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DETERMINATION OF VISCOSITY OF RUBBER LATICES

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For each individual country the only valid standard is the national standard of that country.

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BRIEF HISTORY

The ISO Recommendation R 1652, *Determination of viscosity of rubber latices*, was drawn up by Technical Committee ISO/TC 45, *Rubber*, the Secretariat of which is held by the British Standards Institution (BSI).

Work on this question led to the adoption of Draft ISO Recommendation No. 1652, which was circulated to all the ISO Member Bodies for enquiry in July 1968. It was approved, subject to a few modifications of an editorial nature, by the following Member Bodies :

Australia	Hungary	Poland
Austria	India	Spain
Brazil	Iran	Sweden
Canada	Israel	Switzerland
Colombia	Italy	Thailand
Czechoslovakia	Japan	U.A.R.
France	Korea, Rep. of	United Kingdom
Germany	Netherlands	U.S.A.
Greece	New Zealand	U.S.S.R.

No Member Body opposed the approval of the Draft.

This Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided to accept it as an ISO RECOMMENDATION.

ISO Recommendation R 1652 October 1970

DETERMINATION OF VISCOSITY OF RUBBER LATICES

1. SCOPE

This ISO Recommendation describes a procedure for the determination of the viscosity of both natural and synthetic rubber latices.

Two instruments are specified :

The *L instrument* is applicable for viscosities of up to 2000 mN·s/m^2 (2000 cP).

The *R instrument* is applicable for viscosities of above 200 mN·s/m^2 (200 cP).

2. PRINCIPLE

The viscosity is determined by means of a viscometer which measures the torque produced on a specified spindle rotating at constant speed and at a low rate of shear while immersed to a known depth in the latex.

Measurements may be made on the undiluted latex or on the latex after dilution to a required total solids content.

3. APPARATUS

3.1 *Viscometer.** This consists of an electric synchronous motor which drives, at a constant speed of rotation, a shaft to which spindles of different shapes and dimensions may be attached. The spindle is partially immersed in latex and the drag on the spindle rotating in the latex causes a torque to be developed on the spindle shaft. The equilibrium torque developed is indicated by means of a pointer and scale which is calibrated in units from 0 to 100.

The *L instrument* uses a spring torque of 67.37 ± 0.07 μ N·m (673.7 ± 0.7 dyn·cm) at full scale deflection.

The *R instrument* uses a spring torque of 718.7 ± 0.7 μ N·m (7187 ± 7 dyn·cm) at full scale deflection.

The spindles should be accurately made in accordance with the Figure, page 7, and to the dimensions given in Table 1.

A spirit level or bubble level should be incorporated in the motor housing to indicate, with the spindle attached to the motor shaft, when the spindle is vertical.

A guard should be used to protect the spindle in operation. This should consist of a rectangular bar of section approximately 9.5 mm × 3 mm, with the corners rounded, bent into a U.

The upper ends of the vertical legs of the guard should be securely attached to the motor housing but in such a way that the guard is removable for cleaning. The horizontal portion of the guard should join the vertical legs of the guard through internal radii of approximately 6 mm.

* Suitable instruments are obtainable from Brookfield Engineering Laboratories Inc. Models LVF and LVT meet the requirements for the *L instrument*, and models RVF and RVT meet the requirements for the *R instrument*.

The perpendicular distance between the inner faces of the two vertical legs of the guard when the guard is securely attached to the motor housing should be 31.8 ± 0.8 mm with the *L instrument* and 76.2 ± 0.8 mm with the *R instrument*. The perpendicular distance between the upper face of the horizontal portion of the guard and the bottom of the spindle shaft, when the guard is securely attached to the motor housing and when the spindle is attached to the motor shaft, should be not less than 10 mm with the *L instrument* and not less than 4.5 mm with the *R instrument*.

3.2 *Beaker*. A glass beaker of internal diameter at least 85 mm and of a capacity of at least 600 ml.

3.3 *Water bath*, controlled at 25 °C.

4. PREPARATION OF SAMPLE

The total solids content of the latex should be determined according to ISO Recommendation R 124, *Determination of total solids of latex*, 2nd Edition and then, if necessary, accurately adjusted to the required value by the addition of distilled water or water of equivalent purity. The water should be added slowly to the latex and the mixture gently stirred for 5 minutes, taking care to avoid inclusion of air.

If the latex contains occluded air and has a viscosity of less than about 200 mN·s/m^2 (200 cP), the air should be removed by allowing the latex to stand for 24 hours.

If the latex contains occluded air and no other volatile component, and has a viscosity greater than about 200 mN·s/m^2 (200 cP), the air should be removed by allowing the latex to stand under vacuum until foaming ceases.

Should the presence of coagulum be noted, the latex should be carefully strained through a screen having square apertures with sides of approximately 500 µm.

5. PROCEDURE

Pour the latex into the beaker (3.2). Place the beaker in the water bath (3.3) at 25 °C and stir the latex gently until its temperature is 25 ± 2 °C. Immediately attach the spindle securely to the motor shaft and attach the guard securely to the motor housing of the viscometer. Carefully insert the spindle and guard into the latex, in such a way as to avoid air being trapped, until the surface of the latex is at the mid-point of the groove on the spindle shaft. The spindle should be placed vertically in the latex and in the centre of the beaker.

Select the speed of rotation of the instrument as follows :

L instrument : 60 ± 0.2 rev/min

R instrument : 20 ± 0.2 rev/min

Switch on the viscometer motor and take the equilibrium reading to the nearest unit scale division, in accordance with the manufacturer's operating instructions. 20 to 30 seconds may elapse before the equilibrium reading is attained.

The lowest numbered spindle able to record the viscosity should be used.

When the reading has been obtained, the appropriate factor obtained from Table 2 should be used to calculate the viscosity of the latex in millinewton seconds per square metre (centipoises).

Because most rubber latices possess non-Newtonian fluid properties, which means that viscosity is dependent on the shearing stress applied, the measured viscosity should always be reported together with the viscometer instrument letter, and also the spindle number and the total solids content of the latex (diluted if required).

TABLE 1 – **Spindle dimensions**

Dimensions in millimetres

Spindle No.	A ± 1.3	B ± 0.03	C ± 0.03	D ± 0.06	E ± 1.3	F ± 0.15
L 1	115.1	3.18	18.84	65.10	–	81.0
L 2	115.1	3.18	18.72	6.86	25.4	50.0
L 3	115.1	3.18	12.70	1.65	25.4	50.0
R 1	133.3	3.18	56.26*	22.48**	27.0	61.1
R 2	133.3	3.18	46.93	1.57	27.0	49.2
R 3	133.3	3.18	34.69	1.65	27.0	49.2

* Wall thickness approximately 0.6 mm

** Wall thickness approximately 1.0 mm

TABLE 2 – **Factors necessary to convert reading on scale 0 to 100 to millinewton seconds per square metre (centipoises)**

Spindle No.	Factor
L 1	X 1
L 2 or R 1	X 5
L 3 or R 2	X 20
R 3	X 50