.37	2.21	...	...	...	...	...	...	...
178	4.41	4.31	4.07	3.83	3.60	3.38	3.17	2.96	2.76	...	...	...	...	...	...	...
179	5.52	5.39	5.09	4.79	4.50	4.23	3.96	3.70	3.45	...	...	...	...	...	...	...
180	11.0	10.8	10.2	9.58	9.01	8.46	7.92	7.40	6.89	...	...	...	...	...	...	...
181	3.53	3.42	3.16	2.91	2.67	2.43	2.20	1.98	1.77	...	...	...	...	...	...	...
182	4.41	4.28	3.95	3.64	3.33	3.04	2.75	2.48	2.21	...	...	...	...	...	...	...
183	6.95	6.74	6.23	5.73	5.25	4.79	4.34	3.90	3.47	...	...	...	...	...	...	...
184	11.0	10.7	9.88	9.10	8.34	7.60	6.88	6.19	5.52	...	...	...	...	...	...	...
185	3.53	3.45	3.25	3.07	2.88	2.71	2.53	2.37	2.21	...	...	...	...	...	...	...
186	4.41	4.31	4.07	3.83	3.60	3.38	3.17	2.96	2.76	...	...	...	...	...	...	...
187	6.95	6.79	6.41	6.04	5.68	5.33	4.99	4.66	4.34	...	...	...	...	...	...	...
188	11.0	10.8	10.2	9.58	9.01	8.46	7.92	7.40	6.89	...	...	...	...	...	...	...
189	3.53	3.46	3.29	3.12	2.96	2.80	2.65	2.50	2.35	2.21	2.08	1.95	1.82	...	...	...
190	4.41	4.32	4.11	3.90	3.69	3.50	3.31	3.12	2.94	2.77	2.60	2.44	2.28	...	...	...
191	6.95	6.81	6.47	6.14	5.82	5.51	5.21	4.92	4.63	4.36	4.09	3.84	3.58	...	...	...
192	11.0	10.8	10.3	9.74	9.23	8.74	8.27	7.80	7.36	6.92	6.50	6.09	5.69	...	...	...
193	5.52	5.13	4.41	3.75	3.14	2.59	2.10	1.60	1.21	...	...	...	...	...	...	...
194	6.89	6.41	5.52	4.69	3.93	3.24	2.62	2.00	1.52	...	...	...	...	...	...	...
195	13.8	12.8	11.0	9.38	7.86	6.48	5.24	4.00	3.03	...	...	...	...	...	...	...

Table 1-1-1M Maximum Allowable Stress Values, *S*, for Thermoplastic Materials (Cont'd)

Line No.	Nominal Composition	Product Form	ASME Spec. No.	Type/Grade	Construction Code Notes	Minimum Yield Strength, MPa	Maximum Temperature Limit, °C	Design Factor	Notes
196	PVC	Extruded pipe	SD-1785	PVC2112	C01	41.4	60.0	D01	M16
197	PVC	Extruded pipe	SD-1785	PVC2112	C01	41.4	60.0	D02	M16
198	PVC	Extruded pipe	SD-1785	PVC2112	C01	41.4	60.0	D03	M16
199	PVC	Extruded pipe	SD-1785	PVC2116	C01	41.4	60.0	D01	M17
200	PVC	Extruded pipe	SD-1785	PVC2116	C01	41.4	60.0	D02	M17
201	PVC	Extruded pipe	SD-1785	PVC2116	C01	41.4	60.0	D03	M17
202	PVC	Extruded pipe	SD-1785	PVC2120	C01	41.4	60.0	D01	M18
203	PVC	Extruded pipe	SD-1785	PVC2120	C01	41.4	60.0	D02	M18
204	PVC	Extruded pipe	SD-1785	PVC2120	C01	41.4	60.0	D03	M18
205	PVC	Extruded tube	SD-2241	PVC2110	C01	41.4	60.0	D01	M15
206	PVC	Extruded tube	SD-2241	PVC2110	C01	41.4	60.0	D02	M15
207	PVC	Extruded tube	SD-2241	PVC2110	C01	41.4	60.0	D03	M15
208	PVC	Extruded tube	SD-2241	PVC2112	C01	41.4	60.0	D01	M16
209	PVC	Extruded tube	SD-2241	PVC2112	C01	41.4	60.0	D02	M16
210	PVC	Extruded tube	SD-2241	PVC2112	C01	41.4	60.0	D03	M16
211	PVC	Extruded tube	SD-2241	PVC2116	C01	41.4	60.0	D01	M17
212	PVC	Extruded tube	SD-2241	PVC2116	C01	41.4	60.0	D02	M17
213	PVC	Extruded tube	SD-2241	PVC2116	C01	41.4	60.0	D03	M17
214	PVC	Extruded tube	SD-2241	PVC2120	C01	41.4	60.0	D01	M18
215	PVC	Extruded tube	SD-2241	PVC2120	C01	41.4	60.0	D02	M18
216	PVC	Extruded tube	SD-2241	PVC2120	C01	41.4	60.0	D03	M18
217	PVC	Extruded pipe	SD-1785	PVC1120	C01	48.3	60.0	D01	M19
218	PVC	Extruded pipe	SD-1785	PVC1120	C01	48.3	60.0	D02	M19
219	PVC	Extruded pipe	SD-1785	PVC1120	C01	48.3	60.0	D03	M19
220	PVC	Extruded pipe	SD-1785	PVC1220	C01	48.3	60.0	D01	M19
221	PVC	Extruded pipe	SD-1785	PVC1220	C01	48.3	60.0	D02	M19
222	PVC	Extruded pipe	SD-1785	PVC1220	C01	48.3	60.0	D03	M19
223	PVC	Extruded pipe	SD-2241	PVC1120	C01	48.3	60.0	D01	M19
224	PVC	Extruded pipe	SD-2241	PVC1120	C01	48.3	60.0	D02	M19
225	PVC	Extruded pipe	SD-2241	PVC1120	C01	48.3	60.0	D03	M19
226	PVC	Extruded pipe	SD-2241	PVC1220	C01	48.3	60.0	D01	M19
227	PVC	Extruded pipe	SD-2241	PVC1220	C01	48.3	60.0	D02	M19
228	PVC	Extruded pipe	SD-2241	PVC1220	C01	48.3	60.0	D03	M19
229	PVC	Extruded pipe	SF-1483	PVCO 1135	C01	48.3	54.4	D01	M20, M21
230	PVC	Extruded pipe	SF-1483	PVCO 1135	C01	48.3	54.4	D02	M20, M21
231	PVC	Extruded pipe	SF-1483	PVCO 1135	C01	48.3	54.4	D03	M20, M21

Table 1-1-1M Maximum Allowable Stress Values, *S*, for Thermoplastic Materials (Cont'd)

Line No.	Maximum Allowable Stress, MPa [Note (1)], for Material Temperature, °C, Not Exceeding															
	23	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95
196	6.89	6.41	5.52	4.69	3.93	3.24	2.62	2.00	1.52	...	...	...	...	...	...	...
197	8.62	8.02	6.89	5.86	4.91	4.05	3.28	2.50	1.90	...	...	...	...	...	...	...
198	17.2	16.0	13.8	11.7	9.83	8.10	6.55	5.00	3.79	...	...	...	...	...	...	...
199	8.83	8.21	7.06	6.00	5.03	4.15	3.35	2.56	1.94	...	...	...	...	...	...	...
200	11.0	10.3	8.83	7.50	6.29	5.18	4.19	3.20	2.43	...	...	...	...	...	...	...
201	22.1	20.5	17.7	15.0	12.6	10.4	8.38	6.40	4.85	...	...	...	...	...	...	...
202	11.0	10.3	8.83	7.50	6.29	5.18	4.19	3.20	2.43	...	...	...	...	...	...	...
203	13.8	12.8	11.0	9.38	7.86	6.48	5.24	4.00	3.03	...	...	...	...	...	...	...
204	27.6	25.6	22.1	18.8	15.7	13.0	10.5	8.00	6.07	...	...	...	...	...	...	...
205	5.52	5.13	4.41	3.75	3.14	2.59	2.10	1.60	1.21	...	...	...	...	...	...	...
206	6.89	6.41	5.52	4.69	3.93	3.24	2.62	2.00	1.52	...	...	...	...	...	...	...
207	13.8	12.8	11.0	9.38	7.86	6.48	5.24	4.00	3.03	...	...	...	...	...	...	...
208	6.89	6.41	5.52	4.69	3.93	3.24	2.62	2.00	1.52	...	...	...	...	...	...	...
209	8.62	8.02	6.89	5.86	4.91	4.05	3.28	2.50	1.90	...	...	...	...	...	...	...
210	17.2	16.0	13.8	11.7	9.83	8.10	6.55	5.00	3.79	...	...	...	...	...	...	...
211	8.83	8.21	7.06	6.00	5.03	4.15	3.35	2.56	1.94	...	...	...	...	...	...	...
212	11.0	10.3	8.83	7.50	6.29	5.18	4.19	3.20	2.43	...	...	...	...	...	...	...
213	22.1	20.5	17.7	15.0	12.6	10.4	8.38	6.40	4.85	...	...	...	...	...	...	...
214	11.0	10.3	8.83	7.50	6.29	5.18	4.19	3.20	2.43	...	...	...	...	...	...	...
215	13.8	12.8	11.0	9.38	7.86	6.48	5.24	4.00	3.03	...	...	...	...	...	...	...
216	27.6	25.6	22.1	18.8	15.7	13.0	10.5	8.00	6.07	...	...	...	...	...	...	...
217	11.0	10.3	8.83	7.50	6.29	5.18	4.19	3.20	2.43	...	...	...	...	...	...	...
218	13.8	12.8	11.0	9.38	7.86	6.48	5.24	4.00	3.03	...	...	...	...	...	...	...
219	27.6	25.6	22.1	18.8	15.7	13.0	10.5	8.00	6.07	...	...	...	...	...	...	...
220	11.0	10.3	8.83	7.50	6.29	5.18	4.19	3.20	2.43	...	...	...	...	...	...	...
221	13.8	12.8	11.0	9.38	7.86	6.48	5.24	4.00	3.03	...	...	...	...	...	...	...
222	27.6	25.6	22.1	18.8	15.7	13.0	10.5	8.00	6.07	...	...	...	...	...	...	...
223	11.0	10.3	8.83	7.50	6.29	5.18	4.19	3.20	2.43	...	...	...	...	...	...	...
224	13.8	12.8	11.0	9.38	7.86	6.48	5.24	4.00	3.03	...	...	...	...	...	...	...
225	27.6	25.6	22.1	18.8	15.7	13.0	10.5	8.00	6.07	...	...	...	...	...	...	...
226	11.0	10.3	8.83	7.50	6.29	5.18	4.19	3.20	2.43	...	...	...	...	...	...	...
227	13.8	12.8	11.0	9.38	7.86	6.48	5.24	4.00	3.03	...	...	...	...	...	...	...
228	27.6	25.6	22.1	18.8	15.7	13.0	10.5	8.00	6.07	...	...	...	...	...	...	...
229	11.0	10.3	8.83	7.50	6.29	5.18	4.19	3.20	...	...	...	...	...	...	...	...
230	13.8	12.8	11.0	9.38	7.86	6.48	5.24	4.00	...	...	...	...	...	...	...	...
231	27.6	25.6	22.1	18.8	15.7	13.0	10.5	8.00	...	...	...	...	...	...	...	...

Table 1-1-1M Maximum Allowable Stress Values, *S*, for Thermoplastic Materials (Cont'd)

Line No.	Nominal Composition	Product Form	ASME Spec. No.	Type/Grade	Construction Code Notes	Minimum Yield Strength, MPa	Maximum Temperature Limit, °C	Design Factor	Notes
232	PVC	Extruded pipe	SF-1483	PVCO 1135	C01	76.5	54.4	D01	M20, M22
233	PVC	Extruded pipe	SF-1483	PVCO 1135	C01	76.5	54.4	D02	M20, M22
234	PVC	Extruded pipe	SF-1483	PVCO 1135	C01	76.5	54.4	D03	M20, M22
235	PVDF	Extruded pipe	SF-1673	PVDF 2020	...	44.8	93.3	D02	M23
236	PVDF	Extruded pipe	SF-1673	PVDF 2020	...	44.8	93.3	D03	M23
237	PVDF	Extruded pipe	SF-1673	PVDF 2025	...	53.0	93.3	D02	M24
238	PVDF	Extruded pipe	SF-1673	PVDF 2025	...	53.0	93.3	D03	M24

Table 1-1-1M Maximum Allowable Stress Values, *S*, for Thermoplastic Materials (Cont'd)

Line No.	Maximum Allowable Stress, MPa [Note (1)], for Material Temperature, °C, Not Exceeding															
	23	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95
232	19.6	18.2	15.7	13.3	11.2	9.20	7.44	5.68	...	...	...	...	...	...	...	...
233	24.5	22.8	19.6	16.6	14.0	11.5	9.30	7.10	...	...	...	...	...	...	...	...
234	49.0	45.5	39.2	33.3	27.9	23.0	18.6	14.2	...	...	...	...	...	...	...	...
235	13.8	13.5	12.7	11.9	11.1	10.4	9.66	8.97	8.30	7.65	7.02	6.41	5.82	5.24	4.68	4.13
236	27.6	26.9	25.3	23.7	22.2	20.8	19.3	17.9	16.6	15.3	14.1	12.8	11.6	10.5	9.35	8.26
237	17.2	16.9	16.0	15.2	14.4	13.6	12.9	12.1	11.4	10.7	10.1	9.41	8.78	8.17	7.57	6.99
238	34.5	33.8	32.1	30.4	28.8	27.2	25.7	24.3	22.8	21.5	20.1	18.8	17.6	16.3	15.1	14.0

Table 1-1-1M Maximum Allowable Stress Values, *S*, for Thermoplastic Materials (Cont'd)

GENERAL NOTES:

(a) The stress values in this Table may be interpolated to determine values for intermediate temperatures. The values at intermediate temperatures shall be rounded to the same number of decimal places as the value at the higher temperature between which values are being interpolated. The rounding rule is: when the next digit beyond the last place to be retained is less than 5, retain unchanged the digit in the last place retained; when the digit next beyond the last place to be retained is 5 or greater, increase by 1 the digit in the last place retained.

(b) The following abbreviations are used: CPVC, chlorinated poly(vinyl chloride); PVC, poly(vinyl chloride); and PVDF, poly(vinylidene fluoride).

NOTE: (1) Multiply MPa by 1000 to obtain kPa.

CONSTRUCTION CODE NOTE (ASME NM.1):

C01 Compounding ingredients may vary between material manufacturers for the same grade of CPVC or PVC. While these different ingredients do not impact the allowable stress values provided in this Table, they can influence the acceptability of the various joining methods allowed by ASME NM.1. In addition to the material and joining requirements set forth in ASME NM.1, the joining method to be used shall be approved by the piping component manufacturer.

DESIGN FACTOR NOTES (ASME NM.1):

D01 The allowable stress values are based on the hydrostatic design basis (HDB) as determined in accordance with ASTM D2837 multiplied by a design factor (DF) of 0.40.

D02 The allowable stress values are based on the hydrostatic design basis (HDB) as determined in accordance with ASTM D2837 multiplied by a design factor (DF) of 0.50.

D03 The allowable stress values are based on the hydrostatic design basis (HDB) as determined in accordance with ASTM D2837 multiplied by a design factor (DF) of 1.0. These values are only to be used when the DF is incorporated in the construction code equations.

D04 The allowable stress values are based on the hydrostatic design basis (HDB) as identified in PPI TR-4 multiplied by a design factor (DF) of 0.32.

D05 The allowable stress values are based on the hydrostatic design basis (HDB) as identified in PPI TR-4 multiplied by a design factor (DF) of 0.40.

D06 The allowable stress values are based on the hydrostatic design basis (HDB) as identified in PPI TR-4 multiplied by a design factor (DF) of 0.50.

D07 The allowable stress values are based on the hydrostatic design basis (HDB) as identified in PPI TR-4 multiplied by a design factor (DF) of 0.63.

D08 The allowable stress values are based on the hydrostatic design basis (HDB) as identified in PPI TR-4 multiplied by a design factor (DF) of 1.0. These values are only to be used when the DF is incorporated in the construction code equations.

MATERIAL NOTES — CHLORINATED POLY(VINYL CHLORIDE):

M01 Material shall have a

(a) minimum impact resistance of 80.1 J/m of notch at 23°C in accordance with ASTM D256
(b) minimum modulus of elasticity in tension of 2482 MPa at 23°C in accordance with ASTM D638
(c) minimum deflection temperature under load of 100°C at a load of 1.82 MPa in accordance with ASTM D648
(d) average extent of burning of under 25 mm and an average time of burning of under 10 s in accordance with ASTM D635
(e) hydrostatic design basis (HDB) of 4000 psi at 23°C and 1000 psi at 82.2°C in accordance with ASTM D2837
(f) hydrostatic design stress (HDS) of 2000 psi at 23°C and 500 psi at 82.2°C in accordance with ASTM D2837

M02 Material shall have a

(a) minimum impact resistance of 80.1 J/m of notch at 23°C in accordance with ASTM D256
(b) minimum modulus of elasticity in tension of 2482 MPa at 23°C in accordance with ASTM D638
(c) minimum deflection temperature under load of 100°C at a load of 1.82 MPa in accordance with ASTM D648
(d) average extent of burning of under 25 mm and an average time of burning of under 10 s in accordance with ASTM D635
(e) hydrostatic design basis (HDB) of 4000 psi at 23°C and 1250 psi at 82.2°C in accordance with ASTM D2837
(f) hydrostatic design stress (HDS) of 2000 psi at 23°C and 625 psi at 82.2°C in accordance with ASTM D2837

MATERIAL NOTES — POLYAMIDE:

M03 Material shall have a

(a) classification of Group 03, Class 2, and Grade 3 in accordance with ASTM D4066.
(b) minimum elongation at break of 200% in accordance with ASTM D638, using a 3.2 mm ± 0.4 mm thick test specimen. The speed of testing shall be 50 mm/min ±10% at 23°C ± 2°C and 50% ± 5% relative humidity.
(c) minimum flexural modulus of 900 MPa in accordance with ASTM D790, Procedure A using a 3.2 mm × 12.7 mm × 127 mm test specimen. The testing shall be performed with a crosshead speed of 1.3 mm/min ±50% at 23°C ± 2°C and 50% ± 5% relative humidity.
(d) minimum izod impact resistance of 55 J/m in accordance with ASTM D256, using a test specimen with a 12.7-mm depth, a 3.17-mm width, and a notch radius of 0.25 mm.
(e) minimum deflection temperature of 40°C at 1.82 MPa in accordance with ASTM D648, using an unannealed test specimen 3.17 mm in width.
(f) hydrostatic design basis (HDB) of 2500 psi at 23°C, 1600 psi at 60°C, and 1250 psi at 82.2°C in accordance with ASTM D2837.
(g) hydrostatic design stress (HDS) of 1250 psi at 23°C, 800 psi at 60°C, and 625 psi at 82.2°C in accordance with ASTM D2837.

M04 Material shall have a

(a) classification of Group 03, Class 2, and Grade 3 in accordance with ASTM D4066.

Table 1-1-1M Maximum Allowable Stress Values, *S*, for Thermoplastic Materials (Cont'd)

MATERIAL NOTES — POLYAMIDE: (Cont'd):

(b) minimum elongation at break of 200% in accordance with ASTM D638, using a 3.2 mm ± 0.4 mm thick test specimen. The speed of testing shall be 50 mm/min ±10% at 23°C ± 2°C and 50% ± 5% relative humidity.

(c) minimum flexural modulus of 900 MPa in accordance with ASTM D790, Procedure A using a 3.2 mm × 12.7 mm × 127 mm test specimen. The testing shall be performed with a crosshead speed of 1.3 mm/min ±50% at 23°C ± 2°C and 50% ± 5% relative humidity.

(d) minimum izod impact resistance of 55 J/m in accordance with ASTM D256, using a test specimen with a 12.7-mm depth, a 3.17-mm width, and a notch radius of 0.25 mm.

(e) minimum deflection temperature of 40°C at 1.82 MPa in accordance with ASTM D648, using an unannealed test specimen 3.17 mm in width.

(f) hydrostatic design basis (HDB) of 3150 psi at 23°C and 1600 psi at 82.2°C in accordance with ASTM D2837.

(g) hydrostatic design stress (HDS) of 1600 psi at 23°C and 800 psi at 82.2°C in accordance with ASTM D2837.

MATERIAL NOTES — POLYETHYLENE:

M05 Material shall have a carbon black percentage of 2% to 3% in accordance with ASTM D4218 or ASTM D1603, natural with UV stabilizer, or colored with UV stabilizer.

M06 Material shall have a

(a) thermal stability of over 220°C in accordance with ASTM D3350

(b) maximum brittleness temperature of −60°C in accordance with ASTM D746

(c) minimum tensile elongation at break of 400% in accordance with ASTM D638, using a Type IV tensile bar at 50 mm/min at 23°C

(d) slow crack growth resistance of over 500 h in accordance with ASTM F1473 at 2.4 MPa and 80°C in air

(e) hydrostatic design basis (HDB) of 1250 psi at 23°C and 1000 psi at 60°C in accordance with ASTM D2837, PPI TR-3, and PPI TR-4

(f) hydrostatic design stress (HDS) of 800 psi at 23°C in accordance with ASTM D2837, PPI TR-3, and PPI TR-4

M07 Material shall have a

(a) thermal stability of over 220°C in accordance with ASTM D3350

(b) maximum brittleness temperature of −60°C in accordance with ASTM D746

(c) minimum tensile elongation at break of 400% in accordance with ASTM D638, using a Type IV tensile bar at 50 mm/min at 23°C

(d) slow crack growth resistance of over 500 h in accordance with ASTM F1473 at 2.4 MPa and 80°C in air

(e) hydrostatic design basis (HDB) of 1250 psi at 23°C and 630 psi at 82.2°C in accordance with ASTM D2837, PPI TR-3, and PPI TR-4

(f) hydrostatic design stress (HDS) of 800 psi at 23°C in accordance with ASTM D2837, PPI TR-3, and PPI TR-4

M08 Material shall have a carbon black percentage of 2% to 3% in accordance with ASTM D4218 or ASTM D1603, or colored with UV stabilizer.

M09 Material shall have a

(a) thermal stability of over 220°C in accordance with ASTM D3350

(b) maximum brittleness temperature of −60°C in accordance with ASTM D746

(c) minimum tensile elongation at break of 400% in accordance with ASTM D638, using a Type IV tensile bar at 50 mm/min at 23°C

(d) slow crack growth resistance of over 100 h in accordance with ASTM F1473 at 2.4 MPa and 80°C in air

(e) hydrostatic design basis (HDB) of 1600 psi at 23°C and 800 psi at 60°C in accordance with ASTM D2837, PPI TR-3, and PPI TR-4

(f) hydrostatic design stress (HDS) of 800 psi at 23°C in accordance with ASTM D2837, PPI TR-3, and PPI TR-4

M10 Material shall have a

(a) thermal stability of over 220°C in accordance with ASTM D3350

(b) maximum brittleness temperature of −60°C in accordance with ASTM D746

(c) minimum tensile elongation at break of 400% in accordance with ASTM D638, using a Type IV tensile bar at 50 mm/min at 23°C

(d) slow crack growth resistance of over 100 h in accordance with ASTM F1473 at 2.4 MPa and 80°C in air

(e) hydrostatic design basis (HDB) of 1600 psi at 23°C and 1000 psi at 60°C in accordance with ASTM D2837, PPI TR-3, and PPI TR-4

(f) hydrostatic design stress (HDS) of 800 psi at 23°C in accordance with ASTM D2837, PPI TR-3, and PPI TR-4

M11 Material shall have a

(a) thermal stability of over 220°C in accordance with ASTM D3350

(b) maximum brittleness temperature of −60°C in accordance with ASTM D746

(c) minimum tensile elongation at break of 400% in accordance with ASTM D638, using a Type IV tensile bar at 50 mm/min at 23°C

(d) slow crack growth resistance of over 500 h in accordance with ASTM F1473 at 2.4 MPa and 80°C in air

(e) hydrostatic design basis (HDB) of 1600 psi at 23°C and 800 psi at 60°C in accordance with ASTM D2837, PPI TR-3, and PPI TR-4

(f) hydrostatic design stress (HDS) of 1000 psi at 23°C in accordance with ASTM D2837, PPI TR-3, and PPI TR-4

M12 Material shall have a

(a) thermal stability of over 220°C in accordance with ASTM D3350

(b) maximum brittleness temperature of −60°C in accordance with ASTM D746

(c) minimum tensile elongation at break of 400% in accordance with ASTM D638, using a Type IV tensile bar at 50 mm/min at 23°C

(d) slow crack growth resistance of over 500 h in accordance with ASTM F1473 at 2.4 MPa and 80°C in air

(e) hydrostatic design basis (HDB) of 1600 psi at 23°C and 1000 psi at 60°C in accordance with ASTM D2837, PPI TR-3, and PPI TR-4

(f) hydrostatic design stress (HDS) of 1000 psi at 23°C in accordance with ASTM D2837, PPI TR-3, and PPI TR-4

M13 Material shall have a

(a) thermal stability of over 220°C in accordance with ASTM D3350

(b) maximum brittleness temperature of −60°C in accordance with ASTM D746

(c) minimum tensile elongation at break of 400% in accordance with ASTM D638, using a Type IV tensile bar at 50 mm/min at 23°C

(d) slow crack growth resistance of over 500 h in accordance with ASTM F1473 at 2.4 MPa and 80°C in air

(e) hydrostatic design basis (HDB) of 1600 psi at 23°C and 800 psi at 82.2°C in accordance with ASTM D2837, PPI TR-3, and PPI TR-4

(f) hydrostatic design stress (HDS) of 1000 psi at 23°C in accordance with ASTM D2837, PPI TR-3, and PPI TR-4

M14 Material shall have a carbon black percentage of 2% to 3% in accordance with ASTM D4218 or ASTM D1603.

MATERIAL NOTES — POLY(VINYL CHLORIDE):

M15 Material shall have a

(a) minimum impact resistance of 266.9 J/m of notch at 23°C in accordance with ASTM D256

Table 1-1-1M Maximum Allowable Stress Values, *S*, for Thermoplastic Materials (Cont'd)

MATERIAL NOTES — POLY(VINYL CHLORIDE): (Cont'd):

(b) minimum modulus of elasticity in tension of 2206 MPa at 23°C in accordance with ASTM D638
(c) minimum deflection temperature under load of 60°C at a load of 1.82 MPa in accordance with ASTM D648
(d) average extent of burning of under 25 mm and an average time of burning of under 10 s in accordance with ASTM D635
(e) hydrostatic design basis (HDB) of 2000 psi at 23°C in accordance with ASTM D2837
(f) hydrostatic design stress (HDS) of 1000 psi at 23°C in accordance with ASTM D2837

M16 Material shall have a
(a) minimum impact resistance of 266.9 J/m of notch at 23°C in accordance with ASTM D256
(b) minimum modulus of elasticity in tension of 2206 MPa at 23°C in accordance with ASTM D638
(c) minimum deflection temperature under load of 60°C at a load of 1.82 MPa in accordance with ASTM D648
(d) average extent of burning of under 25 mm and an average time of burning of under 10 s in accordance with ASTM D635
(e) hydrostatic design basis (HDB) of 2500 psi at 23°C in accordance with ASTM D2837
(f) hydrostatic design stress (HDS) of 1250 psi at 23°C in accordance with ASTM D2837

M17 Material shall have a
(a) minimum impact resistance of 266.9 J/m of notch at 23°C in accordance with ASTM D256
(b) minimum modulus of elasticity in tension of 2206 MPa at 23°C in accordance with ASTM D638
(c) minimum deflection temperature under load of 60°C at a load of 1.82 MPa in accordance with ASTM D648
(d) average extent of burning of under 25 mm and an average time of burning of under 10 s in accordance with ASTM D635
(e) hydrostatic design basis (HDB) of 3200 psi at 23°C in accordance with ASTM D2837
(f) hydrostatic design stress (HDS) of 1600 psi at 23°C in accordance with ASTM D2837

M18 Material shall have a
(a) minimum impact resistance of 266.9 J/m of notch at 23°C in accordance with ASTM D256
(b) minimum modulus of elasticity in tension of 2206 MPa at 23°C in accordance with ASTM D638
(c) minimum deflection temperature under load of 60°C at a load of 1.82 MPa in accordance with ASTM D648
(d) average extent of burning of under 25 mm and an average time of burning of under 10 s in accordance with ASTM D635
(e) hydrostatic design basis (HDB) of 4000 psi at 23°C in accordance with ASTM D2837
(f) hydrostatic design stress (HDS) of 2000 psi at 23°C in accordance with ASTM D2837

M19 Material shall have a
(a) minimum impact resistance of 34.7 J/m of notch at 23°C in accordance with ASTM D256
(b) minimum modulus of elasticity in tension of 2758 MPa at 23°C in accordance with ASTM D638
(c) minimum deflection temperature under load of 70°C at a load of 1.82 MPa in accordance with ASTM D648
(d) average extent of burning of under 25 mm and an average time of burning of under 10 s in accordance with ASTM D635
(e) hydrostatic design basis (HDB) of 4000 psi at 23°C in accordance with ASTM D2837
(f) hydrostatic design stress (HDS) of 2000 psi at 23°C in accordance with ASTM D2837

M20 Material shall have a
(a) minimum impact resistance of 266.9 J/m of notch at 23°C in accordance with ASTM D256
(b) minimum modulus of elasticity in tension of 2206 MPa at 23°C in accordance with ASTM D638
(c) minimum deflection temperature under load of 60°C at a load of 1.82 MPa in accordance with ASTM D648
(d) average extent of burning of under 25 mm and an average time of burning of under 10 s in accordance with ASTM D635
(e) hydrostatic design basis (HDB) of 7100 psi at 23°C in accordance with ASTM D2837
(f) hydrostatic design stress (HDS) of 3550 psi at 23°C in accordance with ASTM D2837

M21 Allowable stress values apply to the unoriented directions only.

M22 Allowable stress values apply to the oriented direction only.

POLY(VINYLIDENE FLUORIDE):

M23 Material shall have a
(a) classification of Type I in accordance with ASME SD-3222
(b) minimum impact resistance of 80.0 J/m of notch at 23°C in accordance with ASTM D256
(c) minimum flexural modulus of 1.38 GPa at 23°C in accordance with ASTM D790, using Method I
(d) minimum tensile elongation at break of 10% in accordance with ASTM D638, using a Type I tensile bar at 51 mm/min at 23°C
(e) hydrostatic design basis (HDB) of 4000 psi at 23°C and 1250 psi at 93.3°C in accordance with ASTM D2837
(f) hydrostatic design stress (HDS) of 2000 psi at 23°C and 625 psi at 93.3°C in accordance with ASTM D2837

M24 Material shall have a
(a) classification of Type II in accordance with ASME SD-3222
(b) minimum flexural modulus of 1.38 GPa at 23°C in accordance with ASTM D790, using Method I
(c) minimum tensile elongation at break of 10% in accordance with ASTM D638, using a Type I tensile bar at 51 mm/min at 23°C
(d) hydrostatic design basis (HDB) of 5000 psi at 23°C and 1250 psi at 120°C in accordance with ASTM D2837
(e) hydrostatic design stress (HDS) of 2500 psi at 23°C and 625 psi at 120°C in accordance with ASTM D2837

TABLE STARTS ON NEXT PAGE

Table 1-1-2M Maximum Allowable Compression Stress Values, S_{comp}, for Thermoplastic Materials

Line No.	Nominal Composition	Product Form	ASME Spec. No.	Type/Grade	Construction Code Notes	Minimum Yield Strength, MPa	Maximum Temperature Limit, °C	Notes
1	CPVC	Extruded pipe	SD-2846	CPVC 4120-05	C01	48.3	93.3	M01
2	CPVC	Extruded pipe	SD-2846	CPVC 4120-06	C01	48.3	93.3	M02
3	CPVC	Extruded pipe	SF-441	CPVC 4120-05	C01	48.3	93.3	M01
4	CPVC	Extruded pipe	SF-441	CPVC 4120-06	C01	48.3	93.3	M02
5	CPVC	Extruded pipe	SF-442	CPVC 4120-05	C01	48.3	93.3	M01
6	CPVC	Extruded pipe	SF-442	CPVC 4120-06	C01	48.3	93.3	M02
7	Polyamide	Extruded pipe	SF-2945	PA 32312	...	48.0	82.2	M03
8	Polyamide	Extruded pipe	SF-2945	PA 32316	...	48.0	82.2	M04
9	Polyethylene	Extruded pipe	SD-2239	PE2708	...	17.9	60.0	M05, M06
10	Polyethylene	Extruded pipe	SD-2239	PE2708	...	17.9	82.2	M05, M07
11	Polyethylene	Extruded pipe	SD-2513	PE2708	...	17.9	60.0	M06, M08
12	Polyethylene	Extruded pipe	SD-2513	PE2708	...	17.9	82.2	M07, M08
13	Polyethylene	Extruded tube	SD-2737	PE2708	...	17.9	60.0	M05, M06
14	Polyethylene	Extruded tube	SD-2737	PE2708	...	17.9	82.2	M05, M07
15	Polyethylene	Extruded pipe	SD-3035	PE2708	...	17.9	60.0	M05, M06
16	Polyethylene	Extruded pipe	SD-3035	PE2708	...	17.9	82.2	M05, M07
17	Polyethylene	Extruded pipe	SF-714	PE2708	...	17.9	60.0	M06, M08
18	Polyethylene	Extruded pipe	SF-714	PE2708	...	17.9	82.2	M07, M08
19	Polyethylene	Extruded pipe	SD-2239	PE3608	...	20.7	60.0	M05, M09
20	Polyethylene	Extruded pipe	SD-2239	PE3608	...	20.7	60.0	M05, M10
21	Polyethylene	Extruded pipe	SD-2513	PE4710	...	20.7	60.0	M08, M11
22	Polyethylene	Extruded pipe	SD-2513	PE4710	...	20.7	60.0	M08, M12
23	Polyethylene	Extruded pipe	SD-2513	PE4710	...	20.7	82.2	M08, M13
24	Polyethylene	Extruded tube	SD-2737	PE3608	...	20.7	60.0	M05, M09
25	Polyethylene	Extruded tube	SD-2737	PE3608	...	20.7	60.0	M05, M10
26	Polyethylene	Extruded tube	SD-2737	PE4608	...	20.7	60.0	M05, M10
27	Polyethylene	Extruded pipe	SD-2737	PE4710	...	20.7	60.0	M05, M11
28	Polyethylene	Extruded pipe	SD-2737	PE4710	...	20.7	60.0	M05, M12
29	Polyethylene	Extruded pipe	SD-2737	PE4710	...	20.7	82.2	M05, M13
30	Polyethylene	Extruded pipe	SD-3035	PE3608	...	20.7	60.0	M05, M09
31	Polyethylene	Extruded pipe	SD-3035	PE3608	...	20.7	60.0	M05, M10
32	Polyethylene	Extruded pipe	SD-3035	PE4608	...	20.7	60.0	M05, M10
33	Polyethylene	Extruded pipe	SD-3035	PE4710	...	20.7	60.0	M05, M11
34	Polyethylene	Extruded pipe	SD-3035	PE4710	...	20.7	60.0	M05, M12
35	Polyethylene	Extruded pipe	SD-3035	PE4710	...	20.7	82.2	M05, M13
36	Polyethylene	Extruded pipe	SF-714	PE3608	...	20.7	60.0	M08, M09
37	Polyethylene	Extruded pipe	SF-714	PE3608	...	20.7	60.0	M08, M10
38	Polyethylene	Extruded pipe	SF-714	PE4608	...	20.7	60.0	M08, M10
39	Polyethylene	Extruded pipe	SF-714	PE4710	...	20.7	60.0	M08, M11
40	Polyethylene	Extruded pipe	SF-714	PE4710	...	20.7	60.0	M08, M12
41	Polyethylene	Extruded pipe	SF-714	PE4710	...	20.7	82.2	M08, M13

Table 1-1-2M Maximum Allowable Compression Stress Values, S_{comp}, for Thermoplastic Materials

Line No.	Maximum Allowable Compression Stress, MPa [Note (1)], for Material Temperature, °C, Not Exceeding															
	23	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95
1	17.2	16.7	15.5	14.2	13.0	11.9	10.8	9.67	8.62	7.60	6.61	5.65	4.72	3.81	2.92	2.07
2	17.2	16.8	15.6	14.5	13.4	12.3	11.3	10.3	9.34	8.40	7.50	6.62	5.76	4.93	4.12	3.33
3	17.2	16.7	15.5	14.2	13.0	11.9	10.8	9.67	8.62	7.60	6.61	5.65	4.72	3.81	2.92	2.07
4	17.2	16.8	15.6	14.5	13.4	12.3	11.3	10.3	9.34	8.40	7.50	6.62	5.76	4.93	4.12	3.33
5	17.2	16.7	15.5	14.2	13.0	11.9	10.8	9.67	8.62	7.60	6.61	5.65	4.72	3.81	2.92	2.07
6	17.2	16.8	15.6	14.5	13.4	12.3	11.3	10.3	9.34	8.40	7.50	6.62	5.76	4.93	4.12	3.33
7	10.8	10.5	9.97	9.41	8.88	8.36	7.86	7.37	6.89	6.54	6.19	5.86	5.53	5.21	...	...
8	13.6	13.3	12.7	12.0	11.4	10.8	10.2	9.67	9.12	8.60	8.08	7.59	7.10	6.64	...	...
9	5.52	5.45	5.29	5.13	4.98	4.83	4.69	4.55	4.42	...	...	...	...	...	...	...
10	5.52	5.41	5.14	4.88	4.63	4.38	4.15	3.92	3.70	3.48	3.27	3.07	2.87	...	...	...
11	5.52	5.45	5.29	5.13	4.98	4.83	4.69	4.55	4.42	...	...	...	...	...	...	...
12	5.52	5.41	5.14	4.88	4.63	4.38	4.15	3.92	3.70	3.48	3.27	3.07	2.87	...	...	...
13	5.52	5.45	5.29	5.13	4.98	4.83	4.69	4.55	4.42	...	...	...	...	...	...	...
14	5.52	5.41	5.14	4.88	4.63	4.38	4.15	3.92	3.70	3.48	3.27	3.07	2.87	...	...	...
15	5.52	5.45	5.29	5.13	4.98	4.83	4.69	4.55	4.42	...	...	...	...	...	...	...
16	5.52	5.41	5.14	4.88	4.63	4.38	4.15	3.92	3.70	3.48	3.27	3.07	2.87	...	...	...
17	5.52	5.45	5.29	5.13	4.98	4.83	4.69	4.55	4.42	...	...	...	...	...	...	...
18	5.52	5.41	5.14	4.88	4.63	4.38	4.15	3.92	3.70	3.48	3.27	3.07	2.87	...	...	...
19	6.90	6.69	6.18	5.69	5.21	4.75	4.30	3.87	3.45	...	...	...	...	...	...	...
20	6.90	6.74	6.36	5.99	5.64	5.29	4.95	4.63	4.31	...	...	...	...	...	...	...
21	7.93	7.69	7.11	6.54	5.99	5.46	4.95	4.45	3.97	...	...	...	...	...	...	...
22	7.93	7.75	7.31	6.89	6.48	6.08	5.69	5.32	4.96	...	...	...	...	...	...	...
23	7.93	7.77	7.38	7.00	6.64	6.28	5.94	5.61	5.29	4.97	4.67	4.38	4.09	...	...	...
24	6.90	6.69	6.18	5.69	5.21	4.75	4.30	3.87	3.45	...	...	...	...	...	...	...
25	6.90	6.74	6.36	5.99	5.64	5.29	4.95	4.63	4.31	...	...	...	...	...	...	...
26	6.90	6.74	6.36	5.99	5.64	5.29	4.95	4.63	4.31	...	...	...	...	...	...	...
27	7.93	7.69	7.11	6.54	5.99	5.46	4.95	4.45	3.97	...	...	...	...	...	...	...
28	7.93	7.75	7.31	6.89	6.48	6.08	5.69	5.32	4.96	...	...	...	...	...	...	...
29	7.93	7.77	7.38	7.00	6.64	6.28	5.94	5.61	5.29	4.97	4.67	4.38	4.09	...	...	...
30	6.90	6.69	6.18	5.69	5.21	4.75	4.30	3.87	3.45	...	...	...	...	...	...	...
31	6.90	6.74	6.36	5.99	5.64	5.29	4.95	4.63	4.31	...	...	...	...	...	...	...
32	6.90	6.74	6.36	5.99	5.64	5.29	4.95	4.63	4.31	...	...	...	...	...	...	...
33	7.93	7.69	7.11	6.54	5.99	5.46	4.95	4.45	3.97	...	...	...	...	...	...	...
34	7.93	7.75	7.31	6.89	6.48	6.08	5.69	5.32	4.96	...	...	...	...	...	...	...
35	7.93	7.77	7.38	7.00	6.64	6.28	5.94	5.61	5.29	4.97	4.67	4.38	4.09	...	...	...
36	6.90	6.69	6.18	5.69	5.21	4.75	4.30	3.87	3.45	...	...	...	...	...	...	...
37	6.90	6.74	6.36	5.99	5.64	5.29	4.95	4.63	4.31	...	...	...	...	...	...	...
38	6.90	6.74	6.36	5.99	5.64	5.29	4.95	4.63	4.31	...	...	...	...	...	...	...
39	7.93	7.69	7.11	6.54	5.99	5.46	4.95	4.45	3.97	...	...	...	...	...	...	...
40	7.93	7.75	7.31	6.89	6.48	6.08	5.69	5.32	4.96	...	...	...	...	...	...	...
41	7.93	7.77	7.38	7.00	6.64	6.28	5.94	5.61	5.29	4.97	4.67	4.38	4.09	...	...	...

Table 1-1-2M Maximum Allowable Compression Stress Values, S_{comp}, for Thermoplastic Materials (Cont'd)

Line No.	Nominal Composition	Product Form	ASME Spec. No.	Type/Grade	Construction Code Notes	Minimum Yield Strength, MPa	Maximum Temperature Limit, °C	Notes
42	Polyethylene	Extruded pipe	SF-2619	PE3608	...	20.7	60.0	M09, M14
43	Polyethylene	Extruded pipe	SF-2619	PE3608	...	20.7	60.0	M10, M14
44	Polyethylene	Extruded pipe	SF-2619	PE4710	...	20.7	60.0	M11, M14
45	Polyethylene	Extruded pipe	SF-2619	PE4710	...	20.7	60.0	M12, M14
46	Polyethylene	Extruded pipe	SF-2619	PE4710	...	20.7	82.2	M13, M14
47	Polyethylene	Extruded pipe	SD-2239	PE4608	...	20.7	60.0	M05, M10
48	Polyethylene	Extruded pipe	SD-2239	PE4710	...	20.7	60.0	M05, M11
49	Polyethylene	Extruded pipe	SD-2239	PE4710	...	20.7	60.0	M05, M12
50	Polyethylene	Extruded pipe	SD-2239	PE4710	...	20.7	82.2	M05, M13
51	PVC	Extruded pipe	SD-1785	PVC2110	C01	41.4	60.0	M15
52	PVC	Extruded pipe	SD-1785	PVC2112	C01	41.4	60.0	M16
53	PVC	Extruded pipe	SD-1785	PVC2116	C01	41.4	60.0	M17
54	PVC	Extruded pipe	SD-1785	PVC2120	C01	41.4	60.0	M18
55	PVC	Extruded tube	SD-2241	PVC2110	C01	41.4	60.0	M15
56	PVC	Extruded tube	SD-2241	PVC2112	C01	41.4	60.0	M16
57	PVC	Extruded tube	SD-2241	PVC2116	C01	41.4	60.0	M17
58	PVC	Extruded tube	SD-2241	PVC2120	C01	41.4	60.0	M18
59	PVC	Extruded pipe	SD-1785	PVC1120	C01	48.3	60.0	M19
60	PVC	Extruded pipe	SD-1785	PVC1220	C01	48.3	60.0	M19
61	PVC	Extruded pipe	SD-2241	PVC1120	C01	48.3	60.0	M19
62	PVC	Extruded pipe	SD-2241	PVC1220	C01	48.3	60.0	M19
63	PVC	Extruded pipe	SF-1483	PVCO 1135	C01	48.3	54.4	M20, M21
64	PVC	Extruded pipe	SF-1483	PVCO 1135	C01	76.5	54.4	M20, M22
65	PVDF	Extruded pipe	SF-1673	PVDF 2020	...	44.8	93.3	M23
66	PVDF	Extruded pipe	SF-1673	PVDF 2025	...	53.0	93.3	M24

Table 1-1-2M Maximum Allowable Compression Stress Values, S_{comp}, for Thermoplastic Materials (Cont'd)

Line No.	Maximum Allowable Compression Stress, MPa [Note (1)], for Material Temperature, °C, Not Exceeding															
	23	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95
42	6.90	6.69	6.18	5.69	5.21	4.75	4.30	3.87	3.45	...	...	...	...	...	...	...
43	6.90	6.74	6.36	5.99	5.64	5.29	4.95	4.63	4.31	...	...	...	...	...	...	...
44	7.93	7.69	7.11	6.54	5.99	5.46	4.95	4.45	3.97	...	...	...	...	...	...	...
45	7.93	7.75	7.31	6.89	6.48	6.08	5.69	5.32	4.96	...	...	...	...	...	...	...
46	7.93	7.77	7.38	7.00	6.64	6.28	5.94	5.61	5.29	4.97	4.67	4.38	4.09	...	...	...
47	6.90	6.74	6.36	5.99	5.64	5.29	4.95	4.63	4.31	...	...	...	...	...	...	...
48	7.93	7.69	7.11	6.54	5.99	5.46	4.95	4.45	3.97	...	...	...	...	...	...	...
49	7.93	7.75	7.31	6.89	6.48	6.08	5.69	5.32	4.96	...	...	...	...	...	...	...
50	7.93	7.77	7.38	7.00	6.64	6.28	5.94	5.61	5.29	4.97	4.67	4.38	4.09	...	...	...
51	8.62	8.02	6.89	5.86	4.91	4.05	3.28	2.50	1.90	...	...	...	...	...	...	...
52	10.8	10.0	8.62	7.33	6.14	5.06	4.09	3.12	2.37	...	...	...	...	...	...	...
53	13.8	12.8	11.0	9.38	7.86	6.48	5.24	4.00	3.03	...	...	...	...	...	...	...
54	17.2	16.0	13.8	11.7	9.83	8.10	6.55	5.00	3.79	...	...	...	...	...	...	...
55	8.62	8.02	6.89	5.86	4.91	4.05	3.28	2.50	1.90	...	...	...	...	...	...	...
56	10.8	10.0	8.62	7.33	6.14	5.06	4.09	3.12	2.37	...	...	...	...	...	...	...
57	13.8	12.8	11.0	9.38	7.86	6.48	5.24	4.00	3.03	...	...	...	...	...	...	...
58	17.2	16.0	13.8	11.7	9.83	8.10	6.55	5.00	3.79	...	...	...	...	...	...	...
59	17.2	16.0	13.8	11.7	9.83	8.10	6.55	5.00	3.79	...	...	...	...	...	...	...
60	17.2	16.0	13.8	11.7	9.83	8.10	6.55	5.00	3.79	...	...	...	...	...	...	...
61	17.2	16.0	13.8	11.7	9.83	8.10	6.55	5.00	3.79	...	...	...	...	...	...	...
62	17.2	16.0	13.8	11.7	9.83	8.10	6.55	5.00	3.79	...	...	...	...	...	...	...
63	17.2	16.0	13.8	11.7	9.83	8.10	6.55	5.00	...	...	...	...	...	...	...	...
64	30.6	28.5	24.5	20.8	17.4	14.4	11.6	8.87	...	...	...	...	...	...	...	...
65	17.2	16.8	15.8	14.8	13.9	13.0	12.1	11.2	10.4	9.57	8.78	8.01	7.27	6.55	5.84	5.16
66	21.6	21.1	20.0	19.0	18.0	17.0	16.1	15.2	14.3	13.4	12.6	11.8	11.0	10.2	9.46	8.74

Table 1-1-2M Maximum Allowable Compression Stress Values, S_{comp}, for Thermoplastic Materials (Cont'd)

GENERAL NOTES:

(a) The stress values in this Table may be interpolated to determine values for intermediate temperatures. The values at intermediate temperatures shall be rounded to the same number of decimal places as the value at the higher temperature between which values are being interpolated. The rounding rule is: when the next digit beyond the last place to be retained is less than 5, retain unchanged the digit in the last place retained; when the digit next beyond the last place to be retained is 5 or greater, increase by 1 the digit in the last place retained.

(b) The following abbreviations are used: CPVC, chlorinated poly(vinyl chloride); PVC, poly(vinyl chloride); and PVDF, poly(vinylidene fluoride).

NOTE: (1) Multiply MPa by 1000 to obtain kPa.

CONSTRUCTION CODE NOTE (ASME NM.1):

C01 Compounding ingredients may vary between material manufacturers for the same grade of CPVC or PVC. While these different ingredients do not impact the allowable stress values provided in this Table, they can influence the acceptability of the various joining methods allowed by ASME NM.1. In addition to the material and joining requirements set forth in ASME NM.1, the joining method to be used shall be approved by the piping component manufacturer.

MATERIAL NOTES — CHLORINATED POLY(VINYL CHLORIDE):

M01 Material shall have a
- *(a)* minimum impact resistance of 80.1 J/m of notch at 23°C in accordance with ASTM D256
- *(b)* minimum modulus of elasticity in tension of 2482 MPa at 23°C in accordance with ASTM D638
- *(c)* minimum deflection temperature under load of 100°C at a load of 1.82 MPa in accordance with ASTM D648
- *(d)* average extent of burning of under 25 mm and an average time of burning of under 10 s in accordance with ASTM D635
- *(e)* hydrostatic design basis (HDB) of 4000 psi at 23°C and 1,000 psi at 82.2°C in accordance with ASTM D2837
- *(f)* hydrostatic design stress (HDS) of 2000 psi at 23°C and 500 psi at 82.2°C in accordance with ASTM D2837

M02 Material shall have a
- *(a)* minimum impact resistance of 80.1 J/m of notch at 23°C in accordance with ASTM D256
- *(b)* minimum modulus of elasticity in tension of 2482 MPa at 23°C in accordance with ASTM D638
- *(c)* minimum deflection temperature under load of 100°C at a load of 1.82 MPa in accordance with ASTM D648
- *(d)* average extent of burning of under 25 mm and an average time of burning of under 10 s in accordance with ASTM D635
- *(e)* hydrostatic design basis (HDB) of 4000 psi at 23°C and 1250 psi at 82.2°C in accordance with ASTM D2837
- *(f)* hydrostatic design stress (HDS) of 2000 psi at 23°C and 625 psi at 82.2°C in accordance with ASTM D2837

MATERIAL NOTES — POLYAMIDE:

M03 Material shall have a
- *(a)* classification of Group 03, Class 2, and Grade 3 in accordance with ASTM D4066.
- *(b)* minimum elongation at break of 200% in accordance with ASTM D638, using a 3.2 mm ± 0.4 mm thick test specimen. The speed of testing shall be 50 mm/min ±10% at 23°C ± 2°C and 50% ± 5% relative humidity.
- *(c)* minimum flexural modulus of 900 MPa in accordance with ASTM D790, Procedure A using a 3.2 mm × 12.7 mm × 127 mm test specimen. The testing shall be performed with a crosshead speed of 1.3 mm/min ±50% at 23°C ± 2°C and 50% ± 5% relative humidity.
- *(d)* minimum izod impact resistance of 55 J/m in accordance with ASTM D256, using a test specimen with a 12.7-mm depth, a 3.17-mm width, and a notch radius of 0.25 mm.
- *(e)* minimum deflection temperature of 40°C at 1.82 MPa in accordance with ASTM D648, using an unannealed test specimen 3.17 mm in width.
- *(f)* hydrostatic design basis (HDB) of 2500 psi at 23°C, 1600 psi at 60°C, and 1250 psi at 82.2°C in accordance with ASTM D2837.
- *(g)* hydrostatic design stress (HDS) of 1250 psi at 23°C, 800 psi at 60°C, and 625 psi at 82.2°C in accordance with ASTM D2837.

M04 Material shall have a
- *(a)* classification of Group 03, Class 2, and Grade 3 in accordance with ASTM D4066.
- *(b)* minimum elongation at break of 200% in accordance with ASTM D638, using a 3.2 mm ± 0.4 mm thick test specimen. The speed of testing shall be 50 mm/min ±10% at 23°C ± 2°C and 50% ± 5% relative humidity.
- *(c)* minimum flexural modulus of 900 MPa in accordance with ASTM D790, Procedure A using a 3.2 mm × 12.7 mm × 127 mm test specimen. The testing shall be performed with a crosshead speed of 1.3 mm/min ±50% at 23°C ± 2°C and 50% ± 5% relative humidity.
- *(d)* minimum izod impact resistance of 55 J/m in accordance with ASTM D256, using a test specimen with a 12.7-mm depth, a 3.17-mm width, and a notch radius of 0.25 mm.
- *(e)* minimum deflection temperature of 40°C at 1.82 MPa in accordance with ASTM D648, using an unannealed test specimen 3.17 mm in width.
- *(f)* hydrostatic design basis (HDB) of 3150 psi at 23°C and 1600 psi at 82.2°C in accordance with ASTM D2837.
- *(g)* hydrostatic design stress (HDS) of 1600 psi at 23°C and 800 psi at 82.2°C in accordance with ASTM D2837.

MATERIAL NOTES — POLYETHYLENE:

M05 Material shall have a carbon black percentage of 2% to 3% in accordance with ASTM D4218 or ASTM D1603, natural with UV stabilizer, or colored with UV stabilizer.

M06 Material shall have a
- *(a)* thermal stability of over 220°C in accordance with ASTM D3350
- *(b)* maximum brittleness temperature of −60°C in accordance with ASTM D746
- *(c)* minimum tensile elongation at break of 400% in accordance with ASTM D638, using a Type IV tensile bar at 50 mm/min at 23°C
- *(d)* slow crack growth resistance of over 500 h in accordance with ASTM F1473 at 2.4 MPa and 80°C in air
- *(e)* hydrostatic design basis (HDB) of 1250 psi at 23°C and 1000 psi at 60°C in accordance with ASTM D2837, PPI TR-3, and PPI TR-4

Table 1-1-2M Maximum Allowable Compression Stress Values, S_{comp}, for Thermoplastic Materials (Cont'd)

MATERIAL NOTES — POLYETHYLENE: (Cont'd):
(f) a hydrostatic design stress (HDS) of 800 psi at 23°C in accordance with ASTM D2837, PPI TR-3, and PPI TR-4
M07 Material shall have a
(a) thermal stability of over 220°C in accordance with ASTM D3350
(b) maximum brittleness temperature of −60°C in accordance with ASTM D746
(c) minimum tensile elongation at break of 400% in accordance with ASTM D638, using a Type IV tensile bar at 50 mm/min at 23°C
(d) slow crack growth resistance of over 500 h in accordance with ASTM F1473 at 2.4 MPa and 80°C in air
(e) hydrostatic design basis (HDB) of 1250 psi at 23°C and 630 psi at 82.2°C in accordance with ASTM D2837, PPI TR-3, and PPI TR-4
(f) hydrostatic design stress (HDS) of 800 psi at 23°C in accordance with ASTM D2837, PPI TR-3, and PPI TR-4
M08 Material shall have a carbon black percentage of 2% to 3% in accordance with ASTM D4218 or ASTM D1603, or colored with UV stabilizer.
M09 Material shall have a
(a) thermal stability of over 220°C in accordance with ASTM D3350
(b) maximum brittleness temperature of −60°C in accordance with ASTM D746
(c) minimum tensile elongation at break of 400% in accordance with ASTM D638, using a Type IV tensile bar at 50 mm/min at 23°C
(d) slow crack growth resistance of over 100 h in accordance with ASTM F1473 at 2.4 MPa and 80°C in air
(e) hydrostatic design basis (HDB) of 1600 psi at 23°C and 800 psi at 60°C in accordance with ASTM D2837, PPI TR-3, and PPI TR-4
(f) hydrostatic design stress (HDS) of 800 psi at 23°C in accordance with ASTM D2837, PPI TR-3, and PPI TR-4
M10 Material shall have a
(a) thermal stability of over 200°F in accordance with ASTM D3350
(b) maximum brittleness temperature of −60°C in accordance with ASTM D746
(c) minimum tensile elongation at break of 400% in accordance with ASTM D638, using a Type IV tensile bar at 50 mm/min at 23°C
(d) slow crack growth resistance of over 100 h in accordance with ASTM F1473 at 2.4 MPa and 80°C in air
(e) hydrostatic design basis (HDB) of 1600 psi at 23°C and 1000 psi at 60°C in accordance with ASTM D2837, PPI TR-3, and PPI TR-4
(f) hydrostatic design stress (HDS) of 800 psi at 23°C in accordance with ASTM D2837, PPI TR-3, and PPI TR-4
M11 Material shall have a
(a) thermal stability of over 220°C in accordance with ASTM D3350
(b) maximum brittleness temperature of −60°C in accordance with ASTM D746
(c) minimum tensile elongation at break of 400% in accordance with ASTM D638, using a Type IV tensile bar at 50 mm/min at 23°C
(d) slow crack growth resistance of over 500 h in accordance with ASTM F1473 at 2.4 MPa and 80°C in air
(e) hydrostatic design basis (HDB) of 1600 psi at 23°C and 800 psi at 60°C in accordance with ASTM D2837, PPI TR-3, and PPI TR-4
(f) hydrostatic design stress (HDS) of 1000 psi at 23°C in accordance with ASTM D2837, PPI TR-3, and PPI TR-4
M12 Material shall have a
(a) thermal stability of over 220°C in accordance with ASTM D3350
(b) maximum brittleness temperature of −60°C in accordance with ASTM D746
(c) minimum tensile elongation at break of 400% in accordance with ASTM D638, using a Type IV tensile bar at 50 mm/min at 23°C
(d) slow crack growth resistance of over 500 h in accordance with ASTM F1473 at 2.4 MPa and 80°C in air
(e) hydrostatic design basis (HDB) of 1600 psi at 23°C and 1000 psi at 60°C in accordance with ASTM D2837, PPI TR-3, and PPI TR-4
(f) hydrostatic design stress (HDS) of 1000 psi at 23°C in accordance with ASTM D2837, PPI TR-3, and PPI TR-4
M13 Material shall have a
(a) thermal stability of over 220°C in accordance with ASTM D3350
(b) maximum brittleness temperature of −60°C in accordance with ASTM D746
(c) minimum tensile elongation at break of 400% in accordance with ASTM D638, using a Type IV tensile bar at 50 mm/min at 23°C
(d) slow crack growth resistance of over 500 h in accordance with ASTM F1473 at 2.4 MPa and 80°C in air
(e) hydrostatic design basis (HDB) of 1600 psi at 23°C and 800 psi at 82.2°C in accordance with ASTM D2837, PPI TR-3, and PPI TR-4
(f) hydrostatic design stress (HDS) of 1000 psi at 23°C in accordance with ASTM D2837, PPI TR-3, and PPI TR-4
M14 Material shall have a carbon black percentage of 2% to 3% in accordance with ASTM D4218 or ASTM D1603.

MATERIAL NOTES — POLY(VINYL CHLORIDE):
M15 Material shall have a
(a) minimum impact resistance of 266.9 J/m of notch at 23°C in accordance with ASTM D256
(b) minimum modulus of elasticity in tension of 2206 MPa at 23°C in accordance with ASTM D638
(c) minimum deflection temperature under load of 60°C at a load of 1.82 MPa in accordance with ASTM D648
(d) average extent of burning of under 25 mm and an average time of burning of under 10 s in accordance with ASTM D635
(e) hydrostatic design basis (HDB) of 2000 psi at 23°C in accordance with ASTM D2837
(f) hydrostatic design stress (HDS) of 1000 psi at 23°C in accordance with ASTM D2837
M16 Material shall have a
(a) minimum impact resistance of 226.9 J/m of notch at 23°C in accordance with ASTM D256
(b) minimum modulus of elasticity in tension of 2206 MPa at 23°C in accordance with ASTM D638
(c) minimum deflection temperature under load of 60°C at a load of 1.82 MPa in accordance with ASTM D648
(d) average extent of burning of under 25 mm and an average time of burning of under 10 s in accordance with ASTM D635
(e) hydrostatic design basis (HDB) of 2500 psi at 23°C in accordance with ASTM D2837
(f) hydrostatic design stress (HDS) of 1250 psi at 23°C in accordance with ASTM D2837
M17 Material shall have a
(a) minimum impact resistance of 266.9 J/m of notch at 23°C in accordance with ASTM D256
(b) minimum modulus of elasticity in tension of 2206 MPa at 23°C in accordance with ASTM D638
(c) minimum deflection temperature under load of 60°C at a load of 1.82 MPa in accordance with ASTM D648
(d) average extent of burning of under 25 mm and an average time of burning of under 10 s in accordance with ASTM D635

Table 1-1-2M Maximum Allowable Compression Stress Values, S_{comp}, for Thermoplastic Materials (Cont'd)

MATERIAL NOTES — POLY(VINYL CHLORIDE): (Cont'd):
(e) hydrostatic design basis (HDB) of 3200 psi at 23°C in accordance with ASTM D2837
(f) hydrostatic design stress (HDS) of 1600 psi at 23°C in accordance with ASTM D2837

M18 Material shall have a
(a) minimum impact resistance of 266.9 J/m of notch at 23°C in accordance with ASTM D256
(b) minimum modulus of elasticity in tension of 2206 MPa at 23°C in accordance with ASTM D638
(c) minimum deflection temperature under load of 60°C at a load of 1.82 MPa in accordance with ASTM D648
(d) average extent of burning of under 25 mm and an average time of burning of under 10 s in accordance with ASTM D635
(e) hydrostatic design basis (HDB) of 4000 psi at 23°C in accordance with ASTM D2837
(f) hydrostatic design stress (HDS) of 2000 psi at 23°C in accordance with ASTM D2837

M19 Material shall have a
(a) minimum impact resistance of 34.7 J/m of notch at 23°C in accordance with ASTM D256
(b) minimum modulus of elasticity in tension of 2758 MPa at 23°C in accordance with ASTM D638
(c) minimum deflection temperature under load of 70°C at a load of 1.82 MPa in accordance with ASTM D648
(d) average extent of burning of under 25 mm and an average time of burning of under 10 s in accordance with ASTM D635
(e) hydrostatic design basis (HDB) of 4000 psi at 23°C in accordance with ASTM D2837
(f) hydrostatic design stress (HDS) of 2000 psi at 23°C in accordance with ASTM D2837

M20 Material shall have a
(a) minimum impact resistance of 266.9 J/m of notch at 23°C in accordance with ASTM D256
(b) minimum modulus of elasticity in tension of 2206 MPa at 23°C in accordance with ASTM D638
(c) minimum deflection temperature under load of 60°C at a load of 1.82 MPa in accordance with ASTM D648
(d) average extent of burning of under 25 mm and an average time of burning of under 10 s in accordance with ASTM D635
(e) hydrostatic design basis (HDB) of 7100 psi at 23°C in accordance with ASTM D2837
(f) hydrostatic design stress (HDS) of 3550 psi at 23°C in accordance with ASTM D2837

M21 Allowable stress values apply to the unoriented directions only.

M22 Allowable stress values apply to the oriented direction only.

MATERIAL NOTES — POLY(VINYLIDENE FLUORIDE):

M23 Material shall have a
(a) classification of Type I in accordance with ASME SD-3222
(b) minimum impact resistance of 80.0 J/m of notch at 23°C in accordance with ASTM D256
(c) minimum flexural modulus of 1.38 GPa at 23°C in accordance with ASTM D790, using Method I
(d) minimum tensile elongation at break of 10% in accordance with ASTM D638, using a Type I tensile bar at 51 mm/min at 23°C
(e) hydrostatic design basis (HDB) of 4000 psi at 23°C and 1250 psi at 93.3°C in accordance with ASTM D2837
(f) hydrostatic design stress (HDS) of 2000 psi at 23°C and 625 psi at 93.3°C in accordance with ASTM D2837

M24 Material shall have a
(a) classification of Type II in accordance with ASME SD-3222
(b) minimum flexural modulus of 1.38 GPa at 23°C in accordance with ASTM D790, using Method I
(c) minimum tensile elongation at break of 10% in accordance with ASTM D638, using a Type I tensile bar at 51 mm/min at 23°C
(d) hydrostatic design basis (HDB) of 5000 psi at 23°C and 1250 psi at 120°C in accordance with ASTM D2837
(e) hydrostatic design stress (HDS) of 2500 psi at 23°C and 625 psi at 120°C in accordance with ASTM D2837

TABLE STARTS ON NEXT PAGE

Table 1-1-3M Maximum Allowable Secondary Stress Range Values, S_A, for Thermoplastic Materials

Line No.	Nominal Composition	Product Form	ASME Spec. No.	Type/Grade	Construction Code Notes	Minimum Yield Strength, MPa	Maximum Temperature Limit, °C	Design Factor	Notes
1	CPVC	Extruded pipe	SD-2846	CPVC 4120-05	C01	48.3	93.3	D01	M01
2	CPVC	Extruded pipe	SD-2846	CPVC 4120-05	C01	48.3	93.3	D01	M01
3	CPVC	Extruded pipe	SD-2846	CPVC 4120-05	C01	48.3	93.3	D01	M01
4	CPVC	Extruded pipe	SD-2846	CPVC 4120-05	C01	48.3	93.3	D01	M01
5	CPVC	Extruded pipe	SD-2846	CPVC 4120-05	C01	48.3	93.3	D01	M01
6	CPVC	Extruded pipe	SD-2846	CPVC 4120-05	C01	48.3	93.3	D01	M01
7	CPVC	Extruded pipe	SD-2846	CPVC 4120-06	C01	48.3	93.3	D01	M02
8	CPVC	Extruded pipe	SD-2846	CPVC 4120-06	C01	48.3	93.3	D01	M02
9	CPVC	Extruded pipe	SD-2846	CPVC 4120-06	C01	48.3	93.3	D01	M02
10	CPVC	Extruded pipe	SD-2846	CPVC 4120-06	C01	48.3	93.3	D01	M02
11	CPVC	Extruded pipe	SD-2846	CPVC 4120-06	C01	48.3	93.3	D01	M02
12	CPVC	Extruded pipe	SD-2846	CPVC 4120-06	C01	48.3	93.3	D01	M02
13	CPVC	Extruded pipe	SF-441	CPVC 4120-05	C01	48.3	93.3	D01	M01
14	CPVC	Extruded pipe	SF-441	CPVC 4120-05	C01	48.3	93.3	D01	M01
15	CPVC	Extruded pipe	SF-441	CPVC 4120-05	C01	48.3	93.3	D01	M01
16	CPVC	Extruded pipe	SF-441	CPVC 4120-05	C01	48.3	93.3	D01	M01
17	CPVC	Extruded pipe	SF-441	CPVC 4120-05	C01	48.3	93.3	D01	M01
18	CPVC	Extruded pipe	SF-441	CPVC 4120-05	C01	48.3	93.3	D01	M01
19	CPVC	Extruded pipe	SF-441	CPVC 4120-06	C01	48.3	93.3	D01	M02
20	CPVC	Extruded pipe	SF-441	CPVC 4120-06	C01	48.3	93.3	D01	M02
21	CPVC	Extruded pipe	SF-441	CPVC 4120-06	C01	48.3	93.3	D01	M02
22	CPVC	Extruded pipe	SF-441	CPVC 4120-06	C01	48.3	93.3	D01	M02
23	CPVC	Extruded pipe	SF-441	CPVC 4120-06	C01	48.3	93.3	D01	M02
24	CPVC	Extruded pipe	SF-441	CPVC 4120-06	C01	48.3	93.3	D01	M02
25	CPVC	Extruded pipe	SF-442	CPVC 4120-05	C01	48.3	93.3	D01	M01
26	CPVC	Extruded pipe	SF-442	CPVC 4120-05	C01	48.3	93.3	D01	M01
27	CPVC	Extruded pipe	SF-442	CPVC 4120-05	C01	48.3	93.3	D01	M01
28	CPVC	Extruded pipe	SF-442	CPVC 4120-05	C01	48.3	93.3	D01	M01
29	CPVC	Extruded pipe	SF-442	CPVC 4120-05	C01	48.3	93.3	D01	M01
30	CPVC	Extruded pipe	SF-442	CPVC 4120-05	C01	48.3	93.3	D01	M01
31	CPVC	Extruded pipe	SF-442	CPVC 4120-06	C01	48.3	93.3	D01	M02
32	CPVC	Extruded pipe	SF-442	CPVC 4120-06	C01	48.3	93.3	D01	M02
33	CPVC	Extruded pipe	SF-442	CPVC 4120-06	C01	48.3	93.3	D01	M02
34	CPVC	Extruded pipe	SF-442	CPVC 4120-06	C01	48.3	93.3	D01	M02
35	CPVC	Extruded pipe	SF-442	CPVC 4120-06	C01	48.3	93.3	D01	M02
36	CPVC	Extruded pipe	SF-442	CPVC 4120-06	C01	48.3	93.3	D01	M02
37	Polyamide	Extruded pipe	SF-2945	PA 32312	...	48.0	82.2	D01	M03
38	Polyamide	Extruded pipe	SF-2945	PA 32312	...	48.0	82.2	D01	M03
39	Polyamide	Extruded pipe	SF-2945	PA 32312	...	48.0	82.2	D01	M03
40	Polyamide	Extruded pipe	SF-2945	PA 32312	...	48.0	82.2	D01	M03
41	Polyamide	Extruded pipe	SF-2945	PA 32312	...	48.0	82.2	D01	M03
42	Polyamide	Extruded pipe	SF-2945	PA 32312	...	48.0	82.2	D01	M03

Table 1-1-3M Maximum Allowable Secondary Stress Range Values, S_A, for Thermoplastic Materials

Line No.	Number of Equivalent Thermal Cycles, N	Maximum Allowable Secondary Stress Range, MPa [Note (1)], for Material Temperature, °C, Not Exceeding															
		23	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95
1	$N \le 1000$	21.4	20.9	20.1	19.2	18.4	17.7	16.9	16.0	15.2	14.3	13.5	12.6	11.7	10.9	9.84	8.63
2	$1000 < N \le 10000$	12.8	12.5	12.0	11.5	11.0	10.6	10.1	9.57	9.06	8.55	8.04	7.53	7.02	6.51	5.88	5.16
3	$10000 < N \le 25000$	10.5	10.2	9.83	9.41	8.99	8.68	8.26	7.84	7.42	7.00	6.59	6.17	5.75	5.33	4.81	4.22
4	$25000 < N \le 50000$	8.98	8.80	8.44	8.08	7.72	7.45	7.09	6.73	6.37	6.01	5.66	5.30	4.94	4.58	4.13	3.63
5	$50000 < N \le 75000$	8.20	8.03	7.71	7.38	7.05	6.80	6.48	6.15	5.82	5.49	5.16	4.84	4.51	4.18	3.78	3.31
6	$75000 < N \le 100000$	7.69	7.53	7.23	6.92	6.61	6.38	6.07	5.77	5.46	5.15	4.84	4.54	4.23	3.92	3.54	3.11
7	$N \le 1000$	21.4	20.9	20.1	19.2	18.4	17.7	16.9	16.0	15.2	14.3	13.5	12.6	11.7	10.9	9.84	8.63
8	$1000 < N \le 10000$	12.8	12.5	12.0	11.5	11.0	10.6	10.1	9.57	9.06	8.55	8.04	7.53	7.02	6.51	5.88	5.16
9	$10000 < N \le 25000$	10.5	10.2	9.83	9.41	8.99	8.68	8.26	7.84	7.42	7.00	6.59	6.17	5.75	5.33	4.81	4.22
10	$25000 < N \le 50000$	8.98	8.80	8.44	8.08	7.72	7.45	7.09	6.73	6.37	6.01	5.66	5.30	4.94	4.58	4.13	3.63
11	$50000 < N \le 75000$	8.20	8.03	7.71	7.38	7.05	6.80	6.48	6.15	5.82	5.49	5.16	4.84	4.51	4.18	3.78	3.31
12	$75000 < N \le 100000$	7.69	7.53	7.23	6.92	6.61	6.38	6.07	5.77	5.46	5.15	4.84	4.54	4.23	3.92	3.54	3.11
13	$N \le 1000$	21.4	20.9	20.1	19.2	18.4	17.7	16.9	16.0	15.2	14.3	13.5	12.6	11.7	10.9	9.84	8.63
14	$1000 < N \le 10000$	12.8	12.5	12.0	11.5	11.0	10.6	10.1	9.57	9.06	8.55	8.04	7.53	7.02	6.51	5.88	5.16
15	$10000 < N \le 25000$	10.5	10.2	9.83	9.41	8.99	8.68	8.26	7.84	7.42	7.00	6.59	6.17	5.75	5.33	4.81	4.22
16	$25000 < N \le 50000$	8.98	8.80	8.44	8.08	7.72	7.45	7.09	6.73	6.37	6.01	5.66	5.30	4.94	4.58	4.13	3.63
17	$50000 < N \le 75000$	8.20	8.03	7.71	7.38	7.05	6.80	6.48	6.15	5.82	5.49	5.16	4.84	4.51	4.18	3.78	3.31
18	$75000 < N \le 100000$	7.69	7.53	7.23	6.92	6.61	6.38	6.07	5.77	5.46	5.15	4.84	4.54	4.23	3.92	3.54	3.11
19	$N \le 1000$	21.4	20.9	20.1	19.2	18.4	17.7	16.9	16.0	15.2	14.3	13.5	12.6	11.7	10.9	9.84	8.63
20	$1000 < N \le 10000$	12.8	12.5	12.0	11.5	11.0	10.6	10.1	9.57	9.06	8.55	8.04	7.53	7.02	6.51	5.88	5.16
21	$10000 < N \le 25000$	10.5	10.2	9.83	9.41	8.99	8.68	8.26	7.84	7.42	7.00	6.59	6.17	5.75	5.33	4.81	4.22
22	$25000 < N \le 50000$	8.98	8.80	8.44	8.08	7.72	7.45	7.09	6.73	6.37	6.01	5.66	5.30	4.94	4.58	4.13	3.63
23	$50000 < N \le 75000$	8.20	8.03	7.71	7.38	7.05	6.80	6.48	6.15	5.82	5.49	5.16	4.84	4.51	4.18	3.78	3.31
24	$75000 < N \le 100000$	7.69	7.53	7.23	6.92	6.61	6.38	6.07	5.77	5.46	5.15	4.84	4.54	4.23	3.92	3.54	3.11
25	$N \le 1000$	21.4	20.9	20.1	19.2	18.4	17.7	16.9	16.0	15.2	14.3	13.5	12.6	11.7	10.9	9.84	8.63
26	$1000 < N \le 10000$	12.8	12.5	12.0	11.5	11.0	10.6	10.1	9.57	9.06	8.55	8.04	7.53	7.02	6.51	5.88	5.16
27	$10000 < N \le 25000$	10.5	10.2	9.83	9.41	8.99	8.68	8.26	7.84	7.42	7.00	6.59	6.17	5.75	5.33	4.81	4.22
28	$25000 < N \le 50000$	8.98	8.80	8.44	8.08	7.72	7.45	7.09	6.73	6.37	6.01	5.66	5.30	4.94	4.58	4.13	3.63
29	$50000 < N \le 75000$	8.20	8.03	7.71	7.38	7.05	6.80	6.48	6.15	5.82	5.49	5.16	4.84	4.51	4.18	3.78	3.31
30	$75000 < N \le 100000$	7.69	7.53	7.23	6.92	6.61	6.38	6.07	5.77	5.46	5.15	4.84	4.54	4.23	3.92	3.54	3.11
31	$N \le 1000$	21.4	20.9	20.1	19.2	18.4	17.7	16.9	16.0	15.2	14.3	13.5	12.6	11.7	10.9	9.84	8.63
32	$1000 < N \le 10000$	12.8	12.5	12.0	11.5	11.0	10.6	10.1	9.57	9.06	8.55	8.04	7.53	7.02	6.51	5.88	5.16
33	$10000 < N \le 25000$	10.5	10.2	9.83	9.41	8.99	8.68	8.26	7.84	7.42	7.00	6.59	6.17	5.75	5.33	4.81	4.22
34	$25000 < N \le 50000$	8.98	8.80	8.44	8.08	7.72	7.45	7.09	6.73	6.37	6.01	5.66	5.30	4.94	4.58	4.13	3.63
35	$50000 < N \le 75000$	8.20	8.03	7.71	7.38	7.05	6.80	6.48	6.15	5.82	5.49	5.16	4.84	4.51	4.18	3.78	3.31
36	$75000 < N \le 100000$	7.69	7.53	7.23	6.92	6.61	6.38	6.07	5.77	5.46	5.15	4.84	4.54	4.23	3.92	3.54	3.11
37	$N \le 1000$	8.62	8.43	7.97	7.53	7.10	6.69	6.28	5.89	5.52	5.23	4.95	4.68	4.42	4.17	...	...
38	$1000 < N \le 10000$	8.62	8.43	7.97	7.53	7.10	6.69	6.28	5.89	5.52	5.23	4.95	4.68	4.42	4.17	...	...
39	$10000 < N \le 25000$	8.62	8.43	7.97	7.53	7.10	6.69	6.28	5.89	5.52	5.23	4.95	4.68	4.42	4.17	...	...
40	$25000 < N \le 50000$	8.62	8.43	7.97	7.53	7.10	6.69	6.28	5.89	5.52	5.23	4.95	4.68	4.42	4.17	...	...
41	$50000 < N \le 75000$	8.62	8.43	7.97	7.53	7.10	6.69	6.28	5.89	5.52	5.23	4.95	4.68	4.42	4.17	...	...
42	$75000 < N \le 100000$	8.62	8.43	7.97	7.53	7.10	6.69	6.28	5.89	5.52	5.23	4.95	4.68	4.42	4.17	...	...

Table 1-1-3M Maximum Allowable Secondary Stress Range Values, S_A, for Thermoplastic Materials (Cont'd)

Line No.	Nominal Composition	Product Form	ASME Spec. No.	Type/Grade	Construction Code Notes	Minimum Yield Strength, MPa	Maximum Temperature Limit, °C	Design Factor	Notes
43	Polyamide	Extruded pipe	SF-2945	PA 32316	...	48.0	82.2	D01	M04
44	Polyamide	Extruded pipe	SF-2945	PA 32316	...	48.0	82.2	D01	M04
45	Polyamide	Extruded pipe	SF-2945	PA 32316	...	48.0	82.2	D01	M04
46	Polyamide	Extruded pipe	SF-2945	PA 32316	...	48.0	82.2	D01	M04
47	Polyamide	Extruded pipe	SF-2945	PA 32316	...	48.0	82.2	D01	M04
48	Polyamide	Extruded pipe	SF-2945	PA 32316	...	48.0	82.2	D01	M04
49	Polyethylene	Extruded pipe	SD-2239	PE2708	...	17.9	60.0	D01	M05, M06
50	Polyethylene	Extruded pipe	SD-2239	PE2708	...	17.9	60.0	D01	M05, M06
51	Polyethylene	Extruded pipe	SD-2239	PE2708	...	17.9	60.0	D01	M05, M06
52	Polyethylene	Extruded pipe	SD-2239	PE2708	...	17.9	60.0	D01	M05, M06
53	Polyethylene	Extruded pipe	SD-2239	PE2708	...	17.9	60.0	D01	M05, M06
54	Polyethylene	Extruded pipe	SD-2239	PE2708	...	17.9	60.0	D01	M05, M06
55	Polyethylene	Extruded pipe	SD-2239	PE2708	...	17.9	82.2	D01	M05, M07
56	Polyethylene	Extruded pipe	SD-2239	PE2708	...	17.9	82.2	D01	M05, M07
57	Polyethylene	Extruded pipe	SD-2239	PE2708	...	17.9	82.2	D01	M05, M07
58	Polyethylene	Extruded pipe	SD-2239	PE2708	...	17.9	82.2	D01	M05, M07
59	Polyethylene	Extruded pipe	SD-2239	PE2708	...	17.9	82.2	D01	M05, M07
60	Polyethylene	Extruded pipe	SD-2239	PE2708	...	17.9	82.2	D01	M05, M07
61	Polyethylene	Extruded pipe	SD-2513	PE2708	...	17.9	60.0	D01	M06, M08
62	Polyethylene	Extruded pipe	SD-2513	PE2708	...	17.9	60.0	D01	M06, M08
63	Polyethylene	Extruded pipe	SD-2513	PE2708	...	17.9	60.0	D01	M06, M08
64	Polyethylene	Extruded pipe	SD-2513	PE2708	...	17.9	60.0	D01	M06, M08
65	Polyethylene	Extruded pipe	SD-2513	PE2708	...	17.9	60.0	D01	M06, M08
66	Polyethylene	Extruded pipe	SD-2513	PE2708	...	17.9	60.0	D01	M06, M08
67	Polyethylene	Extruded pipe	SD-2513	PE2708	...	17.9	82.2	D01	M07, M08
68	Polyethylene	Extruded pipe	SD-2513	PE2708	...	17.9	82.2	D01	M07, M08
69	Polyethylene	Extruded pipe	SD-2513	PE2708	...	17.9	82.2	D01	M07, M08
70	Polyethylene	Extruded pipe	SD-2513	PE2708	...	17.9	82.2	D01	M07, M08
71	Polyethylene	Extruded pipe	SD-2513	PE2708	...	17.9	82.2	D01	M07, M08
72	Polyethylene	Extruded pipe	SD-2513	PE2708	...	17.9	82.2	D01	M07, M08
73	Polyethylene	Extruded tube	SD-2737	PE2708	...	17.9	60.0	D01	M05, M06
74	Polyethylene	Extruded tube	SD-2737	PE2708	...	17.9	60.0	D01	M05, M06
75	Polyethylene	Extruded tube	SD-2737	PE2708	...	17.9	60.0	D01	M05, M06
76	Polyethylene	Extruded tube	SD-2737	PE2708	...	17.9	60.0	D01	M05, M06
77	Polyethylene	Extruded tube	SD-2737	PE2708	...	17.9	60.0	D01	M05, M06
78	Polyethylene	Extruded tube	SD-2737	PE2708	...	17.9	60.0	D01	M05, M06
79	Polyethylene	Extruded tube	SD-2737	PE2708	...	17.9	82.2	D01	M05, M07
80	Polyethylene	Extruded tube	SD-2737	PE2708	...	17.9	82.2	D01	M05, M07
81	Polyethylene	Extruded tube	SD-2737	PE2708	...	17.9	82.2	D01	M05, M07
82	Polyethylene	Extruded tube	SD-2737	PE2708	...	17.9	82.2	D01	M05, M07
83	Polyethylene	Extruded tube	SD-2737	PE2708	...	17.9	82.2	D01	M05, M07
84	Polyethylene	Extruded tube	SD-2737	PE2708	...	17.9	82.2	D01	M05, M07

Table 1-1-3M Maximum Allowable Secondary Stress Range Values, S_A, for Thermoplastic Materials (Cont'd)

Line No.	Number of Equivalent Thermal Cycles, N	Maximum Allowable Secondary Stress Range, MPa [Note (1)], for Material Temperature, °C, Not Exceeding															
		23	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95
43	$N \le 1000$	8.62	8.43	7.97	7.53	7.10	6.69	6.28	5.89	5.52	5.23	4.95	4.68	4.42	4.17	...	...
44	$1000 < N \le 10000$	8.62	8.43	7.97	7.53	7.10	6.69	6.28	5.89	5.52	5.23	4.95	4.68	4.42	4.17	...	...
45	$10000 < N \le 25000$	8.62	8.43	7.97	7.53	7.10	6.69	6.28	5.89	5.52	5.23	4.95	4.68	4.42	4.17	...	...
46	$25000 < N \le 50000$	8.62	8.43	7.97	7.53	7.10	6.69	6.28	5.89	5.52	5.23	4.95	4.68	4.42	4.17	...	...
47	$50000 < N \le 75000$	8.62	8.43	7.97	7.53	7.10	6.69	6.28	5.89	5.52	5.23	4.95	4.68	4.42	4.17	...	...
48	$75000 < N \le 100000$	8.62	8.43	7.97	7.53	7.10	6.69	6.28	5.89	5.52	5.23	4.95	4.68	4.42	4.17	...	...
49	$N \le 1000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
50	$1000 < N \le 10000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
51	$10000 < N \le 25000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
52	$25000 < N \le 50000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
53	$50000 < N \le 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
54	$N > 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
55	$N \le 1000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
56	$1000 < N \le 10000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
57	$10000 < N \le 25000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
58	$25000 < N \le 50000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
59	$50000 < N \le 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
60	$N > 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
61	$N \le 1000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
62	$1000 < N \le 10000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
63	$10000 < N \le 25000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
64	$25000 < N \le 50000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
65	$50000 < N \le 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
66	$N > 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
67	$N \le 1000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
68	$1000 < N \le 10000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
69	$10000 < N \le 25000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
70	$25000 < N \le 50000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
71	$50000 < N \le 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
72	$N > 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
73	$N \le 1000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
74	$1000 < N \le 10000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
75	$10000 < N \le 25000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
76	$25000 < N \le 50000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
77	$50000 < N \le 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
78	$N > 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
79	$N \le 1000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
80	$1000 < N \le 10000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
81	$10000 < N \le 25000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
82	$25000 < N \le 50000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
83	$50000 < N \le 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
84	$N > 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1-1-3M Maximum Allowable Secondary Stress Range Values, S_A, for Thermoplastic Materials (Cont'd)

Line No.	Nominal Composition	Product Form	ASME Spec. No.	Type/Grade	Construction Code Notes	Minimum Yield Strength, MPa	Maximum Temperature Limit, °C	Design Factor	Notes
85	Polyethylene	Extruded pipe	SD-3035	PE2708	...	17.9	60.0	D01	M05, M06
86	Polyethylene	Extruded pipe	SD-3035	PE2708	...	17.9	60.0	D01	M05, M06
87	Polyethylene	Extruded pipe	SD-3035	PE2708	...	17.9	60.0	D01	M05, M06
88	Polyethylene	Extruded pipe	SD-3035	PE2708	...	17.9	60.0	D01	M05, M06
89	Polyethylene	Extruded pipe	SD-3035	PE2708	...	17.9	60.0	D01	M05, M06
90	Polyethylene	Extruded pipe	SD-3035	PE2708	...	17.9	60.0	D01	M05, M06
91	Polyethylene	Extruded pipe	SD-3035	PE2708	...	17.9	82.2	D01	M05, M07
92	Polyethylene	Extruded pipe	SD-3035	PE2708	...	17.9	82.2	D01	M05, M07
93	Polyethylene	Extruded pipe	SD-3035	PE2708	...	17.9	82.2	D01	M05, M07
94	Polyethylene	Extruded pipe	SD-3035	PE2708	...	17.9	82.2	D01	M05, M07
95	Polyethylene	Extruded pipe	SD-3035	PE2708	...	17.9	82.2	D01	M05, M07
96	Polyethylene	Extruded pipe	SD-3035	PE2708	...	17.9	82.2	D01	M05, M07
97	Polyethylene	Extruded pipe	SF-714	PE2708	...	17.9	60.0	D01	M06, M08
98	Polyethylene	Extruded pipe	SF-714	PE2708	...	17.9	60.0	D01	M06, M08
99	Polyethylene	Extruded pipe	SF-714	PE2708	...	17.9	60.0	D01	M06, M08
100	Polyethylene	Extruded pipe	SF-714	PE2708	...	17.9	60.0	D01	M06, M08
101	Polyethylene	Extruded pipe	SF-714	PE2708	...	17.9	60.0	D01	M06, M08
102	Polyethylene	Extruded pipe	SF-714	PE2708	...	17.9	60.0	D01	M06, M08
103	Polyethylene	Extruded pipe	SD-3035	PE2708	...	17.9	82.2	D01	M07, M08
104	Polyethylene	Extruded pipe	SD-3035	PE2708	...	17.9	82.2	D01	M07, M08
105	Polyethylene	Extruded pipe	SD-3035	PE2708	...	17.9	82.2	D01	M07, M08
106	Polyethylene	Extruded pipe	SD-3035	PE2708	...	17.9	82.2	D01	M07, M08
107	Polyethylene	Extruded pipe	SD-3035	PE2708	...	17.9	82.2	D01	M07, M08
108	Polyethylene	Extruded pipe	SD-3035	PE2708	...	17.9	82.2	D01	M07, M08
109	Polyethylene	Extruded pipe	SD-2239	PE3608	...	20.7	60.0	D01	M05, M09
110	Polyethylene	Extruded pipe	SD-2239	PE3608	...	20.7	60.0	D01	M05, M09
111	Polyethylene	Extruded pipe	SD-2239	PE3608	...	20.7	60.0	D01	M05, M09
112	Polyethylene	Extruded pipe	SD-2239	PE3608	...	20.7	60.0	D01	M05, M09
113	Polyethylene	Extruded pipe	SD-2239	PE3608	...	20.7	60.0	D01	M05, M09
114	Polyethylene	Extruded pipe	SD-2239	PE3608	...	20.7	60.0	D01	M05, M09
115	Polyethylene	Extruded pipe	SD-2239	PE3608	...	20.7	60.0	D01	M05, M10
116	Polyethylene	Extruded pipe	SD-2239	PE3608	...	20.7	60.0	D01	M05, M10
117	Polyethylene	Extruded pipe	SD-2239	PE3608	...	20.7	60.0	D01	M05, M10
118	Polyethylene	Extruded pipe	SD-2239	PE3608	...	20.7	60.0	D01	M05, M10
119	Polyethylene	Extruded pipe	SD-2239	PE3608	...	20.7	60.0	D01	M05, M10
120	Polyethylene	Extruded pipe	SD-2239	PE3608	...	20.7	60.0	D01	M05, M10
121	Polyethylene	Extruded pipe	SD-2239	PE4608	...	20.7	60.0	D01	M05, M10
122	Polyethylene	Extruded pipe	SD-2239	PE4608	...	20.7	60.0	D01	M05, M10
123	Polyethylene	Extruded pipe	SD-2239	PE4608	...	20.7	60.0	D01	M05, M10
124	Polyethylene	Extruded pipe	SD-2239	PE4608	...	20.7	60.0	D01	M05, M10
125	Polyethylene	Extruded pipe	SD-2239	PE4608	...	20.7	60.0	D01	M05, M10
126	Polyethylene	Extruded pipe	SD-2239	PE4608	...	20.7	60.0	D01	M05, M10

Table 1-1-3M Maximum Allowable Secondary Stress Range Values, S_A, for Thermoplastic Materials (Cont'd)

Line No.	Number of Equivalent Thermal Cycles, N	Maximum Allowable Secondary Stress Range, MPa [Note (1)], for Material Temperature, °C, Not Exceeding															
		23	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95
85	$N \le 1000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
86	$1000 < N \le 10000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
87	$10000 < N \le 25000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
88	$25000 < N \le 50000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
89	$50000 < N \le 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
90	$N > 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
91	$N \le 1000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
92	$1000 < N \le 10000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
93	$10000 < N \le 25000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
94	$25000 < N \le 50000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
95	$50000 < N \le 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
96	$N > 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
97	$N \le 1000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
98	$1000 < N \le 10000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
99	$10000 < N \le 25000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
100	$25000 < N \le 50000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
101	$50000 < N \le 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
102	$N > 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
103	$N \le 1000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
104	$1000 < N \le 10000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
105	$10000 < N \le 25000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
106	$25000 < N \le 50000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
107	$50000 < N \le 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
108	$N > 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
109	$N \le 1000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
110	$1000 < N \le 10000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
111	$10000 < N \le 25000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
112	$25000 < N \le 50000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
113	$50000 < N \le 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
114	$N > 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
115	$N \le 1000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
116	$1000 < N \le 10000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
117	$10000 < N \le 25000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
118	$25000 < N \le 50000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
119	$50000 < N \le 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
120	$N > 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
121	$N \le 1000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
122	$1000 < N \le 10000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
123	$10000 < N \le 25000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
124	$25000 < N \le 50000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
125	$50000 < N \le 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
126	$N > 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1-1-3M Maximum Allowable Secondary Stress Range Values, S_A, for Thermoplastic Materials (Cont'd)

Line No.	Nominal Composition	Product Form	ASME Spec. No.	Type/Grade	Construction Code Notes	Minimum Yield Strength, MPa	Maximum Temperature Limit, °C	Design Factor	Notes
127	Polyethylene	Extruded pipe	SD-2239	PE4710	...	20.7	60.0	D01	M05, M11
128	Polyethylene	Extruded pipe	SD-2239	PE4710	...	20.7	60.0	D01	M05, M11
129	Polyethylene	Extruded pipe	SD-2239	PE4710	...	20.7	60.0	D01	M05, M11
130	Polyethylene	Extruded pipe	SD-2239	PE4710	...	20.7	60.0	D01	M05, M11
131	Polyethylene	Extruded pipe	SD-2239	PE4710	...	20.7	60.0	D01	M05, M11
132	Polyethylene	Extruded pipe	SD-2239	PE4710	...	20.7	60.0	D01	M05, M11
133	Polyethylene	Extruded pipe	SD-2239	PE4710	...	20.7	60.0	D01	M05, M12
134	Polyethylene	Extruded pipe	SD-2239	PE4710	...	20.7	60.0	D01	M05, M12
135	Polyethylene	Extruded pipe	SD-2239	PE4710	...	20.7	60.0	D01	M05, M12
136	Polyethylene	Extruded pipe	SD-2239	PE4710	...	20.7	60.0	D01	M05, M12
137	Polyethylene	Extruded pipe	SD-2239	PE4710	...	20.7	60.0	D01	M05, M12
138	Polyethylene	Extruded pipe	SD-2239	PE4710	...	20.7	60.0	D01	M05, M12
139	Polyethylene	Extruded pipe	SD-2239	PE4710	...	20.7	82.2	D01	M05, M13
140	Polyethylene	Extruded pipe	SD-2239	PE4710	...	20.7	82.2	D01	M05, M13
141	Polyethylene	Extruded pipe	SD-2239	PE4710	...	20.7	82.2	D01	M05, M13
142	Polyethylene	Extruded pipe	SD-2239	PE4710	...	20.7	82.2	D01	M05, M13
143	Polyethylene	Extruded pipe	SD-2239	PE4710	...	20.7	82.2	D01	M05, M13
144	Polyethylene	Extruded pipe	SD-2239	PE4710	...	20.7	82.2	D01	M05, M13
145	Polyethylene	Extruded pipe	SD-2513	PE4710	...	20.7	60.0	D01	M08, M11
146	Polyethylene	Extruded pipe	SD-2513	PE4710	...	20.7	60.0	D01	M08, M11
147	Polyethylene	Extruded pipe	SD-2513	PE4710	...	20.7	60.0	D01	M08, M11
148	Polyethylene	Extruded pipe	SD-2513	PE4710	...	20.7	60.0	D01	M08, M11
149	Polyethylene	Extruded pipe	SD-2513	PE4710	...	20.7	60.0	D01	M08, M11
150	Polyethylene	Extruded pipe	SD-2513	PE4710	...	20.7	60.0	D01	M08, M11
151	Polyethylene	Extruded pipe	SD-2513	PE4710	...	20.7	60.0	D01	M08, M12
152	Polyethylene	Extruded pipe	SD-2513	PE4710	...	20.7	60.0	D01	M08, M12
153	Polyethylene	Extruded pipe	SD-2513	PE4710	...	20.7	60.0	D01	M08, M12
154	Polyethylene	Extruded pipe	SD-2513	PE4710	...	20.7	60.0	D01	M08, M12
155	Polyethylene	Extruded pipe	SD-2513	PE4710	...	20.7	60.0	D01	M08, M12
156	Polyethylene	Extruded pipe	SD-2513	PE4710	...	20.7	60.0	D01	M08, M12
157	Polyethylene	Extruded pipe	SD-2513	PE4710	...	20.7	82.2	D01	M08, M13
158	Polyethylene	Extruded pipe	SD-2513	PE4710	...	20.7	82.2	D01	M08, M13
159	Polyethylene	Extruded pipe	SD-2513	PE4710	...	20.7	82.2	D01	M08, M13
160	Polyethylene	Extruded pipe	SD-2513	PE4710	...	20.7	82.2	D01	M08, M13
161	Polyethylene	Extruded pipe	SD-2513	PE4710	...	20.7	82.2	D01	M08, M13
162	Polyethylene	Extruded pipe	SD-2513	PE4710	...	20.7	82.2	D01	M08, M13
163	Polyethylene	Extruded tube	SD-2737	PE3608	...	20.7	60.0	D01	M05, M09
164	Polyethylene	Extruded tube	SD-2737	PE3608	...	20.7	60.0	D01	M05, M09
165	Polyethylene	Extruded tube	SD-2737	PE3608	...	20.7	60.0	D01	M05, M09
166	Polyethylene	Extruded tube	SD-2737	PE3608	...	20.7	60.0	D01	M05, M09
167	Polyethylene	Extruded tube	SD-2737	PE3608	...	20.7	60.0	D01	M05, M09
168	Polyethylene	Extruded tube	SD-2737	PE3608	...	20.7	60.0	D01	M05, M09

Table 1-1-3M Maximum Allowable Secondary Stress Range Values, S_A, for Thermoplastic Materials (Cont'd)

Line No.	Number of Equivalent Thermal Cycles, N	Maximum Allowable Secondary Stress Range, MPa [Note (1)], for Material Temperature, °C, Not Exceeding															
		23	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95
127	$N \le 1000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
128	$1000 < N \le 10000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
129	$10000 < N \le 25000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
130	$25000 < N \le 50000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
131	$50000 < N \le 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
132	$N > 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
133	$N \le 1000$	26.8	26.3	25.3	24.3	23.3	22.2	21.2	20.1	19.0	...	...	...	...	...	...	...
134	$1000 < N \le 10000$	17.7	17.4	16.8	16.2	15.5	14.9	14.2	13.5	12.8	...	...	...	...	...	...	...
135	$10000 < N \le 25000$	15.0	14.8	14.3	13.8	13.2	12.7	12.1	11.6	11.0	...	...	...	...	...	...	...
136	$25000 < N \le 50000$	13.3	13.1	12.6	12.2	11.7	11.2	10.8	10.3	9.77	...	...	...	...	...	...	...
137	$50000 < N \le 75000$	12.3	12.1	11.7	11.3	10.9	10.5	10.0	9.59	9.11	...	...	...	...	...	...	...
138	$N > 75000$	11.7	11.5	11.2	10.8	10.4	9.97	9.55	9.12	8.68	...	...	...	...	...	...	...
139	$N \le 1000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
140	$1000 < N \le 10000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
141	$10000 < N \le 25000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
142	$25000 < N \le 50000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
143	$50000 < N \le 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
144	$N > 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
145	$N \le 1000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
146	$1000 < N \le 10000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
147	$10000 < N \le 25000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
148	$25000 < N \le 50000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
149	$50000 < N \le 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
150	$N > 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
151	$N \le 1000$	26.8	26.3	25.3	24.3	23.3	22.2	21.2	20.1	19.0	...	...	...	...	...	...	...
152	$1000 < N \le 10000$	17.7	17.4	16.8	16.2	15.5	14.9	14.2	13.5	12.8	...	...	...	...	...	...	...
153	$10000 < N \le 25000$	15.0	14.8	14.3	13.8	13.2	12.7	12.1	11.6	11.0	...	...	...	...	...	...	...
154	$25000 < N \le 50000$	13.3	13.1	12.6	12.2	11.7	11.2	10.8	10.3	9.77	...	...	...	...	...	...	...
155	$50000 < N \le 75000$	12.3	12.1	11.7	11.3	10.9	10.5	10.0	9.59	9.11	...	...	...	...	...	...	...
156	$N > 75000$	11.7	11.5	11.2	10.8	10.4	9.97	9.55	9.12	8.68	...	...	...	...	...	...	...
157	$N \le 1000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
158	$1000 < N \le 10000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
159	$10000 < N \le 25000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
160	$25000 < N \le 50000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
161	$50000 < N \le 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
162	$N > 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
163	$N \le 1000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
164	$1000 < N \le 10000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
165	$10000 < N \le 25000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
166	$25000 < N \le 50000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
167	$50000 < N \le 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
168	$N > 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1-1-3M Maximum Allowable Secondary Stress Range Values, S_A, for Thermoplastic Materials (Cont'd)

Line No.	Nominal Composition	Product Form	ASME Spec. No.	Type/Grade	Construction Code Notes	Minimum Yield Strength, MPa	Maximum Temperature Limit, °C	Design Factor	Notes
169	Polyethylene	Extruded tube	SD-2737	PE3608	...	20.7	60.0	D01	M05, M10
170	Polyethylene	Extruded tube	SD-2737	PE3608	...	20.7	60.0	D01	M05, M10
171	Polyethylene	Extruded tube	SD-2737	PE3608	...	20.7	60.0	D01	M05, M10
172	Polyethylene	Extruded tube	SD-2737	PE3608	...	20.7	60.0	D01	M05, M10
173	Polyethylene	Extruded tube	SD-2737	PE3608	...	20.7	60.0	D01	M05, M10
174	Polyethylene	Extruded tube	SD-2737	PE3608	...	20.7	60.0	D01	M05, M10
175	Polyethylene	Extruded tube	SD-2737	PE4608	...	20.7	60.0	D01	M05, M10
176	Polyethylene	Extruded tube	SD-2737	PE4608	...	20.7	60.0	D01	M05, M10
177	Polyethylene	Extruded tube	SD-2737	PE4608	...	20.7	60.0	D01	M05, M10
178	Polyethylene	Extruded tube	SD-2737	PE4608	...	20.7	60.0	D01	M05, M10
179	Polyethylene	Extruded tube	SD-2737	PE4608	...	20.7	60.0	D01	M05, M10
180	Polyethylene	Extruded tube	SD-2737	PE4608	...	20.7	60.0	D01	M05, M10
181	Polyethylene	Extruded tube	SD-2737	PE4710	...	20.7	60.0	D01	M05, M11
182	Polyethylene	Extruded tube	SD-2737	PE4710	...	20.7	60.0	D01	M05, M11
183	Polyethylene	Extruded tube	SD-2737	PE4710	...	20.7	60.0	D01	M05, M11
184	Polyethylene	Extruded tube	SD-2737	PE4710	...	20.7	60.0	D01	M05, M11
185	Polyethylene	Extruded tube	SD-2737	PE4710	...	20.7	60.0	D01	M05, M11
186	Polyethylene	Extruded tube	SD-2737	PE4710		20.7	60.0	D01	M05, M11
187	Polyethylene	Extruded tube	SD-2737	PE4710	...	20.7	60.0	D01	M05, M12
188	Polyethylene	Extruded tube	SD-2737	PE4710	...	20.7	60.0	D01	M05, M12
189	Polyethylene	Extruded tube	SD-2737	PE4710	...	20.7	60.0	D01	M05, M12
190	Polyethylene	Extruded tube	SD-2737	PE4710	...	20.7	60.0	D01	M05, M12
191	Polyethylene	Extruded tube	SD-2737	PE4710	...	20.7	60.0	D01	M05, M12
192	Polyethylene	Extruded tube	SD-2737	PE4710	...	20.7	60.0	D01	M05, M12
193	Polyethylene	Extruded tube	SD-2737	PE4710	...	20.7	82.2	D01	M05, M13
194	Polyethylene	Extruded tube	SD-2737	PE4710	...	20.7	82.2	D01	M05, M13
195	Polyethylene	Extruded tube	SD-2737	PE4710	...	20.7	82.2	D01	M05, M13
196	Polyethylene	Extruded tube	SD-2737	PE4710	...	20.7	82.2	D01	M05, M13
197	Polyethylene	Extruded tube	SD-2737	PE4710	...	20.7	82.2	D01	M05, M13
198	Polyethylene	Extruded tube	SD-2737	PE4710	...	20.7	82.2	D01	M05, M13
199	Polyethylene	Extruded pipe	SD-3035	PE3608	...	20.7	60.0	D01	M05, M09
200	Polyethylene	Extruded pipe	SD-3035	PE3608	...	20.7	60.0	D01	M05, M09
201	Polyethylene	Extruded pipe	SD-3035	PE3608	...	20.7	60.0	D01	M05, M09
202	Polyethylene	Extruded pipe	SD-3035	PE3608	...	20.7	60.0	D01	M05, M09
203	Polyethylene	Extruded pipe	SD-3035	PE3608	...	20.7	60.0	D01	M05, M09
204	Polyethylene	Extruded pipe	SD-3035	PE3608	...	20.7	60.0	D01	M05, M09
205	Polyethylene	Extruded pipe	SD-3035	PE3608	...	20.7	60.0	D01	M05, M10
206	Polyethylene	Extruded pipe	SD-3035	PE3608	...	20.7	60.0	D01	M05, M10
207	Polyethylene	Extruded pipe	SD-3035	PE3608	...	20.7	60.0	D01	M05, M10
208	Polyethylene	Extruded pipe	SD-3035	PE3608	...	20.7	60.0	D01	M05, M10
209	Polyethylene	Extruded pipe	SD-3035	PE3608	...	20.7	60.0	D01	M05, M10
210	Polyethylene	Extruded pipe	SD-3035	PE3608	...	20.7	60.0	D01	M05, M10

Table 1-1-3M Maximum Allowable Secondary Stress Range Values, S_A, for Thermoplastic Materials (Cont'd)

Line No.	Number of Equivalent Thermal Cycles, N	Maximum Allowable Secondary Stress Range, MPa [Note (1)], for Material Temperature, °C, Not Exceeding															
		23	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95
169	$N \le 1000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
170	$1000 < N \le 10000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
171	$10000 < N \le 25000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
172	$25000 < N \le 50000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
173	$50000 < N \le 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
174	$N > 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
175	$N \le 1000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
176	$1000 < N \le 10000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
177	$10000 < N \le 25000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
178	$25000 < N \le 50000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
179	$50000 < N \le 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
180	$N > 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
181	$N \le 1000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
182	$1000 < N \le 10000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
183	$10000 < N \le 25000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
184	$25000 < N \le 50000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
185	$50000 < N \le 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
186	$N > 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
187	$N \le 1000$	26.8	26.3	25.3	24.3	23.3	22.2	21.2	20.1	19.0	...	...	...	...	...	...	...
188	$1000 < N \le 10000$	17.7	17.4	16.8	16.2	15.5	14.9	14.2	13.5	12.8	...	...	...	...	...	...	...
189	$10000 < N \le 25000$	15.0	14.8	14.3	13.8	13.2	12.7	12.1	11.6	11.0	...	...	...	...	...	...	...
190	$25000 < N \le 50000$	13.3	13.1	12.6	12.2	11.7	11.2	10.8	10.3	9.77	...	...	...	...	...	...	...
191	$50000 < N \le 75000$	12.3	12.1	11.7	11.3	10.9	10.5	10.0	9.59	9.11	...	...	...	...	...	...	...
192	$N > 75000$	11.7	11.5	11.2	10.8	10.4	9.97	9.55	9.12	8.68	...	...	...	...	...	...	...
193	$N \le 1000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
194	$1000 < N \le 10000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
195	$10000 < N \le 25000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
196	$25000 < N \le 50000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
197	$50000 < N \le 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
198	$N > 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
199	N ≤ 1000	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
200	$1000 < N \le 10000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
201	$10000 < N \le 25000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
202	$25000 < N \le 50000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
203	$50000 < N \le 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
204	$N > 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
205	$N \le 1000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
206	$1000 < N \le 10000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
207	$10000 < N \le 25000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
208	$25000 < N \le 50000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
209	$50000 < N \le 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
210	$N > 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1-1-3M Maximum Allowable Secondary Stress Range Values, S_A, for Thermoplastic Materials (Cont'd)

Line No.	Nominal Composition	Product Form	ASME Spec. No.	Type/Grade	Construction Code Notes	Minimum Yield Strength, MPa	Maximum Temperature Limit, °C	Design Factor	Notes
211	Polyethylene	Extruded pipe	SD-3035	PE4608	...	20.7	60.0	D01	M05, M10
212	Polyethylene	Extruded pipe	SD-3035	PE4608	...	20.7	60.0	D01	M05, M10
213	Polyethylene	Extruded pipe	SD-3035	PE4608	...	20.7	60.0	D01	M05, M10
214	Polyethylene	Extruded pipe	SD-3035	PE4608	...	20.7	60.0	D01	M05, M10
215	Polyethylene	Extruded pipe	SD-3035	PE4608	...	20.7	60.0	D01	M05, M10
216	Polyethylene	Extruded pipe	SD-3035	PE4608	...	20.7	60.0	D01	M05, M10
217	Polyethylene	Extruded pipe	SD-3035	PE4710	...	20.7	60.0	D01	M05, M11
218	Polyethylene	Extruded pipe	SD-3035	PE4710	...	20.7	60.0	D01	M05, M11
219	Polyethylene	Extruded pipe	SD-3035	PE4710	...	20.7	60.0	D01	M05, M11
220	Polyethylene	Extruded pipe	SD-3035	PE4710	...	20.7	60.0	D01	M05, M11
221	Polyethylene	Extruded pipe	SD-3035	PE4710	...	20.7	60.0	D01	M05, M11
222	Polyethylene	Extruded pipe	SD-3035	PE4710	...	20.7	60.0	D01	M05, M11
223	Polyethylene	Extruded pipe	SD-3035	PE4710	...	20.7	60.0	D01	M05, M12
224	Polyethylene	Extruded pipe	SD-3035	PE4710	...	20.7	60.0	D01	M05, M12
225	Polyethylene	Extruded pipe	SD-3035	PE4710	...	20.7	60.0	D01	M05, M12
226	Polyethylene	Extruded pipe	SD-3035	PE4710	...	20.7	60.0	D01	M05, M12
227	Polyethylene	Extruded pipe	SD-3035	PE4710	...	20.7	60.0	D01	M05, M12
228	Polyethylene	Extruded pipe	SD-3035	PE4710	...	20.7	60.0	D01	M05, M12
229	Polyethylene	Extruded pipe	SD-3035	PE4710	...	20.7	82.2	D01	M05, M13
230	Polyethylene	Extruded pipe	SD-3035	PE4710	...	20.7	82.2	D01	M05, M13
231	Polyethylene	Extruded pipe	SD-3035	PE4710	...	20.7	82.2	D01	M05, M13
232	Polyethylene	Extruded pipe	SD-3035	PE4710	...	20.7	82.2	D01	M05, M13
233	Polyethylene	Extruded pipe	SD-3035	PE4710	...	20.7	82.2	D01	M05, M13
234	Polyethylene	Extruded pipe	SD-3035	PE4710	...	20.7	82.2	D01	M05, M13
235	Polyethylene	Extruded pipe	SF-714	PE3608	...	20.7	60.0	D01	M08, M09
236	Polyethylene	Extruded pipe	SF-714	PE3608	...	20.7	60.0	D01	M08, M09
237	Polyethylene	Extruded pipe	SF-714	PE3608	...	20.7	60.0	D01	M08, M09
238	Polyethylene	Extruded pipe	SF-714	PE3608	...	20.7	60.0	D01	M08, M09
239	Polyethylene	Extruded pipe	SF-714	PE3608	...	20.7	60.0	D01	M08, M09
240	Polyethylene	Extruded pipe	SF-714	PE3608	...	20.7	60.0	D01	M08, M09
241	Polyethylene	Extruded pipe	SF-714	PE3608	...	20.7	60.0	D01	M08, M10
242	Polyethylene	Extruded pipe	SF-714	PE3608	...	20.7	60.0	D01	M08, M10
243	Polyethylene	Extruded pipe	SF-714	PE3608	...	20.7	60.0	D01	M08, M10
244	Polyethylene	Extruded pipe	SF-714	PE3608	...	20.7	60.0	D01	M08, M10
245	Polyethylene	Extruded pipe	SF-714	PE3608	...	20.7	60.0	D01	M08, M10
246	Polyethylene	Extruded pipe	SF-714	PE3608	...	20.7	60.0	D01	M08, M10
247	Polyethylene	Extruded pipe	SF-714	PE4608	...	20.7	60.0	D01	M08, M10
248	Polyethylene	Extruded pipe	SF-714	PE4608	...	20.7	60.0	D01	M08, M10
249	Polyethylene	Extruded pipe	SF-714	PE4608	...	20.7	60.0	D01	M08, M10
250	Polyethylene	Extruded pipe	SF-714	PE4608	...	20.7	60.0	D01	M08, M10
251	Polyethylene	Extruded pipe	SF-714	PE4608	...	20.7	60.0	D01	M08, M10
252	Polyethylene	Extruded pipe	SF-714	PE4608	...	20.7	60.0	D01	M08, M10

Table 1-1-3M Maximum Allowable Secondary Stress Range Values, S_A, for Thermoplastic Materials (Cont'd)

Line No.	Number of Equivalent Thermal Cycles, N	Maximum Allowable Secondary Stress Range, MPa [Note (1)], for Material Temperature, °C, Not Exceeding															
		23	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95
211	$N \le 1000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
212	$1000 < N \le 10000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
213	$10000 < N \le 25000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
214	$25000 < N \le 50000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
215	$50000 < N \le 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
216	$N > 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
217	$N \le 1000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
218	$1000 < N \le 10000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
219	$10000 < N \le 25000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
220	$25000 < N \le 50000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
221	$50000 < N \le 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
222	$N > 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
223	$N \le 1000$	26.8	26.3	25.3	24.3	23.3	22.2	21.2	20.1	19.0	...	...	...	...	...	...	...
224	$1000 < N \le 10000$	17.7	17.4	16.8	16.2	15.5	14.9	14.2	13.5	12.8	...	...	...	...	...	...	...
225	$10000 < N \le 25000$	15.0	14.8	14.3	13.8	13.2	12.7	12.1	11.6	11.0	...	...	...	...	...	...	...
226	$25000 < N \le 50000$	13.3	13.1	12.6	12.2	11.7	11.2	10.8	10.3	9.77	...	...	...	...	...	...	...
227	$50000 < N \le 75000$	12.3	12.1	11.7	11.3	10.9	10.5	10.0	9.59	9.11	...	...	...	...	...	...	...
228	$N > 75000$	11.7	11.5	11.2	10.8	10.4	9.97	9.55	9.12	8.68	...	...	...	...	...	...	...
229	$N \le 1000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
230	$1000 < N \le 10000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
231	$10000 < N \le 25000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
232	$25000 < N \le 50000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
233	$50000 < N \le 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
234	$N > 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
235	$N \le 1000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
236	$1000 < N \le 10000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
237	$10000 < N \le 25000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
238	$25000 < N \le 50000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
239	$50000 < N \le 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
240	$N > 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
241	$N \le 1000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
242	$1000 < N \le 10000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
243	$10000 < N \le 25000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
244	$25000 < N \le 50000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
245	$50000 < N \le 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
246	$N > 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
247	$N \le 1000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
248	$1000 < N \le 10000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
249	$10000 < N \le 25000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
250	$25000 < N \le 50000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
251	$50000 < N \le 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
252	$N > 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Table 1-1-3M Maximum Allowable Secondary Stress Range Values, S_A, for Thermoplastic Materials (Cont'd)

Line No.	Nominal Composition	Product Form	ASME Spec. No.	Type/Grade	Construction Code Notes	Minimum Yield Strength, MPa	Maximum Temperature Limit, °C	Design Factor	Notes
253	Polyethylene	Extruded pipe	SF-714	PE4710	...	20.7	60.0	D01	M08, M11
254	Polyethylene	Extruded pipe	SF-714	PE4710	...	20.7	60.0	D01	M08, M11
255	Polyethylene	Extruded pipe	SF-714	PE4710	...	20.7	60.0	D01	M08, M11
256	Polyethylene	Extruded pipe	SF-714	PE4710	...	20.7	60.0	D01	M08, M11
257	Polyethylene	Extruded pipe	SF-714	PE4710	...	20.7	60.0	D01	M08, M11
258	Polyethylene	Extruded pipe	SF-714	PE4710	...	20.7	60.0	D01	M08, M11
259	Polyethylene	Extruded pipe	SF-714	PE4710	...	20.7	60.0	D01	M08, M12
260	Polyethylene	Extruded pipe	SF-714	PE4710	...	20.7	60.0	D01	M08, M12
261	Polyethylene	Extruded pipe	SF-714	PE4710	...	20.7	60.0	D01	M08, M12
262	Polyethylene	Extruded pipe	SF-714	PE4710	...	20.7	60.0	D01	M08, M12
263	Polyethylene	Extruded pipe	SF-714	PE4710	...	20.7	60.0	D01	M08, M12
264	Polyethylene	Extruded pipe	SF-714	PE4710	...	20.7	60.0	D01	M08, M12
265	Polyethylene	Extruded pipe	SF-714	PE4710	...	20.7	82.2	D01	M08, M13
266	Polyethylene	Extruded pipe	SF-714	PE4710	...	20.7	82.2	D01	M08, M13
267	Polyethylene	Extruded pipe	SF-714	PE4710	...	20.7	82.2	D01	M08, M13
268	Polyethylene	Extruded pipe	SF-714	PE4710	...	20.7	82.2	D01	M08, M13
269	Polyethylene	Extruded pipe	SF-714	PE4710	...	20.7	82.2	D01	M08, M13
270	Polyethylene	Extruded pipe	SF-714	PE4710	...	20.7	82.2	D01	M08, M13
271	Polyethylene	Extruded pipe	SF-2619	PE3608	...	20.7	60.0	D01	M09, M14
272	Polyethylene	Extruded pipe	SF-2619	PE3608	...	20.7	60.0	D01	M09, M14
273	Polyethylene	Extruded pipe	SF-2619	PE3608	...	20.7	60.0	D01	M09, M14
274	Polyethylene	Extruded pipe	SF-2619	PE3608	...	20.7	60.0	D01	M09, M14
275	Polyethylene	Extruded pipe	SF-2619	PE3608	...	20.7	60.0	D01	M09, M14
276	Polyethylene	Extruded pipe	SF-2619	PE3608	...	20.7	60.0	D01	M09, M14
277	Polyethylene	Extruded pipe	SF-2619	PE3608	...	20.7	60.0	D01	M10, M14
278	Polyethylene	Extruded pipe	SF-2619	PE3608	...	20.7	60.0	D01	M10, M14
279	Polyethylene	Extruded pipe	SF-2619	PE3608	...	20.7	60.0	D01	M10, M14
280	Polyethylene	Extruded pipe	SF-2619	PE3608	...	20.7	60.0	D01	M10, M14
281	Polyethylene	Extruded pipe	SF-2619	PE3608	...	20.7	60.0	D01	M10, M14
282	Polyethylene	Extruded pipe	SF-2619	PE3608	...	20.7	60.0	D01	M10, M14
283	Polyethylene	Extruded pipe	SF-2619	PE4710	...	20.7	60.0	D01	M11, M14
284	Polyethylene	Extruded pipe	SF-2619	PE4710	...	20.7	60.0	D01	M11, M14
285	Polyethylene	Extruded pipe	SF-2619	PE4710	...	20.7	60.0	D01	M11, M14
286	Polyethylene	Extruded pipe	SF-2619	PE4710	...	20.7	60.0	D01	M11, M14
287	Polyethylene	Extruded pipe	SF-2619	PE4710	...	20.7	60.0	D01	M11, M14
288	Polyethylene	Extruded pipe	SF-2619	PE4710	...	20.7	60.0	D01	M11, M14
289	Polyethylene	Extruded pipe	SF-2619	PE4710	...	20.7	60.0	D01	M12, M14
290	Polyethylene	Extruded pipe	SF-2619	PE4710	...	20.7	60.0	D01	M12, M14
291	Polyethylene	Extruded pipe	SF-2619	PE4710	...	20.7	60.0	D01	M12, M14
292	Polyethylene	Extruded pipe	SF-2619	PE4710	...	20.7	60.0	D01	M12, M14
293	Polyethylene	Extruded pipe	SF-2619	PE4710	...	20.7	60.0	D01	M12, M14
294	Polyethylene	Extruded pipe	SF-2619	PE4710	...	20.7	60.0	D01	M12, M14

Table 1-1-3M Maximum Allowable Secondary Stress Range Values, S_A, for Thermoplastic Materials (Cont'd)

Line No.	Number of Equivalent Thermal Cycles, N	Maximum Allowable Secondary Stress Range, MPa [Note (1)], for Material Temperature, °C, Not Exceeding															
		23	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95
253	$N \le 1000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
254	$1000 < N \le 10000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
255	$10000 < N \le 25000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
256	$25000 < N \le 50000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
257	$50000 < N \le 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
258	$N > 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
259	$N \le 1000$	26.8	26.3	25.3	24.3	23.3	22.2	21.2	20.1	19.0	...	...	...	...	...	...	...
260	$1000 < N \le 10000$	17.7	17.4	16.8	16.2	15.5	14.9	14.2	13.5	12.8	...	...	...	...	...	...	...
261	$10000 < N \le 25000$	15.0	14.8	14.3	13.8	13.2	12.7	12.1	11.6	11.0	...	...	...	...	...	...	...
262	$25000 < N \le 50000$	13.3	13.1	12.6	12.2	11.7	11.2	10.8	10.3	9.77	...	...	...	...	...	...	...
263	$50000 < N \le 75000$	12.3	12.1	11.7	11.3	10.9	10.5	10.0	9.59	9.11	...	...	...	...	...	...	...
264	$N > 75000$	11.7	11.5	11.2	10.8	10.4	9.97	9.55	9.12	8.68	...	...	...	...	...	...	...
265	$N \le 1000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
266	$1000 < N \le 10000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
267	$10000 < N \le 25000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
268	$25000 < N \le 50000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
269	$50000 < N \le 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
270	$N > 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
271	$N \le 1000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
272	$1000 < N \le 10000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
273	$10000 < N \le 25000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
274	$25000 < N \le 50000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
275	$50000 < N \le 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
276	$N > 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
277	$N \le 1000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
278	$1000 < N \le 10000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
279	$10000 < N \le 25000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
280	$25000 < N \le 50000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
281	$50000 < N \le 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
282	$N > 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
283	$N \le 1000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
284	$1000 < N \le 10000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
285	$10000 < N \le 25000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
286	$25000 < N \le 50000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
287	$50000 < N \le 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
288	$N > 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
289	$N \le 1000$	26.8	26.3	25.3	24.3	23.3	22.2	21.2	20.1	19.0	...	...	...	...	...	...	...
290	$1000 < N \le 10000$	17.7	17.4	16.8	16.2	15.5	14.9	14.2	13.5	12.8	...	...	...	...	...	...	...
291	$10000 < N \le 25000$	15.0	14.8	14.3	13.8	13.2	12.7	12.1	11.6	11.0	...	...	...	...	...	...	...
292	$25000 < N \le 50000$	13.3	13.1	12.6	12.2	11.7	11.2	10.8	10.3	9.77	...	...	...	...	...	...	...
293	$50000 < N \le 75000$	12.3	12.1	11.7	11.3	10.9	10.5	10.0	9.59	9.11	...	...	...	...	...	...	...
294	$N > 75000$	11.7	11.5	11.2	10.8	10.4	9.97	9.55	9.12	8.68	...	...	...	...	...	...	...

Table 1-1-3M Maximum Allowable Secondary Stress Range Values, S_A, for Thermoplastic Materials (Cont'd)

Line No.	Nominal Composition	Product Form	ASME Spec. No.	Type/Grade	Construction Code Notes	Minimum Yield Strength, MPa	Maximum Temperature Limit, °C	Design Factor	Notes
295	Polyethylene	Extruded pipe	SF-2619	PE4710	...	20.7	82.2	D01	M13, M14
296	Polyethylene	Extruded pipe	SF-2619	PE4710	...	20.7	82.2	D01	M13, M14
297	Polyethylene	Extruded pipe	SF-2619	PE4710	...	20.7	82.2	D01	M13, M14
298	Polyethylene	Extruded pipe	SF-2619	PE4710	...	20.7	82.2	D01	M13, M14
299	Polyethylene	Extruded pipe	SF-2619	PE4710	...	20.7	82.2	D01	M13, M14
300	Polyethylene	Extruded pipe	SF-2619	PE4710	...	20.7	82.2	D01	M13, M14
301	PVC	Extruded pipe	SD-1785	PVC2110	C01	41.4	60.0	D01	M15
302	PVC	Extruded pipe	SD-1785	PVC2110	C01	41.4	60.0	D01	M15
303	PVC	Extruded pipe	SD-1785	PVC2110	C01	41.4	60.0	D01	M15
304	PVC	Extruded pipe	SD-1785	PVC2110	C01	41.4	60.0	D01	M15
305	PVC	Extruded pipe	SD-1785	PVC2110	C01	41.4	60.0	D01	M15
306	PVC	Extruded pipe	SD-1785	PVC2110	C01	41.4	60.0	D01	M15
307	PVC	Extruded pipe	SD-1785	PVC2112	C01	41.4	60.0	D01	M16
308	PVC	Extruded pipe	SD-1785	PVC2112	C01	41.4	60.0	D01	M16
309	PVC	Extruded pipe	SD-1785	PVC2112	C01	41.4	60.0	D01	M16
310	PVC	Extruded pipe	SD-1785	PVC2112	C01	41.4	60.0	D01	M16
311	PVC	Extruded pipe	SD-1785	PVC2112	C01	41.4	60.0	D01	M16
312	PVC	Extruded pipe	SD-1785	PVC2112	C01	41.4	60.0	D01	M16
313	PVC	Extruded pipe	SD-1785	PVC2116	C01	41.4	60.0	D01	M17
314	PVC	Extruded pipe	SD-1785	PVC2116	C01	41.4	60.0	D01	M17
315	PVC	Extruded pipe	SD-1785	PVC2116	C01	41.4	60.0	D01	M17
316	PVC	Extruded pipe	SD-1785	PVC2116	C01	41.4	60.0	D01	M17
317	PVC	Extruded pipe	SD-1785	PVC2116	C01	41.4	60.0	D01	M17
318	PVC	Extruded pipe	SD-1785	PVC2116	C01	41.4	60.0	D01	M17
319	PVC	Extruded pipe	SD-1785	PVC2120	C01	41.4	60.0	D01	M18
320	PVC	Extruded pipe	SD-1785	PVC2120	C01	41.4	60.0	D01	M18
321	PVC	Extruded pipe	SD-1785	PVC2120	C01	41.4	60.0	D01	M18
322	PVC	Extruded pipe	SD-1785	PVC2120	C01	41.4	60.0	D01	M18
323	PVC	Extruded pipe	SD-1785	PVC2120	C01	41.4	60.0	D01	M18
324	PVC	Extruded pipe	SD-1785	PVC2120	C01	41.4	60.0	D01	M18
325	PVC	Extruded tube	SD-2241	PVC2110	C01	41.4	60.0	D01	M15
326	PVC	Extruded tube	SD-2241	PVC2110	C01	41.4	60.0	D01	M15
327	PVC	Extruded tube	SD-2241	PVC2110	C01	41.4	60.0	D01	M15
328	PVC	Extruded tube	SD-2241	PVC2110	C01	41.4	60.0	D01	M15
329	PVC	Extruded tube	SD-2241	PVC2110	C01	41.4	60.0	D01	M15
330	PVC	Extruded tube	SD-2241	PVC2110	C01	41.4	60.0	D01	M15
331	PVC	Extruded tube	SD-2241	PVC2112	C01	41.4	60.0	D01	M16
332	PVC	Extruded tube	SD-2241	PVC2112	C01	41.4	60.0	D01	M16
333	PVC	Extruded tube	SD-2241	PVC2112	C01	41.4	60.0	D01	M16
334	PVC	Extruded tube	SD-2241	PVC2112	C01	41.4	60.0	D01	M16
335	PVC	Extruded tube	SD-2241	PVC2112	C01	41.4	60.0	D01	M16
336	PVC	Extruded tube	SD-2241	PVC2112	C01	41.4	60.0	D01	M16

Table 1-1-3M Maximum Allowable Secondary Stress Range Values, S_A, for Thermoplastic Materials (Cont'd)

Line No.	Number of Equivalent Thermal Cycles, N	Maximum Allowable Secondary Stress Range, MPa [Note (1)], for Material Temperature, °C, Not Exceeding															
		23	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95
295	$N \le 1000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
296	$1000 < N \le 10000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
297	$10000 < N \le 25000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
298	$25000 < N \le 50000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
299	$50000 < N \le 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
300	$N > 75000$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
301	$N \le 1000$	21.4	20.7	19.2	17.7	16.2	14.7	13.0	11.5	10.0	...	...	...	...	...	...	...
302	$1000 < N \le 10000$	12.8	12.4	11.5	10.6	9.69	8.80	7.78	6.89	5.99	...	...	...	...	...	...	...
303	$10000 < N \le 25000$	10.5	10.1	9.41	8.68	7.94	7.21	6.38	5.64	4.91	...	...	...	...	...	...	...
304	$25000 < N \le 50000$	8.98	8.71	8.08	7.45	6.82	6.19	5.48	4.85	4.22	...	...	...	...	...	...	...
305	$50000 < N \le 75000$	8.20	7.95	7.38	6.80	6.23	5.66	5.00	4.43	3.85	...	...	...	...	...	...	...
306	$75000 < N \le 100000$	7.69	7.46	6.92	6.38	5.84	5.30	4.69	4.15	3.61	...	...	...	...	...	...	...
307	$N \le 1000$	21.4	20.7	19.2	17.7	16.2	14.7	13.0	11.5	10.0	...	...	...	...	...	...	...
308	$1000 < N \le 10000$	12.8	12.4	11.5	10.6	9.69	8.80	7.78	6.89	5.99	...	...	...	...	...	...	...
309	$10000 < N \le 25000$	10.5	10.1	9.41	8.68	7.94	7.21	6.38	5.64	4.91	...	...	...	...	...	...	...
310	$25000 < N \le 50000$	8.98	8.71	8.08	7.45	6.82	6.19	5.48	4.85	4.22	...	...	...	...	...	...	...
311	$50000 < N \le 75000$	8.20	7.95	7.38	6.80	6.23	5.66	5.00	4.43	3.85	...	...	...	...	...	...	...
312	$75000 < N \le 100000$	7.69	7.46	6.92	6.38	5.84	5.30	4.69	4.15	3.61	...	...	...	...	...	...	...
313	$N \le 1000$	21.4	20.7	19.2	17.7	16.2	14.7	13.0	11.5	10.0	...	...	...	...	...	...	...
314	$1000 < N \le 10000$	12.8	12.4	11.5	10.6	9.69	8.80	7.78	6.89	5.99	...	...	...	...	...	...	...
315	$10000 < N \le 25000$	10.5	10.1	9.41	8.68	7.94	7.21	6.38	5.64	4.91	...	...	...	...	...	...	...
316	$25000 < N \le 50000$	8.98	8.71	8.08	7.45	6.82	6.19	5.48	4.85	4.22	...	...	...	...	...	...	...
317	$50000 < N \le 75000$	8.20	7.95	7.38	6.80	6.23	5.66	5.00	4.43	3.85	...	...	...	...	...	...	...
318	$75000 < N \le 100000$	7.69	7.46	6.92	6.38	5.84	5.30	4.69	4.15	3.61	...	...	...	...	...	...	...
319	$N \le 1000$	21.4	20.7	19.2	17.7	16.2	14.7	13.0	11.5	10.0	...	...	...	...	...	...	...
320	$1000 < N \le 10000$	12.8	12.4	11.5	10.6	9.69	8.80	7.78	6.89	5.99	...	...	...	...	...	...	...
321	$10000 < N \le 25000$	10.5	10.1	9.41	8.68	7.94	7.21	6.38	5.64	4.91	...	...	...	...	...	...	...
322	$25000 < N \le 50000$	8.98	8.71	8.08	7.45	6.82	6.19	5.48	4.85	4.22	...	...	...	...	...	...	...
323	$50000 < N \le 75000$	8.20	7.95	7.38	6.80	6.23	5.66	5.00	4.43	3.85	...	...	...	...	...	...	...
324	$75000 < N \le 100000$	7.69	7.46	6.92	6.38	5.84	5.30	4.69	4.15	3.61	...	...	...	...	...	...	...
325	$N \le 1000$	21.4	20.7	19.2	17.7	16.2	14.7	13.0	11.5	10.0	...	...	...	...	...	...	...
326	$1000 < N \le 10000$	12.8	12.4	11.5	10.6	9.69	8.80	7.78	6.89	5.99	...	...	...	...	...	...	...
327	$10000 < N \le 25000$	10.5	10.1	9.41	8.68	7.94	7.21	6.38	5.64	4.91	...	...	...	...	...	...	...
328	$25000 < N \le 50000$	8.98	8.71	8.08	7.45	6.82	6.19	5.48	4.85	4.22	...	...	...	...	...	...	...
329	$50000 < N \le 75000$	8.20	7.95	7.38	6.80	6.23	5.66	5.00	4.43	3.85	...	...	...	...	...	...	...
330	$75000 < N \le 100000$	7.69	7.46	6.92	6.38	5.84	5.30	4.69	4.15	3.61	...	...	...	...	...	...	...
331	$N \le 1000$	21.4	20.7	19.2	17.7	16.2	14.7	13.0	11.5	10.0	...	...	...	...	...	...	...
332	$1000 < N \le 10000$	12.8	12.4	11.5	10.6	9.69	8.80	7.78	6.89	5.99	...	...	...	...	...	...	...
333	$10000 < N \le 25000$	10.5	10.1	9.41	8.68	7.94	7.21	6.38	5.64	4.91	...	...	...	...	...	...	...
334	$25000 < N \le 50000$	8.98	8.71	8.08	7.45	6.82	6.19	5.48	4.85	4.22	...	...	...	...	...	...	...
335	$50000 < N \le 75000$	8.20	7.95	7.38	6.80	6.23	5.66	5.00	4.43	3.85	...	...	...	...	...	...	...
336	$75000 < N \le 100000$	7.69	7.46	6.92	6.38	5.84	5.30	4.69	4.15	3.61	...	...	...	...	...	...	...

Table 1-1-3M Maximum Allowable Secondary Stress Range Values, S_A, for Thermoplastic Materials (Cont'd)

Line No.	Nominal Composition	Product Form	ASME Spec. No.	Type/Grade	Construction Code Notes	Minimum Yield Strength, MPa	Maximum Temperature Limit, °C	Design Factor	Notes
337	PVC	Extruded tube	SD-2241	PVC2116	C01	41.4	60.0	D01	M17
338	PVC	Extruded tube	SD-2241	PVC2116	C01	41.4	60.0	D01	M17
339	PVC	Extruded tube	SD-2241	PVC2116	C01	41.4	60.0	D01	M17
340	PVC	Extruded tube	SD-2241	PVC2116	C01	41.4	60.0	D01	M17
341	PVC	Extruded tube	SD-2241	PVC2116	C01	41.4	60.0	D01	M17
342	PVC	Extruded tube	SD-2241	PVC2116	C01	41.4	60.0	D01	M17
343	PVC	Extruded tube	SD-2241	PVC2120	C01	41.4	60.0	D01	M18
344	PVC	Extruded tube	SD-2241	PVC2120	C01	41.4	60.0	D01	M18
345	PVC	Extruded tube	SD-2241	PVC2120	C01	41.4	60.0	D01	M18
346	PVC	Extruded tube	SD-2241	PVC2120	C01	41.4	60.0	D01	M18
347	PVC	Extruded tube	SD-2241	PVC2120	C01	41.4	60.0	D01	M18
348	PVC	Extruded tube	SD-2241	PVC2120	C01	41.4	60.0	D01	M18
349	PVC	Extruded pipe	SD-1785	PVC1120	C01	48.3	60.0	D01	M19
350	PVC	Extruded pipe	SD-1785	PVC1120	C01	48.3	60.0	D01	M19
351	PVC	Extruded pipe	SD-1785	PVC1120	C01	48.3	60.0	D01	M19
352	PVC	Extruded pipe	SD-1785	PVC1120	C01	48.3	60.0	D01	M19
353	PVC	Extruded pipe	SD-1785	PVC1120	C01	48.3	60.0	D01	M19
354	PVC	Extruded pipe	SD-1785	PVC1120	C01	48.3	60.0	D01	M19
355	PVC	Extruded pipe	SD-1785	PVC1220	C01	48.3	60.0	D01	M19
356	PVC	Extruded pipe	SD-1785	PVC1220	C01	48.3	60.0	D01	M19
357	PVC	Extruded pipe	SD-1785	PVC1220	C01	48.3	60.0	D01	M19
358	PVC	Extruded pipe	SD-1785	PVC1220	C01	48.3	60.0	D01	M19
359	PVC	Extruded pipe	SD-1785	PVC1220	C01	48.3	60.0	D01	M19
360	PVC	Extruded pipe	SD-1785	PVC1220	C01	48.3	60.0	D01	M19
361	PVC	Extruded pipe	SD-2241	PVC1120	C01	48.3	60.0	D01	M19
362	PVC	Extruded pipe	SD-2241	PVC1120	C01	48.3	60.0	D01	M19
363	PVC	Extruded pipe	SD-2241	PVC1120	C01	48.3	60.0	D01	M19
364	PVC	Extruded pipe	SD-2241	PVC1120	C01	48.3	60.0	D01	M19
365	PVC	Extruded pipe	SD-2241	PVC1120	C01	48.3	60.0	D01	M19
366	PVC	Extruded pipe	SD-2241	PVC1120	C01	48.3	60.0	D01	M19
367	PVC	Extruded pipe	SD-2241	PVC1220	C01	48.3	60.0	D01	M19
368	PVC	Extruded pipe	SD-2241	PVC1220	C01	48.3	60.0	D01	M19
369	PVC	Extruded pipe	SD-2241	PVC1220	C01	48.3	60.0	D01	M19
370	PVC	Extruded pipe	SD-2241	PVC1220	C01	48.3	60.0	D01	M19
371	PVC	Extruded pipe	SD-2241	PVC1220	C01	48.3	60.0	D01	M19
372	PVC	Extruded pipe	SD-2241	PVC1220	C01	48.3	60.0	D01	M19
373	PVC	Extruded pipe	SF-1483	PVCO 1135	C01	48.3	54.4	D01	M20, M21
374	PVC	Extruded pipe	SF-1483	PVCO 1135	C01	48.3	54.4	D01	M20, M21
375	PVC	Extruded pipe	SF-1483	PVCO 1135	C01	48.3	54.4	D01	M20, M21
376	PVC	Extruded pipe	SF-1483	PVCO 1135	C01	48.3	54.4	D01	M20, M21
377	PVC	Extruded pipe	SF-1483	PVCO 1135	C01	48.3	54.4	D01	M20, M21
378	PVC	Extruded pipe	SF-1483	PVCO 1135	C01	48.3	54.4	D01	M20, M21

Table 1-1-3M Maximum Allowable Secondary Stress Range Values, S_A, for Thermoplastic Materials (Cont'd)

Line No.	Number of Equivalent Thermal Cycles, N	Maximum Allowable Secondary Stress Range, MPa [Note (1)], for Material Temperature, °C, Not Exceeding															
		23	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95
337	$N \le 1000$	21.4	20.7	19.2	17.7	16.2	14.7	13.0	11.5	10.0	...	...	...	...	...	...	...
338	$1000 < N \le 10000$	12.8	12.4	11.5	10.6	9.69	8.80	7.78	6.89	5.99	...	...	...	...	...	...	...
339	$10000 < N \le 25000$	10.5	10.1	9.41	8.68	7.94	7.21	6.38	5.64	4.91	...	...	...	...	...	...	...
340	$25000 < N \le 50000$	8.98	8.71	8.08	7.45	6.82	6.19	5.48	4.85	4.22	...	...	...	...	...	...	...
341	$50000 < N \le 75000$	8.20	7.95	7.38	6.80	6.23	5.66	5.00	4.43	3.85	...	...	...	...	...	...	...
342	$75000 < N \le 100000$	7.69	7.46	6.92	6.38	5.84	5.30	4.69	4.15	3.61	...	...	...	...	...	...	...
343	$N \le 1000$	21.4	20.7	19.2	17.7	16.2	14.7	13.0	11.5	10.0	...	...	...	...	...	...	...
344	$1000 < N \le 10000$	12.8	12.4	11.5	10.6	9.69	8.80	7.78	6.89	5.99	...	...	...	...	...	...	...
345	$10000 < N \le 25000$	10.5	10.1	9.41	8.68	7.94	7.21	6.38	5.64	4.91	...	...	...	...	...	...	...
346	$25000 < N \le 50000$	8.98	8.71	8.08	7.45	6.82	6.19	5.48	4.85	4.22	...	...	...	...	...	...	...
347	$50000 < N \le 75000$	8.20	7.95	7.38	6.80	6.23	5.66	5.00	4.43	3.85	...	...	...	...	...	...	...
348	$75000 < N \le 100000$	7.69	7.46	6.92	6.38	5.84	5.30	4.69	4.15	3.61	...	...	...	...	...	...	...
349	$N \le 1000$	21.4	20.7	19.2	17.7	16.2	14.7	13.0	11.5	10.0	...	...	...	...	...	...	...
350	$1000 < N \le 10000$	12.8	12.4	11.5	10.6	9.69	8.80	7.78	6.89	5.99	...	...	...	...	...	...	...
351	$10000 < N \le 25000$	10.5	10.1	9.41	8.68	7.94	7.21	6.38	5.64	4.91	...	...	...	...	...	...	...
352	$25000 < N \le 50000$	8.98	8.71	8.08	7.45	6.82	6.19	5.48	4.85	4.22	...	...	...	...	...	...	...
353	$50000 < N \le 75000$	8.20	7.95	7.38	6.80	6.23	5.66	5.00	4.43	3.85	...	...	...	...	...	...	...
354	$75000 < N \le 100000$	7.69	7.46	6.92	6.38	5.84	5.30	4.69	4.15	3.61	...	...	...	...	...	...	...
355	$N \le 1000$	21.4	20.7	19.2	17.7	16.2	14.7	13.0	11.5	10.0	...	...	...	...	...	...	...
356	$1000 < N \le 10000$	12.8	12.4	11.5	10.6	9.69	8.80	7.78	6.89	5.99	...	...	...	...	...	...	...
357	$10000 < N \le 25000$	10.5	10.1	9.41	8.68	7.94	7.21	6.38	5.64	4.91	...	...	...	...	...	...	...
358	$25000 < N \le 50000$	8.98	8.71	8.08	7.45	6.82	6.19	5.48	4.85	4.22	...	...	...	...	...	...	...
359	$50000 < N \le 75000$	8.20	7.95	7.38	6.80	6.23	5.66	5.00	4.43	3.85	...	...	...	...	...	...	...
360	$75000 < N \le 100000$	7.69	7.46	6.92	6.38	5.84	5.30	4.69	4.15	3.61	...	...	...	...	...	...	...
361	$N \le 1000$	21.4	20.7	19.2	17.7	16.2	14.7	13.0	11.5	10.0	...	...	...	...	...	...	...
362	$1000 < N \le 10000$	12.8	12.4	11.5	10.6	9.69	8.80	7.78	6.89	5.99	...	...	...	...	...	...	...
363	$10000 < N \le 25000$	10.5	10.1	9.41	8.68	7.94	7.21	6.38	5.64	4.91	...	...	...	...	...	...	...
364	$25000 < N \le 50000$	8.98	8.71	8.08	7.45	6.82	6.19	5.48	4.85	4.22	...	...	...	...	...	...	...
365	$50000 < N \le 75000$	8.20	7.95	7.38	6.80	6.23	5.66	5.00	4.43	3.85	...	...	...	...	...	...	...
366	$75000 < N \le 100000$	7.69	7.46	6.92	6.38	5.84	5.30	4.69	4.15	3.61	...	...	...	...	...	...	...
367	$N \le 1000$	21.4	20.7	19.2	17.7	16.2	14.7	13.0	11.5	10.0	...	...	...	...	...	...	...
368	$1000 < N \le 10000$	12.8	12.4	11.5	10.6	9.69	8.80	7.78	6.89	5.99	...	...	...	...	...	...	...
369	$10000 < N \le 25000$	10.5	10.1	9.41	8.68	7.94	7.21	6.38	5.64	4.91	...	...	...	...	...	...	...
370	$25000 < N \le 50000$	8.98	8.71	8.08	7.45	6.82	6.19	5.48	4.85	4.22	...	...	...	...	...	...	...
371	$50000 < N \le 75000$	8.20	7.95	7.38	6.80	6.23	5.66	5.00	4.43	3.85	...	...	...	...	...	...	...
372	$75000 < N \le 100000$	7.69	7.46	6.92	6.38	5.84	5.30	4.69	4.15	3.61	...	...	...	...	...	...	...
373	$N \le 1000$	21.4	20.7	19.2	17.7	16.2	14.7	13.0	11.5	...	...	...	...	...	...	...	...
374	$1000 < N \le 10000$	12.8	12.4	11.5	10.6	9.69	8.80	7.78	6.89	...	...	...	...	...	...	...	...
375	$10000 < N \le 25000$	10.5	10.1	9.41	8.68	7.94	7.21	6.38	5.64	...	...	...	...	...	...	...	...
376	$25000 < N \le 50000$	8.98	8.71	8.08	7.45	6.82	6.19	5.48	4.85	...	...	...	...	...	...	...	...
377	$50000 < N \le 75000$	8.20	7.95	7.38	6.80	6.23	5.66	5.00	4.43	...	...	...	...	...	...	...	...
378	$75000 < N \le 100000$	7.69	7.46	6.92	6.38	5.84	5.30	4.69	4.15	...	...	...	...	...	...	...	...

Table 1-1-3M Maximum Allowable Secondary Stress Range Values, S_A, for Thermoplastic Materials (Cont'd)

Line No.	Nominal Composition	Product Form	ASME Spec. No.	Type/Grade	Construction Code Notes	Minimum Yield Strength, MPa	Maximum Temperature Limit, °C	Design Factor	Notes
379	PVDF	Extruded pipe	SF-1673	PVDF 2020	...	44.8	93.3	D01	M22
380	PVDF	Extruded pipe	SF-1673	PVDF 2020	...	44.8	93.3	D01	M22
381	PVDF	Extruded pipe	SF-1673	PVDF 2020	...	44.8	93.3	D01	M22
382	PVDF	Extruded pipe	SF-1673	PVDF 2020	...	44.8	93.3	D01	M22
383	PVDF	Extruded pipe	SF-1673	PVDF 2020	...	44.8	93.3	D01	M22
384	PVDF	Extruded pipe	SF-1673	PVDF 2020	...	44.8	93.3	D01	M22
385	PVDF	Extruded pipe	SF-1673	PVDF 2025	...	53.0	93.3	D01	M23
386	PVDF	Extruded pipe	SF-1673	PVDF 2025	...	53.0	93.3	D01	M23
387	PVDF	Extruded pipe	SF-1673	PVDF 2025	...	53.0	93.3	D01	M23
388	PVDF	Extruded pipe	SF-1673	PVDF 2025	...	53.0	93.3	D01	M23
389	PVDF	Extruded pipe	SF-1673	PVDF 2025	...	53.0	93.3	D01	M23
390	PVDF	Extruded pipe	SF-1673	PVDF 2025	...	53.0	93.3	D01	M23

Table 1-1-3M Maximum Allowable Secondary Stress Range Values, S_A, for Thermoplastic Materials (Cont'd)

Line No.	Number of Equivalent Thermal Cycles, N	Maximum Allowable Secondary Stress Range, MPa [Note (1)], for Material Temperature, °C, Not Exceeding															
		23	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95
379	$N \le 1000$	45.6	44.9	43.2	41.4	39.6	37.8	36.1	34.3	32.5	30.9	29.2	27.5	25.9	24.2	22.5	19.2
380	$1000 < N \le 10000$	43.5	42.9	41.3	39.6	38.0	36.4	34.8	33.2	31.6	29.9	28.3	26.7	25.0	23.4	21.8	18.5
381	$10000 < N \le 25000$	42.7	42.1	40.5	39.0	37.4	35.9	34.3	32.8	31.2	29.6	27.9	26.3	24.7	23.1	21.4	18.2
382	$25000 < N \le 50000$	42.0	41.4	39.9	38.4	36.9	35.4	33.9	32.4	30.9	29.3	27.7	26.1	24.4	22.8	21.2	18.0
383	$50000 < N \le 75000$	41.7	41.1	39.6	38.1	36.7	35.2	33.7	32.2	30.7	29.1	27.5	25.9	24.3	22.7	21.1	17.9
384	$75000 < N \le 100000$	41.4	40.8	39.4	37.9	36.5	35.0	33.5	32.1	30.6	29.0	27.4	25.8	24.2	22.6	21.0	17.8
385	$N \le 1000$	53.9	53.1	51.0	48.9	46.8	44.7	42.7	40.6	38.5	36.5	34.5	32.6	30.6	28.6	26.7	22.7
386	$1000 < N \le 10000$	51.5	50.7	48.8	46.9	45.0	43.1	41.2	39.2	37.3	35.4	33.5	31.5	29.6	27.7	25.7	21.9
387	$10000 < N \le 25000$	50.5	49.7	47.9	46.1	44.2	42.4	40.6	38.7	36.9	35.0	33.0	31.1	29.2	27.3	25.4	21.5
388	$25000 < N \le 50000$	49.7	49.0	47.2	45.4	43.7	41.9	40.1	38.3	36.5	34.6	32.7	30.8	28.9	27.0	25.1	21.3
389	$50000 < N \le 75000$	49.3	48.6	46.8	45.1	43.3	41.6	39.8	38.1	36.3	34.4	32.5	30.6	28.7	26.8	24.9	21.1
390	$75000 < N \le 100000$	49.0	48.3	46.5	44.8	43.1	41.4	39.6	37.9	36.2	34.3	32.4	30.5	28.6	26.7	24.8	21.0

Table 1-1-3M Maximum Allowable Secondary Stress Range Values, S_A, for Thermoplastic Materials (Cont'd)

GENERAL NOTES:

(a) The stress values in this Table may be interpolated to determine values for intermediate temperatures. The values at intermediate temperatures shall be rounded to the same number of decimal places as the value at the higher temperature between which values are being interpolated. The rounding rule is: when the next digit beyond the last place to be retained is less than 5, retain unchanged the digit in the last place retained; when the digit next beyond the last place to be retained is 5 or greater, increase by 1 the digit in the last place retained.

(b) The following abbreviations are used: CPVC, chlorinated poly(vinyl chloride); PVC, poly(vinyl chloride); and PVDF, poly(vinylidene fluoride).

NOTE: (1) Multiply MPa by 1000 to obtain kPa.

CONSTRUCTION CODE NOTE (ASME NM.1):

C01 Compounding ingredients may vary between material manufacturers for the same grade of CPVC or PVC. While these different ingredients do not impact the allowable stress values provided in this Table, they can influence the acceptability of the various joining methods allowed by ASME NM.1. In addition to the material and joining requirements set forth in ASME NM.1, the joining method to be used shall be approved by the piping component manufacturer.

DESIGN FACTOR NOTE (ASME NM.1):

D01 Allowable stress range values are based on a design factor (DF) of 0.50.

MATERIAL NOTES — CHLORINATED POLY(VINYL CHLORIDE):

M01 Material shall have a
- *(a)* minimum impact resistance of 80.1 J/m of notch at 23°C in accordance with ASTM D256
- *(b)* minimum modulus of elasticity in tension of 2482 MPa at 23°C in accordance with ASTM D638
- *(c)* minimum deflection temperature under load of 100°C at a load of 1.82 MPa in accordance with ASTM D648
- *(d)* average extent of burning of under 25 mm and an average time of burning of under 10 s in accordance with ASTM D635
- *(e)* hydrostatic design basis (HDB) of 4000 psi at 23°C and 1000 psi at 82.2°C in accordance with ASTM D2837
- *(f)* hydrostatic design stress (HDS) of 2000 psi at 23°C and 500 psi at 82.2°C in accordance with ASTM D2837

M02 Material shall have a
- *(a)* minimum impact resistance of 80.1 J/m of notch at 23°C in accordance with ASTM D256
- *(b)* minimum modulus of elasticity in tension of 2482 MPa at 23°C in accordance with ASTM D638
- *(c)* minimum deflection temperature under load of 100°C at a load of 1.82 MPa in accordance with ASTM D648
- *(d)* average extent of burning of under 25 mm and an average time of burning of under 10 s in accordance with ASTM D635
- *(e)* hydrostatic design basis (HDB) of 4000 psi at 23°C and 1250 psi at 82.2°C in accordance with ASTM D2837
- *(f)* hydrostatic design stress (HDS) of 2000 psi at 23°C and 625 psi at 82.2°C in accordance with ASTM D2837

MATERIAL NOTES — POLYAMIDE:

M03 Material shall have a
- *(a)* classification of Group 03, Class 2, and Grade 3 in accordance with ASTM D4066.
- *(b)* minimum elongation at break of 200% in accordance with ASTM D638, using a 3.2 mm ± 0.4 mm thick test specimen. The speed of testing shall be 50 mm/min ±10% at 23°C ± 2°C and 50% ± 5% relative humidity.
- *(c)* minimum flexural modulus of 900 MPa in accordance with ASTM D790, Procedure A using a 3.2 mm × 12.7 mm × 127 mm test specimen. The testing shall be performed with a crosshead speed of 1.3 mm/min (±50%) at 23°C ± 2°C and 50% ± 5% relative humidity.
- *(d)* minimum izod impact resistance of 55 J/m in accordance with ASTM D256, using a test specimen with a 12.7-mm depth, a 3.17-mm width, and a notch radius of 0.25 mm.
- *(e)* minimum deflection temperature of 40°C at 1.82 MPa in accordance with ASTM D648, using an unannealed test specimen 3.17 mm in width.
- *(f)* hydrostatic design basis (HDB) of 2500 psi at 23°C, 1600 psi at 60°C, and 1250 psi at 82.2°C in accordance with ASTM D2837.
- *(g)* hydrostatic design stress (HDS) of 1250 psi at 23°C, 800 psi at 60°C, and 625 psi at 82.2°C in accordance with ASTM D2837.

M04 Material shall have a
- *(a)* classification of Group 03, Class 2, and Grade 3 in accordance with ASTM D4066.
- *(b)* minimum elongation at break of 200% in accordance with ASTM D638, using a 3.2 mm ± 0.4 mm thick test specimen. The speed of testing shall be 50 mm/min ±10% at 23°C ± 2°C and 50% ± 5% relative humidity.
- *(c)* minimum flexural modulus of 900 MPa in accordance with ASTM D790, Procedure A using a 3.2 mm × 12.7 mm × 127 mm test specimen. The testing shall be performed with a crosshead speed of 1.3 mm/min (±50%) at 23°C ± 2°C and 50% ± 5% relative humidity.
- *(d)* minimum izod impact resistance of 55 J/m in accordance with ASTM D256, using a test specimen with a 12.7-mm depth, a 3.17-mm width, and a notch radius of 0.25 mm.
- *(e)* minimum deflection temperature of 40°C at 1.82 MPa in accordance with ASTM D648, using an unannealed test specimen 3.17 mm in width.
- *(f)* hydrostatic design basis (HDB) of 3150 psi at 23°C and 1600 psi at 82.2°C in accordance with ASTM D2837.
- *(g)* hydrostatic design stress (HDS) of 1600 psi at 23°C and 800 psi at 82.2°C in accordance with ASTM D2837.

MATERIAL NOTES — POLYETHYLENE:

M05 Material shall have a carbon black percentage of 2% to 3% in accordance with ASTM D4218 or ASTM D1603, natural with UV stabilizer, or colored with UV stabilizer.

M06 Material shall have a
- *(a)* thermal stability of over 220°C in accordance with ASTM D3350
- *(b)* maximum brittleness temperature of –60°C in accordance with ASTM D746
- *(c)* minimum tensile elongation at break of 400% in accordance with ASTM D638, using a Type IV tensile bar at 50 mm/min at 23°C

Table 1-1-3M Maximum Allowable Secondary Stress Range Values, S_A, for Thermoplastic Materials (Cont'd)

MATERIAL NOTES — POLYETHYLENE: (Cont'd):
(d) slow crack growth resistance of over 500 h in accordance with ASTM F1473 at 2.4 MPa and 80°C in air
(e) hydrostatic design basis (HDB) of 1250 psi at 23°C and 1000 psi at 60°C in accordance with ASTM D2837, PPI TR-3, and PPI TR-4
(f) hydrostatic design stress (HDS) of 800 psi at 23°C in accordance with ASTM D2837, PPI TR-3, and PPI TR-4.

M07 Material shall have a
(a) thermal stability of over 220°C in accordance with ASTM D3350
(b) maximum brittleness temperature of –60°C in accordance with ASTM D746
(c) minimum tensile elongation at break of 400% in accordance with ASTM D638, using a Type IV tensile bar at 50 mm/min at 23°C
(d) slow crack growth resistance of over 500 h in accordance with ASTM F1473 at 2.4 MPa and 80°C in air
(e) hydrostatic design basis (HDB) of 1250 psi at 23°C and 630 psi at 82.2°C in accordance with ASTM D2837, PPI TR-3, and PPI TR-4
(f) hydrostatic design stress (HDS) of 800 psi at 23°C in accordance with ASTM D2837, PPI TR-3, and PPI TR-4

M08 Material shall have a carbon black percentage of 2% to 3% in accordance with ASTM D4218 or ASTM D1603, or colored with UV stabilizer.

M09 Material shall have a
(a) thermal stability of over 220°C in accordance with ASTM D3350
(b) maximum brittleness temperature of –60°C in accordance with ASTM D746
(c) minimum tensile elongation at break of 400% in accordance with ASTM D638, using a Type IV tensile bar at 50 mm/min at 23°C
(d) slow crack growth resistance of over 100 h in accordance with ASTM F1473 at 2.4 MPa and 80°C in air
(e) hydrostatic design basis (HDB) of 1600 psi at 23°C and 800 psi at 60°C in accordance with ASTM D2837, PPI TR-3, and PPI TR-4
(f) hydrostatic design stress (HDS) of 800 psi at 23°C in accordance with ASTM D2837, PPI TR-3, and PPI TR-4

M10 Material shall have a
(a) thermal stability of over 220°C in accordance with ASTM D3350
(b) maximum brittleness temperature of –60°C in accordance with ASTM D746
(c) minimum tensile elongation at break of 400% in accordance with ASTM D638, using a Type IV tensile bar at 50 mm/min at 23°C
(d) slow crack growth resistance of over 100 h in accordance with ASTM F1473 at 2.4 MPa and 80°C in air
(e) hydrostatic design basis (HDB) of 1600 psi at 23°C and 1000 psi at 60°C in accordance with ASTM D2837, PPI TR-3, and PPI TR-4
(f) hydrostatic design stress (HDS) of 800 psi at 23°C in accordance with ASTM D2837, PPI TR-3, and PPI TR-4

M11 Material shall have a
(a) thermal stability of over 220°C in accordance with ASTM D3350
(b) maximum brittleness temperature of –60°C in accordance with ASTM D746
(c) minimum tensile elongation at break of 400% in accordance with ASTM D638, using a Type IV tensile bar at 50 mm/min at 23°C
(d) slow crack growth resistance of over 500 h in accordance with ASTM F1473 at 2.4 MPa and 80°C in air
(e) hydrostatic design basis (HDB) of 1600 psi at 23°C and 800 psi at 60°C in accordance with ASTM D2837, PPI TR-3, and PPI TR-4
(f) hydrostatic design stress (HDS) of 1000 psi at 23°C in accordance with ASTM D2837, PPI TR-3, and PPI TR-4

M12 Material shall have a
(a) thermal stability of over 220°C in accordance with ASTM D3350
(b) maximum brittleness temperature of –60°C in accordance with ASTM D746
(c) minimum tensile elongation at break of 400% in accordance with ASTM D638, using a Type IV tensile bar at 50 mm/min at 23°C
(d) slow crack growth resistance of over 500 h in accordance with ASTM F1473 at 2.4 MPa and 80°C in air
(e) hydrostatic design basis (HDB) of 1600 psi at 23°C and 1000 psi at 60°C in accordance with ASTM D2837, PPI TR-3, and PPI TR-4
(f) hydrostatic design stress (HDS) of 1000 psi at 23°C in accordance with ASTM D2837, PPI TR-3, and PPI TR-4

M13 Material shall have a
(a) thermal stability of over 220°C in accordance with ASTM D3350
(b) maximum brittleness temperature of –60°C in accordance with ASTM D746
(c) minimum tensile elongation at break of 400% in accordance with ASTM D638, using a Type IV tensile bar at 50 mm/min at 23°C
(d) slow crack growth resistance of over 500 h in accordance with ASTM F1473 at 2.4 MPa and 80°C in air
(e) hydrostatic design basis (HDB) of 1600 psi at 23°C and 800 psi at 82.2°C in accordance with ASTM D2837, PPI TR-3, and PPI TR-4
(f) hydrostatic design stress (HDS) of 1000 psi at 23°C in accordance with ASTM D2837, PPI TR-3, and PPI TR-4

M14 Material shall have a carbon black percentage of 2% to 3% in accordance with ASTM D4218 or ASTM D1603.

MATERIAL NOTES — POLY(VINYL CHLORIDE):

M15 Material shall have a
(a) minimum impact resistance of 266.9 J/m of notch at 23°C in accordance with ASTM D256
(b) minimum modulus of elasticity in tension of 2206 MPa at 23°C in accordance with ASTM D638
(c) minimum deflection temperature under load of 60°C at a load of 1.82 MPa in accordance with ASTM D648
(d) average extent of burning of under 25 mm and an average time of burning of under 10 s in accordance with ASTM D635
(e) hydrostatic design basis (HDB) of 2000 psi at 23°C in accordance with ASTM D2837
(f) hydrostatic design stress (HDS) of 1000 psi at 23°C in accordance with ASTM D2837

M16 Material shall have a
(a) minimum impact resistance of 266.9 J/m of notch at 23°C in accordance with ASTM D256
(b) minimum modulus of elasticity in tension of 2206 MPa at 23°C in accordance with ASTM D638
(c) minimum deflection temperature under load of 60°C at a load of 1.82 MPa in accordance with ASTM D648
(d) average extent of burning of under 25 mm and an average time of burning of under 10 s in accordance with ASTM D635
(e) hydrostatic design basis (HDB) of 2500 psi at 23°C in accordance with ASTM D2837
(f) hydrostatic design stress (HDS) of 1250 psi at 23°C in accordance with ASTM D2837

M17 Material shall have a
(a) minimum impact resistance of 266.9 J/m of notch at 23°C in accordance with ASTM D256
(b) minimum modulus of elasticity in tension of 2206 MPa at 23°C in accordance with ASTM D638
(c) minimum deflection temperature under load of 60°C at a load of 1.82 MPa in accordance with ASTM D648

Table 1-1-3M Maximum Allowable Secondary Stress Range Values, S_A, for Thermoplastic Materials (Cont'd)

MATERIAL NOTES — POLY(VINYL CHLORIDE): (Cont'd):

(d) average extent of burning of under 25 mm and an average time of burning of under 10 s in accordance with ASTM D635
(e) hydrostatic design basis (HDB) of 3200 psi at 23°C in accordance with ASTM D2837
(f) hydrostatic design stress (HDS) of 1600 psi at 23°C in accordance with ASTM D2837

M18 Material shall have a

(a) minimum impact resistance of 266.9 J/m of notch at 23°C in accordance with ASTM D256
(b) minimum modulus of elasticity in tension of 2206 MPa at 23°C in accordance with ASTM D638
(c) minimum deflection temperature under load of 60°C at a load of 1.82 MPa in accordance with ASTM D648
(d) average extent of burning of under 25 mm and an average time of burning of under 10 s in accordance with ASTM D635
(e) hydrostatic design basis (HDB) of 4000 psi at 23°C in accordance with ASTM D2837
(f) hydrostatic design stress (HDS) of 2000 psi at 23°C in accordance with ASTM D2837

M19 Material shall have a

(a) minimum impact resistance of 34.7 J/m of notch at 23°C in accordance with ASTM D256
(b) minimum modulus of elasticity in tension of 2758 MPa at 23°C in accordance with ASTM D638
(c) minimum deflection temperature under load of 70°C at a load of 1.82 MPa in accordance with ASTM D648
(d) average extent of burning of under 25 mm and an average time of burning of under 10 s in accordance with ASTM D635
(e) hydrostatic design basis (HDB) of 4000 psi at 23°C in accordance with ASTM D2837
(f) hydrostatic design stress (HDS) of 2000 psi at 23°C in accordance with ASTM D2837

M20 Material shall have a

(a) minimum impact resistance of 266.9 J/m of notch at 23°C in accordance with ASTM D256
(b) minimum modulus of elasticity in tension of 2206 MPa at 23°C in accordance with ASTM D638
(c) minimum deflection temperature under load of 60°C at a load of 1.82 MPa in accordance with ASTM D648
(d) average extent of burning of under 25 mm and an average time of burning of under 10 s in accordance with ASTM D635
(e) hydrostatic design basis (HDB) of 7100 psi at 23°C in accordance with ASTM D2837
(f) hydrostatic design stress (HDS) of 3550 psi at 23°C in accordance with ASTM D2837

M21 Allowable stress values apply to both the oriented and unoriented directions.

MATERIAL NOTES — POLY(VINYLIDENE FLUORIDE):

M22 Material shall have a

(a) classification of Type I in accordance with ASME SD-3222
(b) minimum impact resistance of 80.0 J/m of notch at 23°C in accordance with ASTM D256
(c) minimum flexural modulus of 1.38 GPa at 23°C in accordance with ASTM D790, using Method I
(d) minimum tensile elongation at break of 10% in accordance with ASTM D638, using a Type I tensile bar at 51 mm/min at 23°C
(e) hydrostatic design basis (HDB) of 4000 psi at 23°C and 1250 psi at 93.3°C in accordance with ASTM D2837
(f) hydrostatic design stress (HDS) of 2000 psi at 23°C and 625 psi at 93.3°C in accordance with ASTM D2837

M23 Material shall have a

(a) classification of Type II in accordance with ASME SD-3222
(b) minimum flexural modulus of 1.38 GPa at 23°C in accordance with ASTM D790, using Method I
(c) minimum tensile elongation at break of 10% in accordance with ASTM D638, using a Type I tensile bar at 51 mm/min at 23°C
(d) hydrostatic design basis (HDB) of 5000 psi at 23°C and 1250 psi at 120°C in accordance with ASTM D2837
(e) hydrostatic design stress (HDS) of 2500 psi at 23°C and 625 psi at 120°C in accordance with ASTM D2837

TABLE STARTS ON NEXT PAGE

Table 1-1-YM Yield Strength Values, S_y, for Thermoplastic Materials

Line No.	Nominal Composition	Product Form	ASME Spec. No.	Type/Grade	Minimum Yield Strength, MPa	Notes
1	CPVC	Extruded pipe	SD-2846	CPVC 4120-05	48.3	M01
2	CPVC	Extruded pipe	SD-2846	CPVC 4120-06	48.3	M01
3	CPVC	Extruded pipe	SF-441	CPVC 4120-05	48.3	M01
4	CPVC	Extruded pipe	SF-441	CPVC 4120-06	48.3	M01
5	CPVC	Extruded pipe	SF-442	CPVC 4120-05	48.3	M01
6	CPVC	Extruded pipe	SF-442	CPVC 4120-06	48.3	M01
7	Polyamide	Extruded pipe	SF-2945	PA 32312	48.0	M02
8	Polyamide	Extruded pipe	SF-2945	PA 32316	48.0	M02
9	Polyethylene	Extruded pipe	SD-2239	PE2708	17.9	M03
10	Polyethylene	Extruded pipe	SD-2513	PE2708	17.9	M03
11	Polyethylene	Extruded tube	SD-2737	PE2708	17.9	M03
12	Polyethylene	Extruded pipe	SD-3035	PE2708	17.9	M03
13	Polyethylene	Extruded pipe	SF-714	PE2708	17.9	M03
14	Polyethylene	Extruded pipe	SD-2239	PE3608	20.7	M03
15	Polyethylene	Extruded pipe	SD-2239	PE4608	20.7	M03
16	Polyethylene	Extruded pipe	SD-2239	PE4710	20.7	M03
17	Polyethylene	Extruded pipe	SD-2513	PE4710	20.7	M03
18	Polyethylene	Extruded tube	SD-2737	PE3608	20.7	M03
19	Polyethylene	Extruded tube	SD-2737	PE4608	20.7	M03
20	Polyethylene	Extruded tube	SD-2737	PE4710	20.7	M03
21	Polyethylene	Extruded pipe	SD-3035	PE3608	20.7	M03
22	Polyethylene	Extruded pipe	SD-3035	PE4608	20.7	M03
23	Polyethylene	Extruded pipe	SD-3035	PE4710	20.7	M03
24	Polyethylene	Extruded pipe	SF-714	PE3608	20.7	M03
25	Polyethylene	Extruded pipe	SF-714	PE4608	20.7	M03
26	Polyethylene	Extruded pipe	SF-714	PE4710	20.7	M03
27	Polyethylene	Extruded pipe	SF-2619	PE3608	20.7	M03
28	Polyethylene	Extruded pipe	SF-2619	PE4710	20.7	M03
29	PVC	Extruded pipe	SD-1785	PVC2110	41.4	M01
30	PVC	Extruded pipe	SD-1785	PVC2112	41.4	M01
31	PVC	Extruded pipe	SD-1785	PVC2116	41.4	M01
32	PVC	Extruded pipe	SD-1785	PVC2120	41.4	M01
33	PVC	Extruded tube	SD-2241	PVC2110	41.4	M01
34	PVC	Extruded tube	SD-2241	PVC2112	41.4	M01
35	PVC	Extruded tube	SD-2241	PVC2116	41.4	M01
36	PVC	Extruded tube	SD-2241	PVC2120	41.4	M01

Table 1-1-YM Yield Strength Values, S_y, for Thermoplastic Materials

Line No.	Yield Strength, MPa [Note (1)], for Material Temperature, °C, Not Exceeding															
	23	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95
1	48.3	47.3	45.4	43.5	41.5	40.1	38.2	36.2	34.3	32.4	30.4	28.5	26.6	24.6	22.7	20.8
2	48.3	47.3	45.4	43.5	41.5	40.1	38.2	36.2	34.3	32.4	30.4	28.5	26.6	24.6	22.7	20.8
3	48.3	47.3	45.4	43.5	41.5	40.1	38.2	36.2	34.3	32.4	30.4	28.5	26.6	24.6	22.7	20.8
4	48.3	47.3	45.4	43.5	41.5	40.1	38.2	36.2	34.3	32.4	30.4	28.5	26.6	24.6	22.7	20.8
5	48.3	47.3	45.4	43.5	41.5	40.1	38.2	36.2	34.3	32.4	30.4	28.5	26.6	24.6	22.7	20.8
6	48.3	47.3	45.4	43.5	41.5	40.1	38.2	36.2	34.3	32.4	30.4	28.5	26.6	24.6	22.7	20.8
7	48.0	46.3	42.6	39.2	36.1	33.4	30.9	28.7	26.8	25.2	23.9	22.9	22.2	21.8	...	...
8	48.0	46.3	42.6	39.2	36.1	33.4	30.9	28.7	26.8	25.2	23.9	22.9	22.2	21.8	...	...
9	17.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10	17.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	17.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	17.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	17.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	20.7	20.1	18.7	17.3	15.9	14.5	13.1	11.7	10.3	8.89	7.49	...	...	...	...	...
15	20.7	20.1	18.7	17.2	15.8	14.4	13.0	11.6	10.2	8.81	7.41	6.00	4.59	...	...	...
16	20.7	20.1	18.7	17.2	15.8	14.4	13.0	11.6	10.2	8.81	7.41	6.00	4.59	...	...	...
17	20.7	20.1	18.7	17.2	15.8	14.4	13.0	11.6	10.2	8.81	7.41	6.00	4.59	...	...	...
18	20.7	20.1	18.7	17.3	15.9	14.5	13.1	11.7	10.3	8.89	7.49	...	...	...	...	...
19	20.7	20.1	18.7	17.2	15.8	14.4	13.0	11.6	10.2	8.81	7.41	6.00	4.59	...	...	...
20	20.7	20.1	18.7	17.2	15.8	14.4	13.0	11.6	10.2	8.81	7.41	6.00	4.59	...	...	...
21	20.7	20.1	18.7	17.3	15.9	14.5	13.1	11.7	10.3	8.89	7.49	...	...	...	...	...
22	20.7	20.1	18.7	17.2	15.8	14.4	13.0	11.6	10.2	8.81	7.41	6.00	4.59	...	...	...
23	20.7	20.1	18.7	17.2	15.8	14.4	13.0	11.6	10.2	8.81	7.41	6.00	4.59	...	...	...
24	20.7	20.1	18.7	17.3	15.9	14.5	13.1	11.7	10.3	8.89	7.49	...	...	...	...	...
25	20.7	20.1	18.7	17.2	15.8	14.4	13.0	11.6	10.2	8.81	7.41	6.00	4.59	...	...	...
26	20.7	20.1	18.7	17.2	15.8	14.4	13.0	11.6	10.2	8.81	7.41	6.00	4.59	...	...	...
27	20.7	20.1	18.7	17.3	15.9	14.5	13.1	11.7	10.3	8.89	7.49	...	...	...	...	...
28	20.7	20.1	18.7	17.2	15.8	14.4	13.0	11.6	10.2	8.81	7.41	6.00	4.59	...	...	...
29	41.4	40.2	37.3	34.4	31.5	28.6	25.3	22.4	18.9	...	...	...	...	...	...	...
30	41.4	40.2	37.3	34.4	31.5	28.6	25.3	22.4	18.9	...	...	...	...	...	...	...
31	41.4	40.2	37.3	34.4	31.5	28.6	25.3	22.4	18.9	...	...	...	...	...	...	...
32	41.4	40.2	37.3	34.4	31.5	28.6	25.3	22.4	18.9	...	...	...	...	...	...	...
33	41.4	40.2	37.3	34.4	31.5	28.6	25.3	22.4	18.9	...	...	...	...	...	...	...
34	41.4	40.2	37.3	34.4	31.5	28.6	25.3	22.4	18.9	...	...	...	...	...	...	...
35	41.4	40.2	37.3	34.4	31.5	28.6	25.3	22.4	18.9	...	...	...	...	...	...	...
36	41.4	40.2	37.3	34.4	31.5	28.6	25.3	22.4	18.9	...	...	...	...	...	...	...

Table 1-1-YM Yield Strength Values, S_y, for Thermoplastic Materials (Cont'd)

Line No.	Nominal Composition	Product Form	ASME Spec. No.	Type/Grade	Minimum Yield Strength, MPa	Notes
37	PVC	Extruded pipe	SD-1785	PVC1120	48.3	M01
38	PVC	Extruded pipe	SD-1785	PVC1220	48.3	M01
39	PVC	Extruded pipe	SD-2241	PVC1120	48.3	M01
40	PVC	Extruded pipe	SD-2241	PVC1220	48.3	M01
41	PVC	Extruded pipe	SF-1483	PVCO 1135	48.3	M01, M04
42	PVC	Extruded pipe	SF-1483	PVCO 1135	76.5	M01, M05
43	PVDF	Extruded pipe	SF-1673	PVDF 2020	44.8	M06
44	PVDF	Extruded pipe	SF-1673	PVDF 2025	53.0	M06

GENERAL NOTES:

(a) The tabulated values of yield strength are those that the Committee believes are suitable for use in design calculations. At temperatures above room temperature, the yield strength values correspond to the yield strength trend curve adjusted to the minimum specified room-temperature yield strength. The yield strength values do not correspond exactly to "minimum" or "average" as these terms are applied to a statistical treatment of a homogeneous set of data. Neither the ASME material specifications nor the rules of ASME NM.1 require elevated temperature testing for yield strengths of production material for use in Code components. It is not intended that results of such tests, if performed, be compared with these tabulated yield strength values for ASME Code acceptance/rejection purposes for materials. If some elevated temperature test results on production material appear lower than the tabulated values by a large amount (more than the typical variability of material and suggesting the possibility of some error), further investigation by retest or other means should be considered.

(b) Notes limiting applications of these materials appear in Tables 1-1-1M, 1-1-2M, and 1-1-3M.

(c) The stress values in this Table may be interpolated to determine values for intermediate temperatures. The values at intermediate temperatures shall be rounded to the same number of decimal places as the value at the higher temperature between which values are being interpolated. The rounding rule is: when the next digit beyond the last place to be retained is less than 5, retain unchanged the digit in the last place retained; when the digit next beyond the last place to be retained is 5 or greater, increase by 1 the digit in the last place retained.

(d) The following abbreviations are used: CPVC, chlorinated poly(vinyl chloride); PVC, poly(vinyl chloride); and PVDF, poly(vinylidene fluoride).

(e) Chlorinated poly(vinyl chloride), polyamide, polyethylene, poly(vinyl chloride), and poly(vinylidene fluoride) are viscoelastic materials. The stress values in this Table are based on short-duration loads and are not appropriate for use as design stresses for long-term sustained loads.

NOTE: (1) Multiply MPa by 1000 to obtain kPa.

MATERIAL NOTES:

M01 The stress values for chlorinated poly(vinyl chloride) and poly(vinyl chloride) in this Table are based on tensile testing in accordance with ASTM D638 using a Type I tensile bar at 5.1 mm/min at 23°C. At other strain rates, other values may apply.

M02 The stress values for polyamide in this Table are based on tensile testing in accordance with ASTM D638, using a 3.2 mm ± 0.4 mm thick test specimen. The speed of testing shall be 50 mm/min ±10% at 23°C ± 2°C and 50% ± 5% relative humidity. At other strain rates, other values may apply.

M03 The stress values for polyethylene in this Table are based on tensile testing in accordance with ASTM D638 using a Type IV tensile bar at 51 mm/min at 23°C. At other strain rates, other values may apply.

M04 These stress values for oriented poly(vinyl chloride) apply to the unoriented directions only.

M05 These stress values for oriented poly(vinyl chloride) apply to the oriented direction only.

M06 The stress values for poly(vinylidene fluoride) in this Table are based on tensile testing in accordance with ASTM D638 using a Type I tensile bar at 51 mm/min at 23°C. At other strain rates, other values may apply.

Table 1-1-YM Yield Strength Values, S_y, for Thermoplastic Materials (Cont'd)

Line No.	Yield Strength, MPa [Note (1)], for Material Temperature, °C, Not Exceeding															
	23	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95
37	48.3	46.9	43.5	40.1	36.7	33.3	29.5	26.1	22.0	...	...	...	...	...	...	...
38	48.3	46.9	43.5	40.1	36.7	33.3	29.5	26.1	22.0	...	...	...	...	...	...	...
39	48.3	46.9	43.5	40.1	36.7	33.3	29.5	26.1	22.0	...	...	...	...	...	...	...
40	48.3	46.9	43.5	40.1	36.7	33.3	29.5	26.1	22.0	...	...	...	...	...	...	...
41	48.3	46.9	43.5	40.1	36.7	33.3	29.5	26.1	...	...	...	...	...	...	...	...
42	76.5	74.2	68.9	63.5	58.1	52.8	46.7	41.3	...	...	...	...	...	...	...	...
43	44.8	44.1	42.4	40.8	39.1	37.5	35.8	34.2	32.5	30.9	29.2	27.6	25.9	24.3	22.6	21.0
44	53.0	51.8	49.3	47.0	44.8	42.8	40.9	39.1	37.3	35.6	33.9	32.3	30.6	29.0	27.4	25.7

Table 1-2.1-1M Data Sheet for Fiberglass Unsaturated Polyester Resin Type I (SC-582)

Description and Service Limits	
Reinforcement material:	Fiberglass (Type E or ECR glass)
Resin material:	Unsaturated polyester resin
Reinforcement pattern:	Random glass
Structural wall thickness range, mm:	2.5 to 17.5
Liner thickness, mm:	2.5

Modulus Data [Notes (1), (2), and (3)]

			Modulus of Elasticity for Total Wall Thickness, mm (Including 2.5-mm Liner), and Temperature, °C											
			Up to and Including 25°C				65°C				93°C			
Property	Symbol	ASTM Test Method	5	10	15	20 and Over	5	10	15	20 and Over	5	10	15	20 and Over
Axial tensile, MPa	E_{AT}	D638, D1599, or D2105	7.72E+03	7.79E+03	7.79E+03	7.79E+03	6.84E+03	6.90E+03	6.97E+03	6.97E+03	5.99E+03	6.06E+03	6.08E+03	6.10E+03
Axial compressive, MPa	E_{AC}	D695	7.72E+03	7.79E+03	7.79E+03	7.79E+03	6.84E+03	6.90E+03	6.97E+03	6.97E+03	5.99E+03	6.06E+03	6.08E+03	6.10E+03
Axial flexural, MPa	E_{AF}	D790 or D2925	7.45E+03	7.59E+03	7.72E+03	7.72E+03	6.59E+03	6.76E+03	6.83E+03	6.88E+03	5.75E+03	5.92E+03	5.99E+03	6.03E+03
Hoop tensile, MPa	E_{HT}	D638, D1599, or D2290	7.72E+03	7.79E+03	7.79E+03	7.79E+03	6.84E+03	6.90E+03	6.97E+03	6.97E+03	5.99E+03	6.06E+03	6.08E+03	6.10E+03
Hoop flexural, MPa	E_{HF}	D790 or D2412	7.45E+03	7.59E+03	7.72E+03	7.72E+03	6.59E+03	6.76E+04	6.83E+03	6.88E+04	5.75E+03	5.92E+03	5.99E+03	6.03E+03
In–plane shear, MPa	G	D4255	2.88E+03	2.90E+03	2.92E+03	2.92E+03	2.56E+03	2.58E+03	2.59E+03	2.60E+03	2.24E+03	2.27E+03	2.28E+03	2.28E+03

Other Property Data [Notes (1), (2), and (3)]

Property	Symbol	Test Method	Value for 5-mm Thickness
Poisson's ratio: hoop–axial tensile	ν_{HAT}	...	0.34
Poisson's ratio: axial–hoop tensile	ν_{AHT}	...	0.34
Coefficient of thermal expansion, mm/mm/°C: axial	α_A	D696	3.79E–05
Coefficient of thermal expansion, mm/mm/°C: hoop	α_H	...	3.79E–05
Density, kg/m^3	ρ	D792	1411.675
Thermal conductivity, W/(m-K)	k	C1045	0.182506

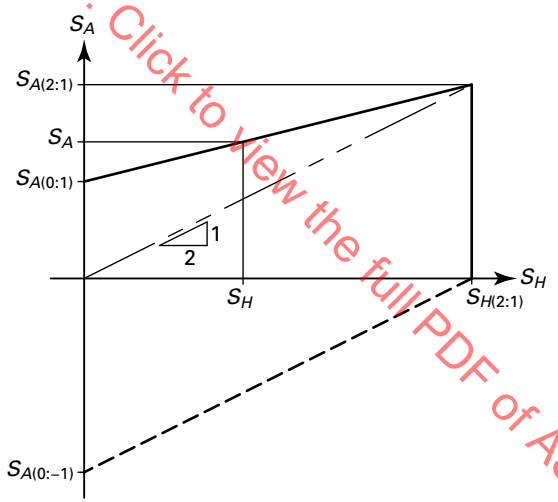
Allowable Stress Data [Note (4)]

Property	Symbol	ASTM Test Method	25°C	65°C	93°C
Axial tensile, MPa	$S_{A(0:1)}$	D638 or D2105	7.79E+00	6.90E+00	6.06E+00
Axial flexural, MPa	$S_{Af(0:1)}$	D790 or D2925	1.14E+01	1.01E+01	8.90E+00
Axial compressive, MPa	$S_{A(0:-1)}$	D695	7.79E+00	6.90E+00	6.06E+00
Axial 2 × 1 biaxial tensile, MPa	$S_{A(2:1)}$	D1599	7.79E+00	6.90E+00	6.06E+00
Hoop 2 × 1 biaxial tensile, MPa	$S_{H(2:1)}$	D1599	7.79E+00	6.90E+00	6.06E+00
Hoop tensile, MPa	$S_{H(1:0)}$	D638, D1599, or D2290	7.79E+00	6.90E+00	6.06E+00
In-plane shear, MPa	τ	D4255	2.90E+00	2.58E+00	2.27E+00

Table 1-2.1-1M Data Sheet for Fiberglass Unsaturated Polyester Resin Type I (SC-582) (Cont'd)

Ultimate Stress Data [Note (4)]

Property	Symbol	ASTM Test Method	25°C	65°C	93°C
Axial tensile, MPa	$S_{A(0:1)}$	D638 or D2105	7.79E+01	6.90E+01	6.06E+01
Axial flexural, MPa	$S_{Af(0:1)}$	D790 or D2925	1.14E+02	1.01E+02	8.90E+01
Axial compressive, MPa	$S_{A(0:-1)}$	D695	7.79E+01	6.90E+01	6.06E+01
Axial 2 × 1 biaxial tensile, MPa	$S_{A(2:1)}$	D1599	7.79E+01	6.90E+01	6.06E+01
Hoop 2 × 1 biaxial tensile, MPa	$S_{H(2:1)}$	D1599	7.79E+01	6.90E+01	6.06E+01
Hoop tensile, MPa	$S_{H(1:0)}$	D638, D1599, or D2290	7.79E+01	6.90E+01	6.06E+01
In-plane shear, MPa	τ	D4255	2.90E+01	2.58E+01	2.27E+01



Allowable Stress Envelope

GENERAL NOTES:

(a) The values in these tables may be interpolated to determine values for intermediate temperatures and thicknesses.

(b) Refer to ASME NM.2, Table 3-3.1-1 for limitations on service based on temperature.

(c) The maximum allowable design stress value shall be 12 410 kPa for flanges constructed of Type I laminates.

NOTES:

(1) Elastic properties apply to total wall, not just to structural wall. This is to ensure that the loads on the piping, the supports, and the connected equipment, as calculated in the pipe stress analysis, are not understated.

(2) For modulus values of the structural wall only, or for pipe for which the liner thickness is 0.0 mm, it is permissible to use the modulus values applicable to a total wall thickness of 20 mm and over.

(3) Elastic properties may also be determined in accordance with ASME NM.2, Mandatory Appendix II.

(4) Allowable and ultimate stress values apply to the structural wall only, not the total wall thickness.

Table 1-2.1-2M Data Sheet for Fiberglass Unsaturated Polyester Resin Type II (SC-582)

Description and Service Limits	
Reinforcement material:	Fiberglass (Type E or ECR glass)
Resin material:	Unsaturated polyester resin
Reinforcement pattern:	Random glass/WR (0/90)
Structural wall thickness range, mm:	2.5 to 17.5
Liner thickness, mm:	2.5

Modulus Data [Notes (1), (2), and (3)]

			Modulus of Elasticity for Total Wall Thickness, mm (Including 2.5-mm Liner), and Temperature, °C											
			Up to and Including 25°C				65°C				93°C			
Property	Symbol	ASTM Test Method	5	10	15	20 and Over	5	10	15	20 and Over	5	10	15	20 and Over
Axial tensile, MPa	E_{AT}	D638, D1599, or D2105	9.10E+03	1.04E+04	1.14E+04	1.15E+04	8.21E+03	9.52E+03	1.04E+04	1.06E+04	7.31E+03	8.62E+03	9.52E+03	9.66E+03
Axial compressive, MPa	E_{AC}	D695	9.10E+03	1.04E+04	1.14E+04	1.15E+04	8.21E+03	9.52E+03	1.04E+04	1.06E+04	7.31E+03	8.62E+03	9.52E+03	9.66E+03
Axial flexural, MPa	E_{AF}	D790 or D2925	8.14E+03	8.48E+03	9.93E+03	9.93E+03	7.24E+03	7.59E+03	9.03E+03	9.03E+03	6.35E+03	6.74E+03	8.14E+03	8.21E+03
Hoop tensile, MPa	E_{HT}	D638, D1599, or D2290	9.17E+03	1.04E+04	1.14E+04	1.15E+04	8.21E+03	9.52E+03	1.04E+04	1.06E+04	7.31E+03	8.62E+03	9.52E+03	9.66E+03
Hoop flexural, MPa	E_{HF}	D790 or D2412	8.14E+03	8.48E+03	9.93E+03	9.93E+03	7.59E+03	7.59E+03	9.03E+03	9.03E+03	6.30E+03	6.72E+04	8.14E+03	8.21E+03
In-plane shear, MPa	G	D4255	2.83E+03	2.83E+03	2.81E+03	2.81E+03	2.48E+03	2.46E+03	2.41E+03	2.42E+03	2.13E+03	2.09E+03	2.03E+03	2.03E+03

Other Property Data [Notes (1), (2), and (3)]

Property	Symbol	Test Method	Value for 5-mm Thickness
Poisson's ratio: hoop–axial tensile	ν_{HAT}	...	0.29
Poisson's ratio: axial–hoop tensile	ν_{AHT}	...	0.29
Coefficient of thermal expansion, mm/mm/°C: axial	α_A	D696	3.47E–05
Coefficient of thermal expansion, mm/mm/°C: hoop	α_H	...	3.47E–05
Density, kg/m^3	ρ	D792	1467.035
Thermal conductivity, W/(m-K)	k	C1045	1.7564

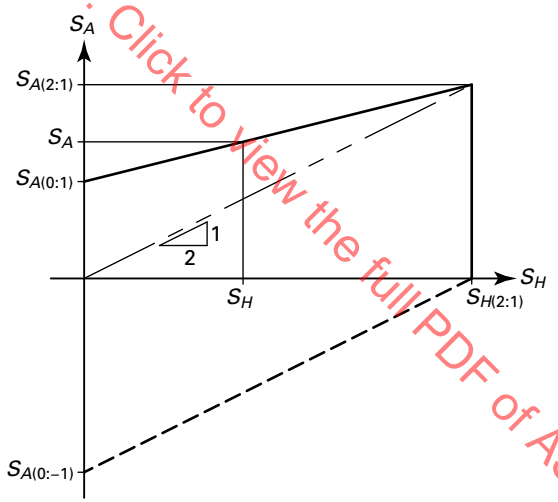
Allowable Stress Data [Note (4)]

Property	Symbol	ASTM Test Method	25°C	65°C	93°C
Axial tensile, MPa	$S_{A(0:1)}$	D638 or D2105	1.35E+01	1.23E+01	1.12E+01
Axial flexural, MPa	$S_{Af(0:1)}$	D790 or D2925	1.70E+01	1.52E+01	1.34E+01
Axial compressive, MPa	$S_{A(0:-1)}$	D695	1.35E+01	1.23E+01	1.12E+01
Axial 2 × 1 biaxial tensile, MPa	$S_{A(2:1)}$	D1599	1.36E+01	1.23E+01	1.12E+01
Hoop 2 × 1 biaxial tensile, MPa	$S_{H(2:1)}$	D1599	1.36E+01	1.23E+01	1.12E+01
Hoop tensile, MPa	$S_{H(1:0)}$	D638, D1599, or D2290	1.36E+01	1.23E+01	1.12E+01
In-plane shear, MPa	τ	D4255	2.83E+00	2.46E+00	2.09E+00

Table 1-2.1-2M Data Sheet for Fiberglass Unsaturated Polyester Resin Type II (SC-582) (Cont'd)

Ultimate Stress Data [Note (4)]

Property	Symbol	ASTM Test Method	25°C	65°C	93°C
Axial tensile, MPa	$S_{A(0:1)}$	D638 or D2105	1.35E+02	1.23E+02	1.12E+02
Axial flexural, MPa	$S_{Af(0:1)}$	D790 or D2925	1.70E+02	1.52E+02	1.34E+02
Axial compressive, MPa	$S_{A(0:-1)}$	D695	1.35E+02	1.23E+02	1.12E+02
Axial 2 × 1 biaxial tensile, MPa	$S_{A(2:1)}$	D1599	1.36E+02	1.23E+02	1.12E+02
Hoop 2 × 1 biaxial tensile, MPa	$S_{H(2:1)}$	D1599	1.36E+02	1.23E+02	1.12E+02
Hoop tensile, MPa	$S_{H(1:0)}$	D638, D1599, or D2290	1.36E+02	1.23E+02	1.12E+02
In-plane shear, MPa	τ	D4255	2.83E+01	2.46E+01	2.09E+01



Allowable Stress Envelope

GENERAL NOTES:

(a) The values in these tables may be interpolated to determine values for intermediate temperatures and thicknesses.

(b) Refer to ASME NM.2, Table 3-3.1-1 for limitations on service based on temperature.

(c) The maximum allowable design stress value shall be 20 690 kPa for flanges constructed of Type II laminates.

NOTES:

(1) Elastic properties apply to total wall, not just to structural wall. This is to ensure that the loads on the piping, the supports, and the connected equipment, as calculated in the pipe stress analysis, are not understated.

(2) For modulus values of the structural wall only, or for pipe for which the liner thickness is 0.0 mm, it is permissible to use the modulus values applicable to a total wall thickness of 20 mm and over.

(3) Elastic properties may also be determined in accordance with ASME NM.2, Mandatory Appendix II.

(4) Allowable and ultimate stress values apply to the structural wall only, not the total wall thickness.

Table 1-2.1-3M Data Sheet for Fiberglass Unsaturated Polyester Resin Type III (55-deg Filament Wound; ASME NM.2, Mandatory Appendix IV)

Description and Service Limits

Reinforcement material:	Fiberglass (Type E or ECR glass)
Resin material:	Unsaturated polyester resin
Reinforcement pattern:	FW (±55)
Structural wall thickness range, mm:	2.5 to 17.5
Liner thickness, mm:	2.5

Modulus Data [Notes (1), (2), and (3)]

			Modulus of Elasticity for Total Wall Thickness, mm (Including 2.5-mm Liner), and Temperature, °C											
			Up to and Including 25°C				65°C				93°C			
Property	Symbol	ASTM Test Method	5	10	15	20 and Over	5	10	15	20 and Over	5	10	15	20 and Over
Axial tensile, MPa	E_{AT}	D638, D1599, or D2105	8.21E+03	8.69E+03	8.83E+03	8.90E+03	6.97E+03	7.17E+03	7.17E+03	7.24E+03	5.66E+03	5.57E+03	5.54E+03	5.52E+04
Axial compressive, MPa	E_{AC}	D695	8.21E+03	8.69E+03	8.83E+03	8.90E+03	6.97E+03	7.17E+03	7.17E+03	7.24E+03	5.66E+03	5.57E+03	5.54E+03	5.52E+04
Axial flexural, MPa	E_{AF}	D790 or D2925	7.66E+03	8.21E+03	8.41E+03	8.55E+03	6.48E+04	6.86E+03	7.03E+03	7.10E+03	5.26E+03	5.50E+03	5.54E+03	5.55E+04
Hoop tensile, MPa	E_{HT}	D638, D1599, or D2290	1.04E+04	1.29E+04	1.37E+04	1.41E+04	9.17E+03	1.14E+04	1.21E+04	1.24E+04	8.00E+03	9.79E+03	1.03E+04	1.06E+04
Hoop flexural, MPa	E_{HF}	D790 or D2412	8.76E+03	1.10E+04	1.21E+04	1.28E+04	7.59E+03	9.72E+02	1.08E+04	1.14E+04	6.43E+03	8.41E+03	9.31E+03	9.79E+03
In-plane shear, MPa	G	D4255	4.73E+03	7.03E+03	7.93E+03	8.34E+03	4.32E+03	6.63E+03	7.52E+03	7.93E+03	3.90E+03	6.23E+03	7.10E+03	7.52E+03

Other Property Data [Notes (1), (2), and (3)]

Property	Symbol	Test Method	Value for 0.2-in. Thickness
Poisson's ratio: hoop–axial tensile	ν_{HAT}	...	0.52
Poisson's ratio: axial–hoop tensile	ν_{AHT}	...	0.39
Coefficient of thermal expansion, mm/mm/°C: axial	α_A	D696	1.98E–05
Coefficient of thermal expansion, mm/mm/°C: hoop	α_H	...	1.04E–05
Density, kg/m^3	ρ	D792	0.059
Thermal conductivity, W/(m-K)	k	C1045	1.76

Allowable Stress Data [Note (4)]

Property	Symbol	ASTM Test Method	25°C	65°C	93°C
Axial tensile, MPa	$S_{A(0:1)}$	D638 or D2105	5.63E+00	5.57E+00	4.46E+00
Axial flexural, MPa	$S_{Af(0:1)}$	D790 or D2925	1.23E+01	1.03E+01	8.28E+00
Axial compressive, MPa	$S_{A(0:-1)}$	D695	1.12E+01	9.31E+00	7.24E+00
Axial 2 × 1 biaxial tensile, MPa	$S_{A(2:1)}$	D1599	1.29E+01	1.26E+01	7.24E+00
Hoop 2 × 1 biaxial tensile, MPa	$S_{H(2:1)}$	D1599	1.67E+01	1.48E+01	1.03E+01
Hoop tensile, MPa	$S_{H(1:0)}$	D638, D1599, or D2290	1.67E+01	1.48E+01	1.03E+01
In-plane shear, MPa	τ	D4255	7.03E+00	6.63E+00	6.23E+00