INTERNATIONAL STANDARD

ISO 1060-1

Second edition
1998-03-15

Plastics — Homopolymer and copolymer resins of vinyl chloride —

Part 1:
Designation system and basis for specifications

Plastiques — Résines d'homopolymères et de copolymères de chlorure de vinyle —

Partie 1: Système de désignation et base de spécification

Reference number
ISO 1060-1:1998(E)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established 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. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 1060-1 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 9, *Thermoplastic materials*.

This second edition cancels and replaces the first edition (ISO 1060-1:1982) and includes the following main changes:

a) the viscosity and the type of rheological behaviour of standard pastes have been introduced as designatory properties for paste resins;

b) retention on a 63 µm sieve has been introduced as a designatory property;

c) plasticizer absorption has been introduced as a designatory property.

ISO 1060 consists of the following parts, under the general title *Plastics — Homopolymer and copolymer resins of vinyl chloride*:

— *Part 1: Designation system and basis for specifications*

— *Part 2: Preparation of test samples and determination of properties*

International Organization for Standardization
Case postale 56 • CH-1211 Genève 20 • Switzerland
Internet central@iso.ch
X.400 c=ch; a=400net; p=iso; o=isocs; s=central

Printed in Switzerland

Plastics — Homopolymer and copolymer resins of vinyl chloride —

Part 1:
Designation system and basis for specifications

1 Scope

1.1 This part of ISO 1060 establishes a system of designation for vinyl chloride thermoplastic resins, which may be used as the basis for specifications.

1.2 The types of vinyl chloride plastics are differentiated from each other by a classification system based on appropriate levels of the designatory properties:

a) reduced viscosity

b) apparent density

c) retention on a 63 µm mesh sieve

d) plasticizer absorption at room temperature (for general-purpose resins and filler resins only)

e) the viscosity and the type of rheological behaviour of a standard paste (for paste resins only)

and on information about basic polymer parameters, polymerization processes and intended applications.

1.3 This part of ISO 1060 is applicable to resins in powder form which consist of homopolymers of the monomer vinyl chloride and copolymers, terpolymers, etc., of vinyl chloride with one or more other monomers, but where vinyl chloride is the main constituent. The resins may contain small amounts of non-polymerized substances (e.g. emulsifying or suspending agents, catalyst residues, etc.) and other substances added during the course of polymerization.

1.4 It is not intended to imply that materials having the same designation give necessarily the same performance. This part of ISO 1060 does not provide engineering data, performance data or data on processing conditions which may be required to specify a material for a particular application and/or method of processing.

If such additional properties are required, they shall be determined in accordance with the test methods specified in part 2 of this International Standard, if suitable.

1.5 In order to specify a resin for a particular application or to ensure reproducible processing, additional requirements may be given in data block 5 (see clause 3, introductory paragraph).

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 1060. At the time of publication, the editions indicated were valid. All standards are subject to revision, and

parties to agreements based on this part of ISO 1060 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 1043-1:1997, *Plastics — Symbols and abbreviated terms — Part 1: Basic polymers and their special characteristics.*

ISO 1060-2:1998, *Plastics — Homopolymer and copolymer resins of vinyl chloride — Preparation of test samples and determination of properties.*

3 Designation and specification system

The designation and specification system for thermoplastics is based on the following standardized pattern:

Designation						
Description block (optional)	Identity block					
	International Standard number block	Individual-item block				
		Data block 1	Data block 2	Data block 3	Data block 4	Data block 5

The designation consists of an optional description block, reading "Thermoplastics", and an identity block comprising the International Standard number and an individual-item block. For unambiguous designation, the individual-item block is subdivided into five data blocks providing the following information:

— Data block 1: Identification of the plastic by its symbol (PVC, etc.) in accordance with ISO 1043-1 and information about the polymerization process and the composition of the polymer (see 3.1).

— Data block 2: Intended application (see 3.2).

— Data block 3: Designatory properties (see 3.3).

— Data block 4: Fillers or reinforcing materials and their nominal content (not included in this standard).

— Data block 5: For the purpose of specifications, a fifth data block may be added containing additional information (see 3.4).

The first character of the individual-item block shall be a hyphen. The data blocks shall be separated from each other by commas.

If a data block is not used, this shall be indicated by doubling the separation sign, i.e. by two commas (,,).

3.1 Data block 1

In this data block, after the hyphen, vinyl chloride polymer resins are identified by the symbol PVC or VC/.../... for homopolymers or copolymers/terpolymers respectively, in accordance with ISO 1043-1, followed, for copolymers/terpolymers, by a space and by a two-figure number indicating the percentage content of combined vinyl chloride. This is calculated from the chlorine content determined in accordance with ISO 1060-2, using the equation

$$[VC] = 1{,}762\ 9 \times [Cl]$$

After a hyphen, the polymerization process is indicated by a single code-letter as specified in table 1.

Table 1 — Code-letters used for additional information in data block 1

Code-letter	Definition
S	Suspension polymerization
E	Emulsion polymerization
M	Bulk polymerization
X	Process other than the above, or an intermediate process, including microsuspension

3.2 Data block 2

In this data block, information about intended application is given. The code-letters used are specified in table 2.

Table 2 — Code-letters used in data block 2

Code-letter	Intended application
P	Paste resins
F	Filler resins
G	General-purpose resins (excluding categories P and F)

3.3 Data block 3

In this data block, the reduced viscosity is represented by a three-figure code-number (see 3.3.1), the apparent bulk density by a two-figure code-number (see 3.3.2) and retention on a 63 µm mesh sieve by a two-figure code-number (see 3.3.3). For general-purpose resins and filler resins, the plasticizer absorption at room temperature is represented by a two-figure code-number (see 3.3.4). For paste resins, the viscosity of a standard paste is represented by a letter indicating the paste formulation used, two two-figure code-numbers for the viscosity at 16 s^{-1} and 100 s^{-1} and a code-letter indicating the type of rheological behaviour of the paste (see 3.3.5). The codes representing the four designatory properties are separated from each other by hyphens.

If a property value falls on or near a range limit, the manufacturer shall state which range will designate the material. If subsequent individual test values lie on, or on either side of, the range limit because of manufacturing tolerances, the designation is not affected.

NOTE — Not all combinations of the values of designatory properties are provided in currently available polymers.

3.3.1 Reduced viscosity

The reduced viscosity shall be determined in accordance with ISO 1060-2.

The possible values of the reduced viscosity are divided into 26 ranges, each represented by a three-figure code-number as specified in table 3.

Table 3 — Code-numbers used for reduced viscosity in data block 3

Code-number	Range of reduced viscosity (ml/g)
045	⩽ 47
050	> 47 but ⩽ 52
055	> 52 but ⩽ 57
060	> 57 but ⩽ 62
065	> 62 but ⩽ 67
070	> 67 but ⩽ 72
075	> 72 but ⩽ 77
080	> 77 but ⩽ 82
085	> 82 but ⩽ 87
090	> 87 but ⩽ 92
095	> 92 but ⩽ 97
100	> 97 but ⩽ 105
110	> 105 but ⩽ 115
120	> 115 but ⩽ 125
130	> 125 but ⩽ 135
145	> 135 but ⩽ 152
160	> 152 but ⩽ 167
175	> 167 but ⩽ 182
190	> 182 but ⩽ 197
205	> 197 but ⩽ 212
220	> 212 but ⩽ 227
235	> 227 but ⩽ 242
250	> 242 but ⩽ 257
265	> 257 but ⩽ 272
280	> 272 but ⩽ 287
295	> 287
XXX	not possible to measure because of insolubles

3.3.2 Apparent density

The apparent density shall be determined in accordance with ISO 1060-2.

The possible values of the apparent density are divided into 12 ranges, each represented by a two-figure code-number as specified in table 4.

Table 4 — Code-numbers used for apparent density in data block 3

Code-number	Range of apparent density (g/ml)
30	⩽ 0,32
35	> 0,32 but ⩽ 0,37
40	> 0,37 but ⩽ 0,42
45	> 0,42 but ⩽ 0,47
50	> 0,47 but ⩽ 0,52
55	> 0,52 but ⩽ 0,57
60	> 0,57 but ⩽ 0,62
65	> 0,62 but ⩽ 0,67
70	> 0,67 but ⩽ 0,72
75	> 0,72 but ⩽ 0,77
80	> 0,77 but ⩽ 0,82
85	> 0,82

3.3.3 Retention on a 63 µm sieve

The retention on a 63 µm sieve shall be determined in accordance with ISO 1060-2.

The possible values of the retention on the 63 µm sieve are divided into eight ranges, each represented by a two-figure code-number as specified in table 5.

Table 5 — Code-numbers used for retention on a 63 µm sieve in data block 3

Code-number	Range of retention on 63 µm sieve (%)
00	⩽ 1
03	> 1 but ⩽ 5
12	> 5 but ⩽ 20
30	> 20 but ⩽ 40
50	> 40 but ⩽ 60
70	> 60 but ⩽ 80
88	> 80 but ⩽ 95
98	> 95

3.3.4 Plasticizer absorption at room temperature (for general purpose resins and filler resins only)

The plasticizer absorption at room temperature shall be determined in accordance with ISO 1060-2.

The possible values of the plasticizer absorption are divided into five ranges, each represented by a two-figure code-number as specified in table 6.

Table 6 — Code-numbers used for plasticizer absorption in data block 3

Code-number	Range of plasticizer absorption (parts per 100 parts of resin by mass — phr)
05	⩽ 10
15	> 10 but ⩽ 20
25	> 20 but ⩽ 30
35	> 30 but ⩽ 40
45	> 40
XX	not practical to measure reproducibly

3.3.5 Viscosity and type of rheological behaviour of a standard paste (for paste resins only)

3.3.5.1 Viscosity of paste

The viscosity of a standard paste shall be determined in accordance with ISO 1060-2, 24 h ± 0,5 h after preparation of the paste and at shear rates of 16 s^{-1} ± 1 s^{-1} and 100 s^{-1} ± 1 s^{-1}. The conditioning and test temperature shall be 23 °C ± 0,2 °C.

The possible values of the two viscosities determined at the shear rates of 16 s^{-1} and 100 s^{-1} respectively are divided into nine ranges, each represented by a two-figure code-number as specified in table 7. The code-numbers for the two viscosities are separated by an oblique stroke. The standard paste formulation used, A or B, is recorded immediately in front of these code-numbers.

Table 7 — Code-numbers used for viscosity of a standard paste in data block 3

Code-number	Range of viscosity (Pa·s)
02	⩽ 3
04	> 3 but ⩽ 5
06	> 5 but ⩽ 7
08	> 7 but ⩽ 9
10	> 9 but ⩽ 11
15	> 11 but ⩽ 18
20	> 18 but ⩽ 25
30	> 25 but ⩽ 40
50	> 40
XX	not practical to measure reproducibly

3.3.5.2 Rheological behaviour of paste

The rheological behaviour between the shear rates 16 s^{-1} and 100 s^{-1} of the standard paste chosen to determine the viscosities in accordance with 3.3.5.1 shall be expressed by one of the following code-letters: D = dilatant, N = Newtonian, P = pseudoplastic and X = unspecified (see table 8). The code-letter which describes the rheological behaviour shall be recorded in the designation immediately after the viscosities determined in accordance with 3.3.5.1.

Table 8 — Code-letters used for rheological behaviour in data block 3

Code-letter representing rheological behaviour	Ratio $\frac{\text{Viscosity at shear rate of 16 } s^{-1}}{\text{Viscosity at shear rate of 100 } s^{-1}}$
D	< 0,75
N	0,75 to 1,33
P	> 1,33
X	unspecified

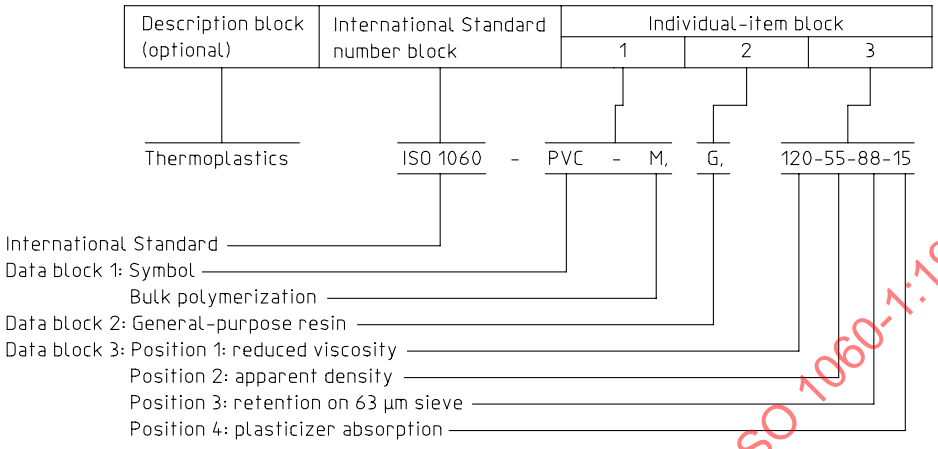
If the viscosity at the shear rate of 100 s^{-1} is not measurable, even with the formulation B paste, the rheological behaviour may be determined by measuring the viscosity over a smaller range of shear rates (e.g. 16 s^{-1} to 40 s^{-1}) and determining the viscosity at 100 s^{-1} by extrapolating from 40 s^{-1} to 100 s^{-1}.

3.4 Data block 5

Indication of additional requirements in this optional data block is a way of transforming the designation of a material into a specification for a particular application. This may be done for example by reference to a suitable national standard or to some other document recognized as suitable by the interested parties.

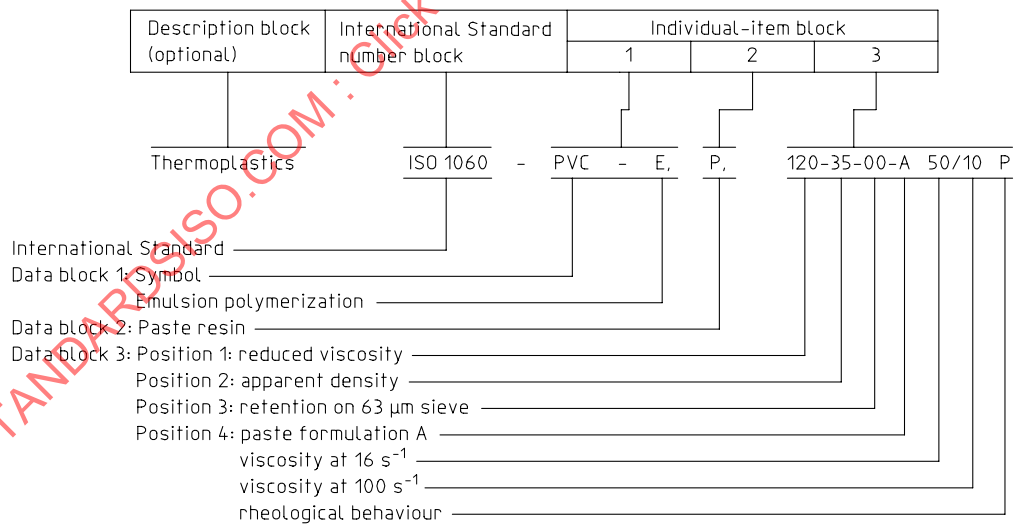
4 Examples of designations and specifications

4.1 A vinyl chloride homopolymer (PVC) produced by bulk polymerization (M) and intended for general-purpose applications (G), having a reduced viscosity of 120 ml/g (120), an apparent density of 0,55 g/ml (55), a retention on a 63 µm sieve of 92 % (88) and a plasticizer absorption of 16 phr (15), would be designated:



Designation: ISO 1060-PVC-M,G,120-55-88-15

4.2 A vinyl chloride homopolymer (PVC) produced by emulsion polymerization (E) for use as a paste resin (P), having a reduced viscosity of 123 ml/g (120), an apparent density of 0,32 g/ml (35), a retention on a 63 µm sieve of 0,1 % (00) and a viscosity of standard paste A of 50 Pa·s at 16 s^{-1} (50) and 10 Pa·s at 100 s^{-1} (10) and showing pseudoplastic behaviour (P), would be designated:



Designation: ISO 1060-PVC-E,P,120-35-00-A50/10P