Designation: D4317 – 16 (Reapproved 2023)

Standard Specification for Polyvinyl Acetate-Based Emulsion Adhesives[1]

This standard is issued under the fixed designation D4317; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

INTRODUCTION

This specification is a replacement for Federal Specification MMM-A-180C, Class B, August 6, 1979, Adhesive, Vinyl Acetate Resin Emulsion, which superseded MMM-A-193C, October 26, 1967. It has been expanded to include the more water-resistant polyvinyl acetate-based adhesives now on the market, in addition to the less water-resistant ones formerly covered by the Federal Specification.

1. Scope

1.1 This specification covers polyvinyl acetate or polyvinyl acetate copolymer resin emulsion adhesives suitable for use on wood, wood-based substrates, or plastic laminates. It does not cover the group of polyvinyl-based adhesives which are suitable for bonding flexible films.

1.2 The adhesives are classified at three performance levels in accordance with water-resistance as shown in Table 1 and Table 2. See Section 5 for a description of the expected exposure conditions for each class of adhesive. See Table X1.1 for a classification of typical end products that are manufactured using adhesives at the three performance levels covered by this specification.

1.3 The following index is provided as a guide to the test methods portion of this specification:

	Section
Tests for Physical Properties	9
Viscosity	9.1.1
Density	9.1.2
Nonvolatiles	9.1.3
pH	9.1.4
Tests for Adhesive Bond	10
Block Shear Strength, Compression	10.2
Plywood Shear Tests	10.3

1.4 The values stated in SI units are to be regarded as the standard. The values given in parenthesis are for information purposes only.

1.5 The following safety hazards caveat pertains only to the test method portion, Sections 9 and 10, 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D905 Test Method for Strength Properties of Adhesive Bonds in Shear by Compression Loading

D906 Test Method for Strength Properties of Adhesives in Plywood Type Construction in Shear by Tension Loading

D907 Terminology of Adhesives

D1084 Test Methods for Viscosity of Adhesives

D1490 Test Method for Nonvolatile Content of Urea-Formaldehyde Resin Solutions

D1875 Test Method for Density of Adhesives in Fluid Form

D2556 Test Method for Apparent Viscosity of Adhesives Having Shear-Rate-Dependent Flow Properties Using Rotational Viscometry

E4 Practices for Force Calibration and Verification of Testing Machines

E70 Test Method for pH of Aqueous Solutions With the Glass Electrode

E1953 Practice for Description of Thermal Analysis and Rheology Apparatus

[1] This specification is under the jurisdiction of ASTM Committee D14 on Adhesives and is the direct responsibility of Subcommittee D14.30 on Wood Adhesives.

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

TABLE 1 Test Requirements

Test	Section Number	Test Requirement, min, psi (kPa)	Required Tests		
			Type 1	Type 2	Type 3
Block shear (compression) dry at 75 °F (24 °C)	10.2	2800 (19 306)	X	X	X
Plywood (tension):					
dry at 75 °F (24 °C)	10.3.3.1	400 (2758)	X	X	X
dry at 160 °F (71.1 °C)	10.3.3.2 or 10.3.3.3	250[A] (1724)	X	X	X
Two-cycle boil	10.3.3.4	see Table 2	X		
48 h soak	10.3.3.5	250 (1724)	X	X	
Humidity exposure	10.3.3.6	250[A] (1724)			X
Freeze-thaw stability	10.3.3.7	[B]	optional[B]	optional[B]	optional[B]
Storage life	10.3.3.8	[C]	X[C]	X[C]	X[C]

[A] Or 40 % of dry value at 75 °F (24 °C), whichever is larger.
[B] Testing and certification for freeze-thaw stability is optional. To classify a test adhesive as freeze-thaw stable, test an initial lot of the adhesive brand in accordance with 6.2 and 10.3.3.7.
[C] Testing of an initial lot of the adhesive brand in accordance with 6.3 and 10.3.3.8 is required.

TABLE 2 Test Requirements (*Continued*)

Average Failing Load, psi (kPa)[A]	Type I Test Requirement Two-Cycle Boil (10.3.3.4) (Minimum Wood Failure, %)	
	Average of All Specimens	Individual Specimen
Under 250 (1724)	50	25
250 to 350 (1724 to 2413)	30	10
Above 350 (2143)	15	10

[A] See Table 9 in Interim Voluntary Product Standard for Hardwood and Decorative Plywood, HP-1, 1993.

2.2 *Federal Standards:*
Fed. Std. No. 123 Marking for Shipment (Civil Agencies)[3]
PPP-C-96 Cans, Metal, 28-Gauge and Lighter[3]
PPP-D-723 Drums, Fiber[3]
PPP-D-729 Drums, Shipping and Storage, Steel, 55 gal (208 L)[3]

2.3 *Military Standard:*
MIL-STD-129 Marking for Shipment and Storage[3]

3. Terminology

3.1 *Definitions:*

3.1.1 Many terms in this specification are defined in Terminology D907.

3.1.2 *emulsion, n*—a two-phase liquid system in which small droplets of one liquid (the internal phase) are immiscible in, and are dispersed uniformly throughout, a second continuous liquid phase (the external phase).

3.1.2.1 *Discussion*—The *internal phase* is sometimes described as the *disperse phase*.

3.1.3 *latex, n*—a stable dispersion of polymeric substance in an essentially aqueous medium.

3.1.4 *polyvinyl acetate emulsion adhesive, n*—a latex adhesive in which the polymeric portion comprises polyvinyl acetate, copolymers based mainly on polyvinyl acetate, or a mixture of these, and which may contain modifiers and secondary binders to provide specific properties.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *adhesive designation, n*—an adhesive that is manufactured by a unique combination of raw materials and process, that conforms to a given set of physical and performance properties, and is identified by a specific name, number, or alphanumeric designation.

3.2.2 *lot, n*—adhesive manufactured at one place from the same batch or blend of raw materials subjected to the same operation and conditions.

3.2.3 *assembly, n*—See *adhesive assembly* in Terminology D907.

NOTE 1—In this specification, the maple block lamination in Test Method D905 and the birch plywood construction in Test Method D906 are described as assemblies.

4. Significance and Use

4.1 This specification addresses the need for a set of testing procedures that demonstrates the difference in physical properties and in adhesive bonding properties among the many available polyvinyl acetate-based adhesives. Because of the diverse nature of the end products bonded with these adhesives, testing in compliance with this specification can only evaluate the adhesive tested under a given set of conditions. The physical properties of the adhesive are tested and included in the report in order to give information on certain handling and working properties. The adhesive bonding properties are measured by tests performed on maple block specimens and birch plywood specimens, prepared and tested in accordance with Test Methods D905 and D906, respectively. The test requirements are based on knowledge within the industry of values which may be expected. Test Methods D905 and D906 have a long history of use as a basis for many specifications.

4.2 This specification does not describe the end-use products for which each class of adhesive is acceptable, but it does describe the general exposure conditions for which each class will perform in a satisfactory manner. See Appendix X1.

5. Classification of Adhesive Performance

5.1 For purposes of this specification, adhesives are classified on the basis of water resistance at three performance levels, wet-use, intermediate use, and dry-use:

[3] Available from DLA Document Services, Building 4/D, 700 Robbins Ave., Philadelphia, PA 19111-5094, http://quicksearch.dla.mil.