



Designation: D 3965 – 04

Standard Specification for Rigid Acrylonitrile-Butadiene-Styrene (ABS) Materials for Pipe and Fittings¹

This standard is issued under the fixed designation D 3965; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope*

1.1 This specification covers materials made from only virgin ABS polymers and blends of ABS polymers suitable for use in the extrusion of pipe and molding of fittings.

1.2 The requirements of this specification are applicable only to the ABS polymers and blends of ABS polymers as classified and do not address the requirements of the finished pipe or fittings. The applicable ASTM standard specification for pipe or fittings should be consulted for their requirements.

1.3 This specification excludes ABS polymers and blends of ABS polymers made from reprocessed, regrind, reclaimed, or recycled materials. ABS rework, generated in-house by the original plastic manufacturer, may be used by that original manufacturer, provided the ABS product shipped meets the physical and mechanical properties required by its callout in Table 1 of this specification.

1.4 This specification provides a means for describing ABS materials used in the manufacture of pipe and fittings. It is not intended for the selection of materials. Material selection should be made by those having expertise in the plastics field after careful consideration of the design and the performance required of the part, the environment to which it will be exposed, the fabrication process to be employed, the inherent properties of the material other than those covered by this specification, and the economics.

1.5 This specification provides for the classification of ABS polymers and blends of ABS polymers into groups based on five properties: Izod impact strength at room temperature, Izod impact strength at low temperature, deflection temperature under load, tensile stress at yield point, and modulus of elasticity in tension. The properties included in this specification are those required to identify the ABS material by the cell classifications.

NOTE 1—Other requirements necessary to identify particular characteristics of ABS polymers and blends of ABS polymers will be added as test methods become available or the need is identified.

¹ This specification is under the jurisdiction of ASTM Committee D20 on Plastics and is the direct responsibility of Subcommittee D20.15 on Thermoplastic Materials.

Current edition approved October 1, 2004. Published October 2004. Originally approved in 1980. Last previous edition approved in 1999 as D 3965 - 99.

NOTE 2—Due to pipe and fitting standards requirements a separate standard is planned for recycled materials.

NOTE 3—This specification and ISO 7245-1984 are not equivalent.

1.6 The values stated in SI units shall be the standard. The values given in brackets are for information only.

1.7 The following safety hazards caveat pertains only to the test methods portion, Section 13, of this specification: *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:²

- D 256 Test Methods for Impact Resistance of Plastics and Electrical Insulating Materials
- D 618 Practice for Conditioning Plastics for Testing
- D 638 Test Method for Tensile Properties of Plastics
- D 648 Test Method for Deflection Temperature of Plastics Under Flexural Load
- D 792 Test Methods for Specific Gravity (Relative Density) and Density of Plastics by Displacement
- D 883 Terminology Relating to Plastics
- D 1600 Terminology for Abbreviated Terms Relating to Plastics
- D 3641 Practice for Injection Molding Test Specimens of Thermoplastic Molding and Extrusion Materials
- D 3892 Practice for Packaging/Packing of Plastics
- D 4000 Classification System for Specifying Plastic Materials
- D 5947 Test Method for Physical Dimensions of Solid Plastics Specimens
- F 412 Terminology Relating to Plastic Piping Systems

2.2 ISO Standard:

- ISO 7245-1984 Pipes and Fittings of Acrylonitrile-Butadiene-Styrene (ABS)—General Specification for

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

*A Summary of Changes section appears at the end of this standard.

TABLE 1 Physical Property Requirements for ABS Pipe and Fitting Materials

NOTE—The minimum property value for any material will determine the cell number although the maximum expected value may fall within the next higher cell.

ASTM Test Method	Cell Limits					
	0	1	2	3	4	5
Izod impact, min:	D 256, Test Method A, Cantilever Beam (Izod-Type) Test					
at 23°C [73°F], J/m	^A	110	160	210	320	430
[ft-lbf/in. of notch]	^A	[2]	[3]	[4]	[6]	[8]
at -30°C [-22°F], J/m	^A	50	110	160	210	270
[ft-lbf/in. of notch]	^A	[1]	[2]	[3]	[4]	[5]
Deflection temperature under load, min, 1.82 MPa, [264 psi] annealed, 3.18 mm [0.125 in.] thickness:	D 648					
°C	^A	76	82	88	93	99
[°F]	^A	[170]	[180]	[190]	[200]	[210]
Tensile stress at yield point, min:	D 638					
MPa	^A	24	31	38	45	52
[psi]	^A	[3500]	[4500]	[5500]	[6500]	[7500]
Modulus of elasticity in tension, min:	D 638					
MPa	^A	1380	1650	1930	2210	2480
[psi]	^A	[200 000]	[240 000]	[280 000]	[320 000]	[360 000]

^A Unspecified.

Moulding and Extrusion Materials³

3. Terminology

3.1 *Definitions*—Definitions are in accordance with Terminologies D 883 and F 412 and abbreviations are in accordance with Terminology D 1600, unless otherwise indicated. The abbreviation for acrylonitrile-butadienestyrene plastic is ABS.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *blend*—a homogenous mixture of polymers prepared by melt compounding or physical combination.

3.2.2 *lot*—a unit of manufacture; may consist of a blend of two or more production runs or batches of material.

3.2.3 *natural material*—a polymer as it exists when initially made by the original producer without addition of colorants.

3.2.4 *reprocessed plastic*—a thermoplastic prepared from usually melt-processed scrap or reject parts by a plastics processor or from purchased nonstandard or nonuniform virgin material.

3.2.5 *original plastic manufacturer*—a company that produces ABS resin by polymerization of monomers or compounding of virgin styrene-acrylonitrile plastic (SAN) and virgin polybutadiene rubber, which meets the requirements of this specification.

4. Classification

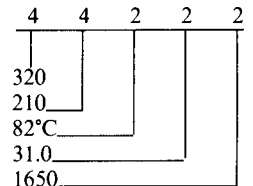
4.1 ABS polymers and blends of ABS polymers shall be classified in accordance with Table 1. Each ABS polymer and blend of ABS polymers is given a five-digit cell classification representing the physical properties in the order in which they are listed in Table 1.

NOTE 4—The manner in which selected materials are identified by this classification system is illustrated by an ABS Class 44222 material having

the following requirements:

Property and Minimum value:

- Izod impact, 23°C, J/m
- Izod impact, -30°C, J/m
- DTUL, 1.82 MPa
- Tensile stress at yield point, MPa
- Modulus of elasticity in tension, MPa



4.2 Although the values listed are necessary to include the range of properties available in existing materials, users should not infer that every possible combination of the properties exists or can be obtained.

4.3 Mechanical properties of pigmented or colored materials can differ from the mechanical properties of natural material, depending on the choice of colorants and the concentration. The main property affected is ductility, as illustrated by a reduction in Izod impact strength and tensile elongation values. ABS polymers and blends of ABS polymers containing colorants or color concentrates, or both, shall meet the minimum ABS material cell classification from Table 1 for the pipe and fitting products specified.

5. Materials and Manufacture

5.1 The ABS material shall be produced by polymerization of the monomers, acrylonitrile, butadiene, and styrene, or their closely related chemical derivatives, or from a blend of ABS polymers from those monomers. The blend of ABS polymers can be intimately mixed by melt compounding, or it can be a homogenous physical mixture of discrete ABS polymers.

5.2 The ABS polymer and each ABS polymer component of a blend shall be uniform in physical properties, as defined by a cell classification, and shall be of composition, size, and shape as specified by its product specification or purchase order or contract. The color of the ABS plastic material with added colorants shall be as required in the product specification.

³ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.