

Methods of testing

Plastics —

Part 7: Rheological properties —

**Method 732A: Determination of
viscosity number: general conditions**

IMPORTANT NOTE. Before reading this method it is essential to read BS 2782-0, *Introduction*, issued separately.

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Plastics and Rubber Standards Policy Committee (PRM/-) to Technical Committee PRM/21, upon which the following bodies were represented:

- British Plastics Federation
- British Steel Industry
- British Telecommunications plc
- British Textile Confederation
- Department of Trade and Industry (National Physical Laboratory)
- EEA (the Association of Electronics, Telecommunications and Business Equipment Industries)
- Electrical and Electronic Insulation Association (BEAMA Ltd.)
- Electrical Installation Equipment Manufacturers' Association (BEAMA Ltd.)
- GAMBICA (BEAMA Ltd.)
- Ministry of Defence
- Packaging and Industrial Films Association
- PIRA
- Plastic Industrial Containers Association
- Plastics and Rubber Institute
- RAPRA Technology Ltd.
- Standards Association of Australia
- Yarsley Technical Centre Ltd.

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National foreword

This British Standard has been prepared under the direction of the Plastics and Rubber Standards Policy Committee and is identical with ISO 1628-1:1984 “*Guidelines for the standardization of methods for the determination of viscosity number and limiting viscosity number of polymers in dilute solution — Part 1: General conditions*”, published by the International Organization for Standardization (ISO). It supersedes BS 2782:Method 730A:1979 which is withdrawn.

Cross-references

International Standard	Corresponding British Standard
ISO 31-3:1978	BS 5775 <i>Specification for quantities, units and symbols</i> Part 3:1979 <i>Mechanics</i> (Identical)
ISO 3205:1976	BS 2782 <i>Methods of testing plastics</i> Part 0:1982 <i>Introduction</i> (Annex B is identical)

The Technical Committee has reviewed the provisions of ISO 3105:1976 to which reference is made in the text and has decided that they are acceptable for use in conjunction with this standard.

WARNING NOTE. This British Standard, which is identical with ISO 1628-1, does not necessarily detail all the precautions necessary to meet the requirements of the Health and Safety at Work etc. Act 1974. Attention should be paid to any appropriate safety precautions and the method should be operated only by trained personnel.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 10, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope and field of application

This part of ISO 1628 defines the general conditions for determining the viscosity number and limiting viscosity number of organic polymers in dilute solution.

It is intended to be used as a guide in the development of standards for measuring the viscosities of individual types of polymers.

Furthermore, this International Standard may serve as a guide in measuring and reporting the viscosities of polymers for which no separate standards exist.

Annex A and Annex B give details for cleaning the apparatus and on the most important sources of error.

2 References

ISO 31/3, *Quantities and units of mechanics*.

ISO 3105, *Glass capillary kinematic viscometers — Specification and operating instructions*.

ISO 3205, *Preferred test temperatures*.

3 Definitions and units

3.1 Definitions applicable to any liquid

3.1.1

viscosity; dynamic viscosity, η

the viscosity of a fluid sheared between two parallel planes, one of which moves relative to the other in rectilinear and uniform motion in its own plane, is defined by the Newton equation:

$$\tau = \eta \dot{\gamma} \quad \dots (1)$$

where

τ is the shear stress;

η is the viscosity;

$\dot{\gamma} = \frac{dv}{dz}$ is the velocity gradient or rate of shear

(v is the velocity of one plane relative to the other and z the coordinate perpendicular to the two planes).

see ISO 31/3

NOTE Viscosity is usually taken to mean “Newtonian viscosity”, in which case the ratio of shearing stress to the velocity gradient is constant. In non-Newtonian behaviour, which is the usual case with high polymer solutions, the ratio varies with the shear rate. Such ratios are often called “apparent viscosities” at the corresponding shear rate.

the dimensions of viscosity are:

$$\text{ML}^{-1}\text{T}^{-1}$$

and the units are:

— International System: Pa s

— For practical use, the sub-multiple 10^{-3} Pa s is more convenient; this sub-unit corresponds to the centipoise (cP) unit which is no longer recommended.

3.1.2

viscosity/density ratio; kinematic viscosity, ν

this ratio is defined by the equation:

$$\nu = \frac{\eta}{\rho} \quad \dots (2)$$

where ρ is the density of the fluid at the temperature at which the viscosity is measured its dimensions are:

$$\text{L}^2\text{T}^{-1}$$

and its units are:

— International System: $\text{m}^2 \text{s}^{-1}$

— For practical use, the use of the sub-multiple $10^{-6} \text{m}^2 \text{s}^{-1}$, i.e. $\text{mm}^2 \text{s}^{-1}$, is more convenient; this sub-unit corresponds to the centistoke (cSt) unit which is no longer recommended.

3.2 Definitions applicable to polymer solutions

3.2.1

viscosity ratio (formerly called relative viscosity)

the ratio of the viscosities of the polymer solution (of stated concentration) η and of the pure solvent η_0 , at the same temperature:

$$\frac{\eta}{\eta_0} \quad \dots (3)$$

being a number, it is dimensionless

3.2.2

viscosity ratio increment (formerly called specific viscosity)

viscosity ratio minus one:

$$\left(\frac{\eta}{\eta_0}\right) - 1 = \frac{\eta - \eta_0}{\eta_0} \quad \dots (4)$$

being a number it is dimensionless

3.2.3

viscosity number, V.N. (formerly called reduced viscosity)

the ratio of the viscosity ratio increment to the polymer concentration in the solution:

$$\text{V.N.} = \frac{\eta - \eta_0}{\eta_0 c} \quad \dots (5)$$

its dimensions are

$$\text{M}^{-1}\text{L}^3$$

and its units are:

— International System: m^3/kg