



Designation: D1755 – 09

Standard Specification for Poly(Vinyl Chloride) Resins¹

This standard is issued under the fixed designation D1755; 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 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

- D281 Test Method for Oil Absorption of Pigments by Spatula Rub-out
- D495 Test Method for High-Voltage, Low-Current, Dry Arc Resistance of Solid Electrical Insulation
- D883 Terminology Relating to Plastics
- D1125 Test Methods for Electrical Conductivity and Resistivity of Water

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.

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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.

- D1243 Test Method for Dilute Solution Viscosity of Vinyl Chloride Polymers
- D1600 Terminology for Abbreviated Terms Relating to Plastics
- D1823 Test Method for Apparent Viscosity of Plastics and Organosols at High Shear Rates by Extrusion Viscometer
- D1824 Test Method for Apparent Viscosity of Plastics and Organosols at Low Shear Rates
- D1895 Test Methods for Apparent Density, Bulk Factor, and Pourability of Plastic Materials
- D1921 Test Methods for Particle Size (Sieve Analysis) of Plastic Materials
- D2132 Test Method for Dust-and-Fog Tracking and Erosion Resistance of Electrical Insulating Materials
- D2396 Test Methods for Powder-Mix Time of Poly(Vinyl Chloride) (PVC) Resins Using a Torque Rheometer
- D3030 Test Method for Volatile Matter (Including Water) of Vinyl Chloride Resins
- D3892 Practice for Packaging/Packing of Plastics
- E1 Specification for ASTM Liquid-in-Glass Thermometers

3. Terminology

3.1 *Definitions*—Definitions are in accordance with Terminology D883 and Terminology D1600, unless otherwise indicated.

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 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. If it were desirable, 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

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

TABLE 1 Type GP, General-Purpose Resin Requirements

Designation Order No.	Property	Cell Limits									
		0	1	2	3	4	5	6	7	8	9
1	Dilute solution (inherent) viscosity	unspecified	>0.39	>0.70	>0.75	>0.87	>0.99	>1.09	>1.19	>1.29	>1.38
2	Sieve analysis, percent through No. 200 (75- μ m) 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:										
	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	\geq 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	\geq 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	\geq 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	\geq 10	...
6	Conductivity, max, μ S/cm-g	unspecified	...	...	<6	\geq 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	\geq 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

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.

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.

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

6. Sampling

6.1 Sample using a statistically acceptable procedure.

7. Number of Tests

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 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 **D1243**.

10. Apparent (Bulk) Density

10.1 Test Methods **D1895**.

11. Sieve Analysis

11.1 Test Method **D1921**.

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

12. Brookfield Viscosity

12.1 Test Method **D1824**. 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).

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.

12.1.3.3 Place the mixing bowl in the desiccator, evacuate to 133 Pa (1 mm Hg), and allow it to remain in the desiccator for an additional 10 min after the foam collapses. Consider the time in the desiccator as part of the normal aging period. Take care to ensure that the plastisol does not overflow the container during evacuation.

13. Severs Viscosity

13.1 Test Method **D1823**. Determinations shall be made through a 3.17 ± 0.13 -mm (0.125 ± 0.005 -in.) diameter orifice at a gas pressure of 0.69 MPa (100 psi). The plastisol sample shall be prepared in accordance with 12.1.1 – 12.1.3.

14. Electrical Conductivity of Water Extract

14.1 *Definitions*—See the Definitions Section of Test Methods **D1125**.

14.2 *Summary of Test Method*—This test is intended to distinguish between electrical and nonelectrical grades of unprocessed resin. In general, the test will not detect relatively small differences among different lots of electrical grade resin. A water dispersion of the resin is boiled for a short time and the electrical conductivity of the solution measured. The conductivity of the water extract results from ionic impurities in the resin that adversely affect its use for electrical insulation. Electrical grade resins generally yield conductivity values less than $6 \mu\text{S}/\text{cm}\cdot\text{g}$.

14.3 *Apparatus:*

14.3.1 *A-C Wheatstone Bridge*, having a range up to 250 000 Ω , a 100 ± 50 -Hz oscillator and a sensitive null point indicator with minimum accuracy of $\pm 2\%$.

14.3.2 *Dip Cell*, having platinum electrodes and a cell constant of about 0.1 cm^{-1} , similar to the one shown in **Fig. 1**. The cell shall be prepared and calibrated in accordance with Test Method **D495**.

14.3.3 *Thermometer*, equivalent to or better than ASTM Partial Immersion Thermometer, having a range from -20 to $+150^\circ\text{C}$ and conforming to the requirements for Thermometer 1C in accordance with Specifications **E1**.

14.3.4 *Electric Hot Plate*.

14.4 *Reagents:*

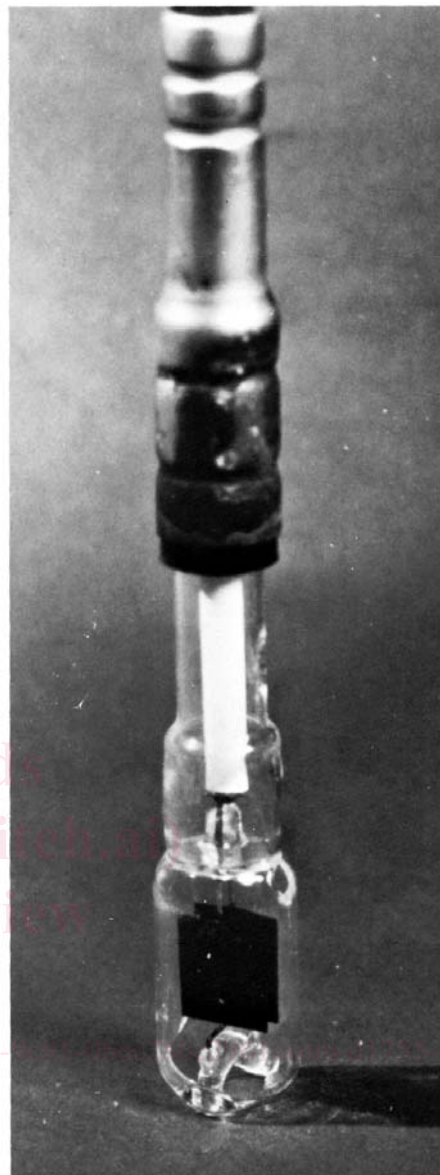


FIG. 1 Dip Cell for Electrical Conductivity Test

14.4.1 *High-Purity Water*—Water having a conductivity not greater than $1.0 \mu\text{S}/\text{cm}$, prepared in accordance with Test Method **D2132**.

NOTE 4—It is also possible to obtain a high-purity water by passing ordinary distilled water through a dual-bed ion exchange column packed with an appropriate resin.

14.4.2 *Isopropyl Alcohol*, ACS reagent grade.

14.5 *Procedure:*

14.5.1 Place a resin sample weighing 2.00 ± 0.01 g in a 250-mL Erlenmeyer flask that has previously been rinsed twice with boiling, high-purity water. Add 5.0 ± 0.5 mL of isopropyl alcohol to the sample, and swirl the mixture until the resin is uniformly wet. Add 100 ± 1 mL of boiling, high-purity water, set a watch glass on top of the flask, and boil gently for 5 min. Cool rapidly to $23 \pm 1^\circ\text{C}$. Allow the resin to settle, and then place the dip cell in the flask so that the electrodes are