
International Standard



1060/1

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Plastics — Homopolymer and copolymer resins of vinyl chloride — Part 1: Designation

Plastiques — Résines d'homopolymères et de copolymères de chlorure de vinyle — Partie 1: Désignation

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 1060/1 was developed by Technical Committee ISO/TC 61, *Plastics*, and was circulated to the member bodies in June 1980.

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It has been approved by the member bodies of the following countries:

| | | |
|---------------------|----------------|-----------------------|
| Australia | France | Poland |
| Austria | Germany, F.R. | Romania |
| Belgium | Hungary | South Africa, Rep. of |
| Brazil | India | Spain |
| Canada | Ireland | Sweden |
| China | Italy | Switzerland |
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The member body of the following country expressed disapproval of the document on technical grounds:

Netherlands

This International Standard cancels and replaces International Standards ISO 1060-1975 and ISO 2798-1974, of which it constitutes a technical revision.

Plastics — Homopolymer and copolymer resins of vinyl chloride —

Part 1: Designation

1 Scope and field of application

This part of ISO 1060 specifies a method of designation of homopolymer and copolymer resins of vinyl chloride as a function of their chemical nature, their poly(vinyl chloride) content (in the case of the copolymers), their polymerization process, their final general utilization, and a number of properties. Indications concerning special properties can also be added.

Specifications for specific resins should be based on this designation.

ISO 1060/2 specifies the preparation of the sample and the test methods to be used for the determination of the properties specified in this International Standard and of additional properties.

2 References

ISO 60, *Plastics — Determination of apparent density of material that can be poured from a specified funnel.*

ISO 174, *Plastics — Homopolymer and copolymer resins of vinyl chloride — Determination of viscosity number in dilute solution.*

ISO 1043, *Plastics — Symbols.*

ISO 1060/2, *Plastics — Homopolymer and copolymer resins of vinyl chloride — Part 2: Determination of properties.*

ISO 1158, *Plastics — Homopolymers and copolymers of vinyl chloride — Determination of chlorine.*

ISO 1624, *Plastics — Homopolymer and copolymer resins of vinyl chloride — Determination of particle size distribution by sieve analysis in water.*

ISO 2555, *Resins in the liquid state or as emulsions or dispersions — Determination of Brookfield RV viscosity.*

ISO 4575, *Plastics — Polyvinyl chloride pastes — Determination of apparent viscosity using the Severs rheometer.*

ISO 4608, *Plastics — PVC resins for general use — Determination of plasticizer absorption at room temperature.*

ISO 4612, *Plastics — PVC paste resins — Preparation of a paste.*

3 Definition

For the purpose of this International Standard, the following definition applies:

homopolymer and copolymer resins of vinyl chloride: Resins in powder form consisting respectively of

— a homopolymer of vinyl chloride ($\text{CH}_2 = \text{CHCl}$ monomer);

— a copolymer of vinyl chloride with one or more other monomers, in which vinyl chloride is the main constituent.

This powder is intended to be used with the necessary additives to form a compound used in the production of thermoplastics. It can have a very low content of non-polymerized substances used in the polymerization process (for example emulsifying or suspension agents, catalyst residues) or deliberately added in the course of this process as part of the polymerization system to stabilize the resin (pre-stabilizers).

NOTE — The designation can also be used for homogeneous mixtures, prepared mechanically, of several vinyl chloride homopolymers or of a homopolymer of vinyl chloride with one or more polymers or copolymers of other monomers in which the poly(vinyl chloride) is the main element, provided that it is clearly shown that the designation refers to a "mixture".

4 Designation system

Homopolymer and copolymer resins of vinyl chloride are designated by the number of this International Standard and 3 or 4 data blocks (separated from each other by a comma) providing the following information:

4.1 Data block 1

The polymer is identified by its symbol according to ISO 1043.

For copolymer resins the symbol is followed by an interval, then by a two-digit number indicating the PVC content. The latter is obtained by determining the chlorine content in accordance with ISO 1158 and using the table in the annex which shows the relationship between chlorine content and PVC content.

For all resins, after a hyphen, the polymerization process is coded by a letter, as follows:

- S : polymerization in suspension
- E : polymerization in emulsion
- M : bulk polymerization
- X : processes other than above or intermediate.

4.2 Data block 2

The general end use, coded by a letter as follows:

- G : general-purpose resins
- P : paste resins.

4.3 Data block 3

The properties to be designated in this data block are as follows:

- for all resins, the viscosity number indicated by three figures (see 4.3.1);
- for G resins, the apparent bulk density indicated by two figures (see 4.3.2);
- for P resins, the amount of DOP required for a paste with a defined viscosity, indicated by one figure (see 4.3.3).

4.3.1 Viscosity number (VN), determined in accordance with ISO 174. The value is indicated as a three-digit number (the first digit being a zero for values below 100), followed by a hyphen.

No batch of designated resin shall have a viscosity number outside the following tolerances for the value indicated in the designation

- ± 3 for VN ≤ 090
- ± 5 for 090 < VN ≤ 135
- ± 7,5 for VN > 135

4.3.2 For G resins: apparent bulk density, determined in accordance with ISO 60. The value is indicated as a two-digit number, corresponding to the two figures after the decimal point of the determined value.

No batch of designated resin shall have an apparent bulk density outside a tolerance of ± 3 for the value indicated in the designation (± 0,03 for the determined value).

4.3.3 For P resins: amount of di-2-ethylhexyl phthalate (DOP) in parts per hundred by weight of resin (p.h.r) required for

preparing a paste conforming to ISO 4612 with a viscosity of about 25 Pa·s.

The viscosity is measured under the following conditions:

- 24 h after preparation of the paste;
- conditioning and test temperature: 23 ± 1 °C;
- Brookfield RV viscometer (RVF, RVF-100, RVT);
- rotational frequency of the spindle: 20 min⁻¹;
- spindle No. 6;
- viscosity to be read after 1 min of rotation.

The value is expressed as a one-digit number, indicating the class as given in table 1.

Table 1

| Classes | 4 | 5 | 6 | 7 | 8 | 9 |
|------------|------|------------|------------|------------|------------|------|
| DOP, p.h.r | < 45 | > 45 to 55 | > 55 to 65 | > 65 to 75 | > 75 to 85 | > 85 |

NOTE — Because of the uncertainty arising from the methods of preparing the paste and measuring its viscosity, certain resins may sometimes appear in one class and sometimes in another. In such cases it shall be stated that the resin is on the borderline between two classes.

Data block 3 can be the end of the designation, or can be followed by two commas and data block No. 4.

4.4 Data block 4

Properties whose use is optional.

4.4.1 For G resins:

- a) Sieve analysis, determined in accordance with ISO 1624: Retention on sieve of 250 µm mesh.
- b) Sieve analysis, determined in accordance with ISO 1624: Retention on sieve of 63 µm mesh.
- c) Plasticizer absorption at room temperature, determined in accordance with ISO 4608.

The values for these three properties are indicated as numbers corresponding to the applicable classes (cells) in table 2.

NOTE — In view of the inevitable variations in production, independently measured values on a resin designated as being in a particular class for a given property may possibly fall either,

- in the next lower class if the average value of the property is near the lower limit of the designation, or
- in the next higher class if the average value is near the upper limit.

Table 2

| X | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|--|-------|------------|------------|------------|------------|------------|--------------|--------|---|
| Sieve analysis | | | | | | | | | |
| a) retention on sieve of 250 μm mesh, % (ISO 1624) | | | | | | | | | |
| ND ¹⁾ | < 0,5 | > 0,5 to 5 | > 5 to 20 | > 20 to 40 | > 40 to 60 | > 60 to 80 | > 80 to 99,5 | > 99,5 | — |
| b) retention on sieve 63 μm mesh, % (ISO 1624) | | | | | | | | | |
| ND ¹⁾ | < 0,5 | > 0,5 to 5 | > 5 to 20 | > 20 to 40 | > 40 to 60 | > 60 to 80 | > 80 to 99,5 | > 99,5 | — |
| Plasticizer absorption at room temperature, p.h.r (ISO 4608) | | | | | | | | | |
| ND ¹⁾ | < 10 | 10 to 20 | > 20 to 25 | > 25 to 30 | > 30 to 35 | > 35 to 40 | > 40 | — | — |

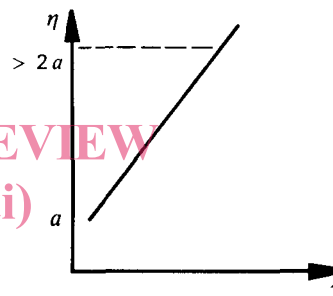
1) ND = not designated

4.4.2 For P resins:

4.4.2.1 Apparent viscosity at a shear rate of 500 s⁻¹, determined with a Severs rheometer in accordance with ISO 4575 on a paste prepared in accordance with ISO 4612 having the formula

“100 and 50” (see ISO 4612) if the class according to 4.3.3 is 4, 5 or 6;

“100 and 70” (see ISO 4612) if the class according to 4.3.3 is 7, 8 or 9,



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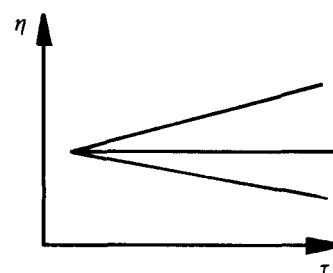
N = NEWTONIAN

The value is expressed as a one-digit number, indicating the class given in table 3.

Curve is substantially horizontal or may exhibit variations in one direction only (increasing or decreasing); ratio not more than 2.

Table 3

| Apparent viscosity, Pa·s | “100 and 50” paste | “100 and 70” paste |
|--|--------------------|--------------------|
| | Classes | |
| The Severs curve does not pass through 500 s ⁻¹ | | |
| < 10 Pa·s | 0 | 5 |
| 10 to 15 Pa·s | 1 | 6 |
| > 15 to 25 Pa·s | 2 | 7 |
| > 25 Pa·s | 3 | 8 |
| | 4 | 9 |



P = PSEUDOPLASTIC

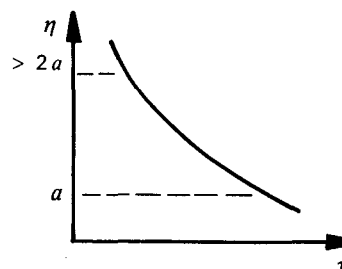
4.4.2.2 Rheological characteristics of the paste (“100 and 50” or “100 and 70”) in the Severs test.

Decreasing viscosity; ratio between the extremes of the Severs curve more than 2.

The rheological characteristics of the Severs curve are expressed by a letter immediately following the number obtained in accordance with 4.4.2.1, in accordance with the following definitions:

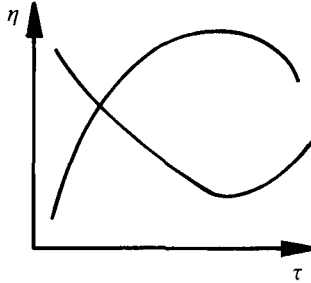
D = DILATANT

Increasing viscosity, with a ratio of more than 2 between the extremes of the Severs curve.



X = UNSPECIFIED

Curve exhibits variations in both directions, increasing and decreasing, ratio > 2.



5 Examples of designation of resins

Examples of designations are presented for the following three types of resin having property values shown in table 4.

5.1 Homopolymer, produced by mass polymerization, for general uses.

5.2 Homopolymer, produced in micro-suspension, for pastes.

5.3 Vinyl chloride/vinyl acetate copolymer containing 90 % of PVC, prepared in suspension, for general uses.

6 Additional properties

By agreement between the interested parties, additional properties may be indicated, such as :

- volatile matter (including water)
- density
- pourability
- thermal stability
- impurities
- hot plasticizer absorption
- melt flow rate
- solubility in the usual solvents (copolymers)
- electrical properties (on specimens prepared with the resin).

These properties shall be determined in accordance with the test methods specified in ISO 1060/2.

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Table 4

| Property | Homopolymer for general uses (5.1) | | Homopolymer for pastes (5.2) | | Copolymer for general uses (5.3) | |
|---|--|------------|---|------------|--|------------|
| | Value | Indication | Value | Indication | Value | Indication |
| Viscosity number (ml/g) | 116 | 116 | 125 | 125 | 83 | 083 |
| Apparent bulk density (g/ml) | 0,56 | 56 | — | — | 0,79 | 79 |
| Quantity of DOP (p.h.r) to prepare a paste of viscosity 25 Pa·s | — | — | 60 | 6 (class) | — | — |
| Retention on sieve 250 μm mesh (%) | 0 | 1 (class) | — | — | 0 | 1 (class) |
| Retention on sieve 63 μm mesh (%) | 2 | 2 (class) | — | — | 96,5 | 7 (class) |
| Plasticizer absorption at room temperature (p.h.r) | 38 | 6 (class) | — | — | ND ¹⁾ | X |
| Apparent viscosity, Severs | — | — | 18 | 3 (class) | — | — |
| Rheological characteristics | — | — | 1,5 | N | — | — |
| Designation | ISO 1060-PVC-M, G, 116-56 or ISO 1060-PVC-M, G, 116-56,, 126 | | ISO 1060-PVC-X, P, 125-6 or ISO 1060-PVC-X, P, 125-6,, 3N | | ISO 1060-VC/VAC 90-S, G, 083-79 or ISO 1060-VC/VAC 90-S, G, 083-79,, 17X | |

1) ND = not designated

Annex

Relationship between the chlorine and vinyl chloride copolymer contents

This relationship applies only for a copolymer based on vinyl chloride, not post-chlorinated and containing no additives or other chlorinated monomeric constituents.

Table 5

| Cl % | PVC % | Cl % | PVC % | Cl % | PVC % | Cl % | PVC % | Cl % | PVC % |
|------|-------|------|-------|------|-------|------|-------|------|-------|
| 18,5 | 32,6 | 26,5 | 46,7 | 34,5 | 60,8 | 42,5 | 74,9 | 50,5 | 89,0 |
| 19,0 | 33,5 | 27,0 | 47,6 | 35,0 | 61,7 | 43,0 | 75,8 | 51,0 | 89,9 |
| 19,5 | 34,4 | 27,5 | 48,5 | 35,5 | 62,6 | 43,5 | 76,7 | 51,5 | 90,8 |
| 20,0 | 35,3 | 28,0 | 49,4 | 36,0 | 63,5 | 44,0 | 77,6 | 52,0 | 91,7 |
| 20,5 | 36,1 | 28,5 | 50,2 | 36,5 | 64,3 | 44,5 | 78,4 | 52,5 | 92,5 |
| 21,0 | 37,0 | 29,0 | 51,1 | 37,0 | 65,2 | 45,0 | 79,3 | 53,0 | 93,4 |
| 21,5 | 37,9 | 29,5 | 52,0 | 37,5 | 66,1 | 45,5 | 80,2 | 53,5 | 94,3 |
| 22,0 | 38,8 | 30,0 | 52,9 | 38,0 | 67,0 | 46,0 | 81,1 | 54,0 | 95,2 |
| 22,5 | 39,7 | 30,5 | 53,8 | 38,5 | 67,9 | 46,5 | 82,0 | 54,5 | 96,1 |
| 23,0 | 40,5 | 31,0 | 54,6 | 39,0 | 68,8 | 47,0 | 82,9 | 55,0 | 97,0 |
| 23,5 | 41,4 | 31,5 | 55,5 | 39,5 | 69,6 | 47,5 | 83,7 | 55,5 | 97,8 |
| 24,0 | 42,3 | 32,0 | 56,4 | 40,0 | 70,5 | 48,0 | 84,6 | 56,0 | 98,7 |
| 24,5 | 43,2 | 32,5 | 57,3 | 40,5 | 71,4 | 48,5 | 85,5 | 56,5 | 99,5 |
| 25,0 | 44,1 | 33,0 | 58,2 | 41,0 | 72,3 | 49,0 | 86,4 | | |
| 25,5 | 45,0 | 33,5 | 59,1 | 41,5 | 73,2 | 49,5 | 87,3 | 56,7 | 100,0 |
| 26,0 | 45,8 | 34,0 | 59,9 | 42,0 | 74,0 | 50,0 | 88,1 | | |

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