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EAST AFRICAN STANDARD

Thermoplastics piping systems for non-pressure applications — Unplasticized poly(vinyl chloride) (PVC-U) pipes and fittings — Determination of the viscosity number and K-value

EAST AFRICAN COMMUNITY

First Edition 2010

Foreword

Development of the East African Standards has been necessitated by the need for harmonizing requirements governing quality of products and services in East Africa. It is envisaged that through harmonized standardization, trade barriers which are encountered when goods and services are exchanged within the Community will be removed.

In order to meet the above objectives, the EAC Partner States have enacted an East African Standardization, Quality Assurance, Metrology and Test Act, 2006 (EAC SQMT Act, 2006) to make provisions for ensuring standardization, quality assurance, metrology and testing of products produced or originating in a third country and traded in the Community in order to facilitate industrial development and trade as well as helping to protect the health and safety of society and the environment in the Community.

East African Standards are formulated in accordance with the procedures established by the East African Standards Committee. The East African Standards Committee is established under the provisions of Article 4 of the EAC SQMT Act, 2006. The Committee is composed of representatives of the National Standards Bodies in Partner States, together with the representatives from the private sectors and consumer organizations. Draft East African Standards are circulated to stakeholders through the National Standards Bodies in the Partner States. The comments received are discussed and incorporated before finalization of standards, in accordance with the procedures of the Community.

Article 15(1) of the EAC SQMT Act, 2006 provides that "Within six months of the declaration of an East African Standard, the Partner States shall adopt, without deviation from the approved text of the standard, the East African Standard as a national standard and withdraw any existing national standard with similar scope and purpose".

East African Standards are subject to review, to keep pace with technological advances. Users of the East African Standards are therefore expected to ensure that they always have the latest versions of the standards they are implementing.

East African Community

P O Box 1096

Arusha

Tanzania

Tel: 255 27 2504253/8

Fax: 255-27-2504481/2504255

E-Mail: eac@eachq.org

Web: www.each.int

Introduction

In the preparation of this East African Standard, the following source was consulted extensively:

ISO 13229:2010, *Thermoplastics piping systems for non-pressure applications — Unplasticized poly(vinyl chloride) (PVC-U) pipes and fittings — Determination of the viscosity number and K-value*

Assistance derived from this source and others inadvertently not mentioned is hereby acknowledged.

INTERNATIONAL STANDARD

ISO 13229

First edition
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Thermoplastics piping systems for non-pressure applications — Unplasticized poly(vinyl chloride) (PVC-U) pipes and fittings — Determination of the viscosity number and K-value

Systèmes de canalisations thermoplastiques pour applications sans pression — Tubes et raccords en poly(chlorure de vinyle) non plastifié (PVC-U) — Détermination de l'indice de viscosité réduite et de la valeur K

Reference number
ISO 13229:2010(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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 13229 was prepared by Technical Committee ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids*, Subcommittee SC 1, *Plastics pipes and fittings for soil, waste and drainage (including land drainage)*.

Thermoplastics piping systems for non-pressure applications — Unplasticized poly(vinyl chloride) (PVC-U) pipes and fittings — Determination of the viscosity number and K-value

1 Scope

This International Standard specifies a method for the determination of the viscosity number (also known as reduced viscosity) and K-value of an unplasticized poly(vinyl chloride) (PVC) resin derived from a pipe, fitting or compound.

In this International Standard, only the method for isolation (or separation) of the PVC resin is detailed, while the determination of the viscosity number is given in ISO 1628-2.

The presence of other additives or polymers can invalidate this method (see Clause 3).

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 1628-2, *Plastics — Determination of the viscosity of polymers in dilute solution using capillary viscometers — Part 2: Poly(vinyl chloride) resins*

3 Principle

A PVC resin, contained in a sample taken from a pipe, a fitting or a compound, is separated from most additives by dissolution in tetrahydrofuran (THF) and precipitation by methanol from a portion of the solution that has been isolated by centrifuging and decantation. The presence of additives in injection-moulding compounds can affect the results for materials for/from injection-moulded fittings.

If other polymers soluble in THF and insoluble in methanol (e.g. PMMA material) are present, this method shall not be used.

The precipitate is used for estimation of the viscosity number and K-value in accordance with ISO 1628-2.

4 Reagents for isolation or separation of the PVC resin

4.1 Tetrahydrofuran (THF), stabilized.

WARNING — It is very important for safety reasons that personal protective clothing be used when applying solvents to the test specimen. The use of solvents in regard to application of this International Standard may be further controlled under national and/or regional legislation. In particular, the THF used shall be collected, stored and sent to solvent recovery.

4.2 Methanol.

5 Apparatus for isolation or separation of the PVC resin

5.1 Glass container, of minimum capacity 100 ml.

5.2 Magnetic stirrer, with an adjustable speed of 0 r/min to 1 200 r/min.

5.3 Glass beaker, of capacity 600 ml, tall form.

5.4 Filter funnel.

5.5 Laboratory filter paper, capable of retaining polymer precipitated in accordance with 6.1.

5.6 Centrifuge with tubes, for 50 ml.

5.7 Vacuum dessicator.

5.8 Water bath, if necessary (see 6.1).

5.9 Pasteur pipette, if necessary (see 6.1).

6 Procedure

6.1 Isolation or separation of the PVC resin

Take approximately 2 g of PVC compound (2,5 g if the filler content is expected to be high), cut, if necessary, from the pipe or fitting tested.

Dissolve it in approximately 50 ml of THF in the glass container (5.1) by stirring. If the dissolution occurs slowly, warm carefully in a water bath (5.8).

The PVC resin shall be completely dissolved before continuing the procedure.

Transfer the solution to a tube of the centrifuge (5.6) and operate the centrifuge for approximately 40 min.

Decant that part of THF solution free of particles into the glass beaker (5.3), if necessary using a pasteur pipette (5.9), without entraining any filler.

In the beaker, precipitate the polymer by carefully adding methanol and stirring, until 10 parts of methanol have been added per part of THF solution.

Filter the suspension using a filter paper (5.5) and wash the precipitate with methanol. Transfer the precipitated polymer, but not the filter paper, to a bowl and dry at 50 °C for at least 12 h in the vacuum dessicator (5.7).

6.2 Determination of the viscosity number

Determine and record the viscosity number, in millilitres per gram, in accordance with ISO 1628-2 using a resin sample of (0,250 ± 0,000 25) g by dissolution in cyclohexanone.

7 Calculation of K-value

Calculate the K-value of the PVC resin using Equation (1):

$$K = \frac{1{,}5 \lg \frac{t}{t_0} - 1 + \left[1 + \left(402 + 1{,}5 \lg \frac{t}{t_0} \right) 1{,}5 \lg \frac{t}{t_0} \right]^{0{,}5}}{151{,}5} \times 1\ 000 \qquad (1)$$

where

t is the efflux time of the solution, in seconds;

t_0 is the efflux time of the solvent, in seconds.

Annex A gives the relation between the K-value and the viscosity number (reduced viscosity) for PVC resin.

8 Accuracy

The accuracy of the method for the determination of the K-value is ±2.

9 Test report

The test report shall include the following information:

a) a reference to this International Standard, i.e. ISO 13229:2010, and the referring standard;

b) complete identification of the pipe, fitting or compound tested;

c) the viscosity number;

d) the K-value;

e) any factor that could have affected the results, such as any incident or any operating details not specified in this International Standard;

f) the date of the test.

Annex A
(informative)

Relationship between *K*-value and viscosity number for PVC resin

For a PVC resin, the *K*-value according to Fikentscher[1] is calculated according to Equation (1).

For convenience, the *K*-values corresponding to a viscosity number from 60 ml/g to 178 ml/g for a solution in cyclohexanone containing 5 g resin/litre are given in Table A.1.

Table A.1 — Viscosity numbers and corresponding *K*-values

Viscosity number ml/g	*K*-value	Viscosity number ml/g	*K*-value	Viscosity number ml/g	*K*-value
60	49,6	100	63,5	140	73,8
62	50,5	102	64,1	142	74,3
64	51,3	104	64,7	144	74,7
66	52,1	106	65,2	146	75,1
68	52,8	108	65,8	148	75,6
70	53,6	110	66,3	150	76,0
72	54,3	112	66,9	152	76,5
74	55,1	114	67,4	154	76,9
76	55,8	116	67,9	156	77,3
78	56,5	118	68,5	158	77,7
80	57,2	120	69,0	160	78,1
82	57,9	122	69,5	162	78,5
84	58,5	124	70,0	164	78,9
86	59,2	126	70,5	166	79,3
88	59,8	128	71,0	168	79,7
90	60,5	130	71,5	170	80,1
92	61,1	132	71,9	172	80,5
94	61,7	134	72,4	174	80,9
96	62,3	136	72,9	176	81,3
98	62,9	138	73,3	178	81,7

Bibliography

[1] FIKENTSCHER, H. *Cellulosa chemie*, No. 13, 1932, pp. 58-64

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