DRAFT TANZANIA STANDARD

Paints and varnishes — Determination of viscosity by means of a Stormer viscometer

TANZANIA BUREAU OF STANDARDS

1st edition

0. FOREWORD

0.1. This Tanzania Draft Standard was prepared by the Technical Committee on *Paints and varnishes*. During the preparation of this standard reference was made to the following South African National Standard as published by SABS Standards Division:

SANS 5153:2003, *Paints and varnishes — Determination of viscosity by means of a Stormer viscometer.*

0.2. For the purpose of deciding whether a particular requirement of this standard is complied with, the final value observed or calculated expressing the result(s) of a test or analysis shall, be rounded off in accordance with TZS 4 (see clause 2). The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

This Draft Tanzania Standard specifies a method for determination of the dynamic viscosity of paints at a fixed frequency of rotation, i.e. constant stress. This method provides useful information for the quality control of surface coating materials and related materials.

2. Normative references

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

ISO 3270, *Paints and varnishes and their raw materials – Temperatures and humidities for conditioning and testing*

TZS 525:2016/ISO 1513, *Paints and varnishes – Examination and preparation of samples for testing*

TZS 1890:2016/ISO 15528, *Paints, varnishes and raw materials for paints and varnishes – Sampling*

3. Principle

The load to maintain a specially designed paddle, at a rotational speed of 200 r/min, when the paddle is immersed in the test liquid, is measured and expressed either in grams or converted to Krebs units.

4. Terms and definitions

For the purposes of this standard, the following terms and definitions apply:

4.1. Krebs units (KU)

approximately logarithmic scale of viscosity values, related to the mass load that is needed to maintain a constant rotational speed of 200 r/min in a Stormer viscometer (see Table 1)

4.2. standard atmosphere

enclosed atmosphere that complies with the requirements of ISO 3270.

5. Apparatus

5.1. Stormer viscometer, with an offset paddle-type rotor and fitted with either a stroboscopic timer or a digital read-out device. The viscometer shall be calibrated in accordance with Annex A. Automatic Stormer viscometers display the viscosity directly and do not require the manual addition of masspieces. These viscometers shall be calibrated in accordance with the manufacturer's instructions.

The masspieces supplied with the instrument shall cover the range from 5 g to 1 000 g.

5.2. Cylindrical container, of capacity 500 mL and of internal diameter 85 mm.

5.3. Thermometer, capable of reading to 23 °C ± 0,2 °C (see the notes to 6.2)

6. Procedure

6.1. Use the test specimen sampled in accordance with TZS 1890 and prepared in accordance with TZS 525 to fill the 500 mL container to within 20 mm from the top.

6.2. So adjust the temperature of the test specimen that it remains at 23 °C ± 2 °C throughout the test.

NOTE 1 It is found in practice that satisfactory results are obtained if the temperature of the specimen is at 23 °C ± 2 °C. A thermometer accurate to within 0.5 °C would be suitable in this case.

NOTE 2 The repeatability and reproducibility of this method will be affected if the smaller temperature range of ± 2 °C is not adhered to.

6.3. Stir the test specimen thoroughly, avoiding entrapment of air, and place the test specimen on the platform of the viscometer. Immerse the paddle into the test specimen up to the mark on the paddle shaft.

6.4. In the case of manual Stormer viscometers (where mass pieces need to be added manually), proceed as follows: Change the mass pieces on the hanger until the weight (to the nearest 5 g) that gives the closest possible rotation to 200 r/min is reached. Determine the rotational speed by observing the strobe pattern (see figure 1) or by using the r/min counter, whichever is available. Record the mass.

6.5. Determine from table 1 the Krebs-unit value that corresponds to the mass required to produce a rotational speed of 200 r/min.

6.6. In the case of automatic Stormer viscometers (where mass pieces need not be added manually), read the Krebs-unit value from the display.

Table 1 - Conversion table, grams to Krebs units

1		2		3		4		5		6		7		8		9		10		11	
g	KU	g	KU	g	KU	g	KU	g	KU	g	KU	g	KU	g	KU	g	KU	g	KU	g	KU
		100	61	200	82	300	95	400	104	500	112	600	120	700	125	800	131	900	136	1 000	140
		105	62	205	83																
		110	63	210	83	310	96	410	105	510	113	610	120	710	126	810	132	910	136	1 010	140
		115	64	215	84																
		120	65	220	85	320	97	420	106	520	114	620	121	720	126	820	132	920	137	1 020	140
		125	67	225	86																
		130	68	230	86	330	98	430	106	530	114	630	121	730	127	830	133	930	137	1 030	140
		135	69	235	87																
		140	70	240	88	340	99	440	107	540	115	640	122	740	127	840	133	940	138	1 040	140
		145	71	245	88																
		150	72	250	89	350	100	450	108	550	116	650	122	750	128	850	134	950	138	1 050	141
		155	73	255	90																
		160	74	260	90	360	101	460	109	560	117	660	123	760	129	860	134	960	138	1 060	141
		165	75	265	91																
70	53	170	76	270	91	370	102	470	110	570	118	670	123	770	129	870	135	970	139	1 070	141
75	54	175	77	275	92																
80	55	180	78	280	93	380	102	480	110	580	118	680	124	780	130	880	135	980	139	1 080	141
85	57	185	79	285	93																
90	58	190	80	290	94	390	103	490	111	590	119	690	124	790	131	890	136	990	140	1 090	141
95	60	195	81	295	94																

Figure 1 (a) - Correct strobe pattern

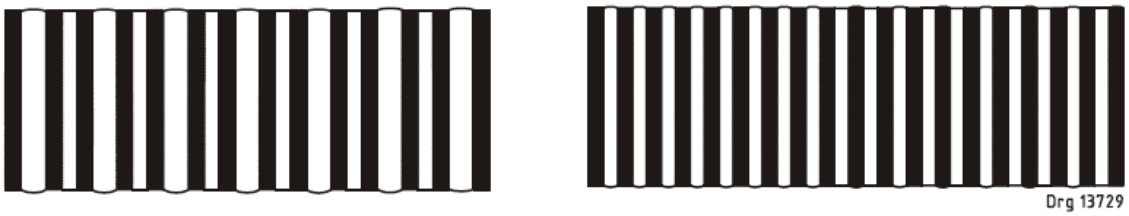

Figure 1(b) Examples of an incorrect strobe pattern

Figure 1 – Strobe patterns

7. Precision

7.1. Repeatability *(r)*

Consider results unrealiable if two results, each the mean of two measurements, on the same material by the same operators at different times, differ by more than 2.0 % in Krebs units at a 95 % confidence level.

7.2. Reproducibility *(R)*

Consider results unrealiable if two results, each the mean of two measurements, on the same material, obtained by operators in different laboratories, differ by more than 5.0 % in Krebs units at a 95 % confidence level.

NOTE: The precision statements are taken from ASTM D562:2001.

8. Test report

The test report shall contain at least the following information:

a) identification of the sample tested;a reference to this standard;viscosity, in Krebs units.

Annex A

(normative)

Calibration procedure for the Stormer viscometer

A.1 Instrument calibration

Remove the rotor from the viscometer and the mass support from the end of the string. Ensure that the string is wound evenly on the drum and does not cross or overlap itself.

Attach a 5 g masspiece to the end of the string and then release the brake. If the viscometer starts to turn and continues to turn for at least two complete revolutions of the drum, the instrument is considered to be within calibration. If the viscometer does not start unaided when the 5 g masspiece is applied, the instrument should be reconditioned.

Check the dimensions of the paddle against the specified dimensions available from the manufacturer, or against the dimensions of a previously unused paddle from the supplier.

A.2 Calibration between different viscometers

A.2.1 Selection of calibration liquids[1]

A calibration between viscometers can be carried out by means of suitable liquids such as mineral oils. The load value of oil is obtained from its viscosity value in millipascals per second by the following equation:

$$L = \frac{(6.1 \times \eta) + (906.6 \times \delta)}{30}$$

Where

L = the load, in grams, needed to produce 200 r/min;

η = the viscosity, in millipascals per second; and

δ = the density of the oil.

Select two oils whose assigned values of load lie within the expected range of load values for the coating materials to be tested.

A.2.2 Procedure

Carry out the test in a standard atmosphere. Each viscometer shall be left in the standard atmosphere for at least 2 h before the commencement of the test.

Adjust the temperature of the oil to 23 °C ± 0.2 °C. Determine to within 5 g, the load that produces a rotational speed of 200 r/min for each of the two oils. Measure the temperature again. If the temperature has changed, repeat the test. If the measured load is within 15 % of the calculated load value for the oils, the viscometer can be considered to be in satisfactory calibration.

[1] Oils at specific viscosities and that fall within the limits of the precision statements can be obtained in the market place for calibration purposes.

Bibliography

ASTM D562, *Standard test method for consistency of paints measuring Krebs unit (KU) viscosity using a stormer-type viscometer*.