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Standard Specification for Poly(Vinyl Chloride) Resins¹

This standard is issued under the fixed designation D 1755; 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 the establishment of requirements for homopolymers of vinyl chloride in original powder form intended for subsequent mixing and processing in thermoplastic compositions. These resins have a nominal specific gravity of 1.4 and a theoretical chlorine content of 56.8 %.

1.2 Two types of resin have been recognized: general purpose and dispersion. When mixed with the customary amount of plasticizer, general-purpose resins yield a dry or moist powder while dispersion resins yield a liquid slurry. Since many resins are polymerized to meet special requirements, a system of classification has been provided that permits a wide choice of grades.

1.3 The values stated in SI units are to be regarded as the standard.

1.4 This standard does not purport to address all of the safety problems, 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.

NOTE—This standard is similar in content (but not technically equivalent) to ISO 1264-1980.

~~1.4 This standard does not purport to address all of the safety problems, 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.~~ 1—This standard and ISO 1264 - 1980 address the same subject matter, but differ in technical content (and results cannot be directly compared between the two test methods.

2. Referenced Documents

2.1 ASTM Standards:²

D 281 Test Method for Oil Absorption of Pigments by Spatula Rub-Out/Rub-out

D 495 Test Method for High-Voltage, Low-Current, Dry Arc Resistance of Solid Electrical Insulation;

D 883 Terminology Relating to Plastics

D 1125 Test Methods for Electrical Conductivity and Resistivity of Water

D 1243 Test Method for Dilute Solution Viscosity of Vinyl Chloride Polymers⁶

~~D1249 Specification for Octyl Ortho-Phthalate Ester Plasticizers⁶~~ Test Method for Dilute Solution Viscosity of Vinyl Chloride Polymers

D 1600 Terminology for Abbreviated Terms Relating to Plastics⁶

~~D1705 Test Method for Particle Size Analysis of Powdered Polymers and Copolymers of Vinyl Chloride⁶~~

~~D1755 Specification for Poly(Vinyl Chloride) Resins⁶~~ Terminology for Abbreviated Terms Relating to Plastics

D 1823 Test Method for Apparent Viscosity of Plasticsols and Organosols at High Shear Rates by Extrusion Viscometer

D 1824 Test Method for Apparent Viscosity of Plasticsols and Organosols at Low Shear Rates by Brookfield Viscometer⁶

D 1895 Test Methods for Apparent Density, Bulk Factor, and Pourability of Plastic Materials⁶

~~D1898 Practice for Sampling of Plastics⁶~~ Test Methods for Apparent Density, Bulk Factor, and Pourability of Plastic Materials

D 1921 Test Methods for Particle Size (Sieve Analysis) of Plastic Materials

D 2132 Test Method for Dust-and-Fog Tracking and Erosion Resistance of Electrical Insulating Materials

D 2396 Test Method for Powder-Mix Test of Poly(Vinyl Chloride) (PVC) Resins Using a Torque Rheometer

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 (Section D20.15.07).

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² Hutson, J. L., "Proposed Method for Classifying Poly(Vinyl Chloride) Resins." ASTM Research Report File No. RR: D-20-1: (May 20, 1959). Available from ASTM Headquarters.

³ 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.

- D2873 [Test Method for Interior Porosity of Poly\(Vinyl Chloride\) \(PVC\) Resins by Mercury Intrusion Porosimetry](#)⁸ Test Methods for Powder-Mix Time of Poly(Vinyl Chloride) (PVC) Resins Using a Torque Rheometer
- D 3030 [Test Method for Volatile Matter \(Including Water\) of Vinyl Chloride Resins](#)
- D 3892 [Practice for Packaging/Packing of Plastics](#)
- E 1 [Specifications for ASTM Thermometers](#) Specification for ASTM Liquid-in-Glass Thermometers

3. Terminology

3.1 *Definitions*—Definitions are in accordance with Terminology D 883 and Terminology D 1600, unless otherwise indicated.

TABLE 1 Type GP, General-Purpose Resin Requirements

Designation Order No.	Property	Cell Limits									
		0	1	2	3	4	5	6	7	8	9
4	Dilute solution—(inherent) viscosity	unspecified	<0.70	0.70 to 0.79	0.80 to 0.89	0.90 to 0.99	1.00 to 1.09	1.10 to 1.19	1.20 to 1.29	1.30 to 1.39	≥1.40
1	Dilute solution (inherent) viscosity	unspecified	>0.39	>0.70	>0.75	>0.87	>0.99	>1.09	>1.19	>1.29	>1.38
2	Sieve analysis, percent through No. 200 (75-µm) sieve	unspecified	0 to 9	10 to 19	20 to 29	30 to 39	40 to 49	50 to 59	60 to 79	80 to 99	100
2	Sieve analysis, percent through No. 200 (75-µm) sieve	unspecified	0 to 9	10 to 19	20 to 29	30 to 39	40 to 49	50 to 59	60 to 79	80 to 99	100
3	Apparent (bulk) density:										
3	Apparent (bulk) density: g/1000 cm ³	unspecified	<144	144 to 232	233 to 328	329 to 425	426 to 520	521 to 616	617 to 712	713 to 808	≥809
	g/1000 cm ³	unspecified	<144	144 to 232	233 to 328	329 to 425	426 to 520	521 to 616	617 to 712	713 to 808	≥809
	lb/ft ³	unspecified	<9.00	9.00 to 14.50	14.51 to 20.50	20.51 to 26.50	26.51 to 32.50	32.51 to 38.50	38.51 to 44.50	44.51 to 50.50	≥50.51
	lb/ft ³	unspecified	<9.00	9.00 to 14.50	14.51 to 20.50	20.51 to 26.50	26.51 to 32.50	32.51 to 38.50	38.51 to 44.50	44.51 to 50.50	≥50.51
4	Plasticizer sorption, parts DOP phr ^A	unspecified	<50	50 to 74	75 to 99	100 to 124	125 to 149	150 to 174	175 to 199	200 to 244	≥225
4	Plasticizer sorption, parts DOP phr ^A	unspecified	<50	50 to 74	75 to 99	100 to 124	125 to 149	150 to 174	175 to 199	200 to 244	≥225
5	Dry flow, s/400 cm ³	unspecified	...	...	<2.0	2.0 to 3.9	4.0 to 5.9	6.0 to 7.9	8.0 to 9.9	≥10	...
5	Dry flow, s/400 cm ³	unspecified	...	...	<2.0	2.0 to 3.9	4.0 to 5.9	6.0 to 7.9	8.0 to 9.9	≥10	...
6	Conductivity, max, µS/cm-g	unspecified	unspecified	...	...	<6	≥6	...	...	...	...
6	Conductivity, max, µS/cm-g	unspecified	unspecified	...	...	<6	≥6	...	...	...	...

^A phr = per 100 parts of resin.

TABLE 2 Type D, Dispersion Resin Requirements

Designation Order No.	Property	Cell Limits									
		0	1	2	3	4	5	6	7	8	9
1	Dilute solution (inherent) viscosity	unspecified	<0.90	0.90 to 0.99	1.00 to 1.09	1.10 to 1.19	1.20 to 1.29	1.30 to 1.39	1.40 to 1.49	1.50 to 1.59	≥1.60
2	Brookfield viscosity (RVF), poise	unspecified	0 to 24	25 to 49	50 to 74	75 to 99	100 to 124	125 to 149	150 to 174	175 to 199	>199
3	Severs viscosity, poise	unspecified	0 to 49	50 to 99	100 to 149	150 to 199	200 to 299	300 to 499	500 to 999	1000 to 1499	>1499

4. Classification

4.1 *Types*—This specification covers two types of resin:

4.1.1 *Type GP*—General-purpose resins primarily intended for either dry blending, preblending, or thermoplastic processing.

4.1.2 *Type D*—Dispersion resins primarily intended for use in organosols and plastisols. As a class, these are small in particle size.

4.2 *Grades*—This specification provides for as many grades of resin as may it is feasible to be selected from the possible combinations of requirements in Table 1 and Table 2. A grade is designated by first indicating the type (GP or D), followed by cell numbers for each property in the order in which they are listed in Table 1 and Table 2. Where there is no interest in a property, a “0” is entered in place of a cell number. ~~Should it be~~ If it were desirable, ~~a cell limit may be extended~~ it is acceptable to extend a cell limit by half the cell range into the next higher or lower cell, but not both. When this is done, it is indicated by a dash above the cell number (\bar{n}) if the extension is into the higher cell, or a dash below (n) if ~~into the lower cell~~. ~~Extension of cell limits applies only to cells where ranges of properties are allowed and not where maximum or minimum values are specified. The cell number of the first property (dilute solution viscosity) is separated from those that follow by a dash.~~

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~~NOTE2—Resin GP643054. This is a grade of general-purpose resin (see Table 1) having the requirements given in Table 3. Standard values defined by round-robin testing of eight laboratories are listed in Table 4.) if into the lower cell. Extension of cell limits applies only to cells where ranges of properties are allowed and not where maximum or minimum values are specified. The cell number of the first property (dilute solution viscosity) is separated from those that follow by a dash.~~

~~4.3 *Inherent Viscosity Cell Number*—When selecting the inherent viscosity cell number, the number shall cover the full inherent viscosity production range for the specific product. A resin with an inherent viscosity of 1.07 to 1.11 production range would have a 5 cell number. A resin with an inherent viscosity of 1.10 to 1.14 production range would have a 6 cell number~~

5. General Requirements

5.1 The resin shall be in powder form.

5.2 The resin shall conform to the requirements of Table 1 or Table 2, as specified by the type and grade designation agreed upon between the purchaser and the supplier.

~~NOTE3—Properties 2—It is possible that properties not covered, such as heat stability, color, and volatile loss, may~~are also be important for application performance in compounds.

6. Sampling

~~6.1 Unless otherwise agreed upon between the purchaser and the supplier, the material shall be sampled in accordance with the sampling procedure in Practice D1898.~~

~~6.1 Sample using a statistically acceptable procedure.~~

7. Number of Tests

~~7.1 One set of test specimens as prescribed in the Sections on General and Specific Sampling Procedures of Practice D1898 shall be considered sufficient for testing each batch.~~

~~7.1 One set of test specimens shall be considered sufficient for testing each batch.~~

8. Retest and Rejection

~~8.1 If any failure occurs, the materials may~~shall be permitted to be retested to establish conformity in accordance with an agreement between the purchaser and the supplier.

TEST METHODS

9. Dilute Solution Viscosity

9.1 Test Method D 1243.

10. Apparent (Bulk) Density

10.1 Test Methods D 1895.

11. Sieve Analysis

11.1 Test Method D 1921.

~~NOTE4—Test Method D1705 may be substituted at the option of the purchaser and the supplier.~~

~~NOTE5—Specifications for sieve analysis (3—Specifications for sieve analysis (Table 1) are primarily intended to control fines.~~

12. Brookfield Viscosity

12.1 Test Method D 1824. Take readings using a Brookfield RVF viscometer at 20 r/min with a No. 6 spindle. Prepare the plastisol sample as follows:

~~12.1.1 *Plasticizer*—Di (2-ethylhexyl) phthalate (DOP), Type I in Specification D1249.~~—Di (2-ethylhexyl) phthalate (DOP).

12.1.2 *Apparatus*:

12.1.2.1 *Mixer*, planetary-gear type, equipped with flat beater mixing paddle.

12.1.2.2 *Vacuum Desiccator*, capable of being evacuated to 133 Pa (1 mm Hg).

12.1.3 *Procedure*:

12.1.3.1 Condition the mixing bowl and materials to $23 \pm 1^\circ\text{C}$. Weigh 500 ± 0.5 g of resin into the mixing bowl. Weigh 300 ± 0.5 g of plasticizer and add it directly on top of the resin in the mixing bowl. Hand mix with the flat beater for 1 min.

12.1.3.2 Mount the bowl on the mixer and mix for 5 min at the No. 1 speed. Stop the mixer and scrape down the sides of the bowl and the beater. Resume mixing at the No. 2 speed for an additional 15 min. Note and record the temperature of the plastisol immediately after mixing. The temperature rise must not exceed 5°C . Use a cooling bath if necessary.