

Methods of test for

Cereals and pulses —

**Part 27: Determination of rheological
properties of doughs using an
alveograph**

Committees responsible for this British Standard

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- Agricultural Engineers' Association
- Association of Public Analysts
- British Edible Pulse Association
- Department of Trade and Industry (National Weights and Measures Laboratory)
- Flour Milling and Baking Research Association
- Grain and Feed Trade Association
- Home Grown Cereals Authority
- Institute of Brewing
- Institute of Food Science and Technology
- Intervention Board for Agricultural Produce
- Ministry of Agriculture, Fisheries and Food
- NABIM
- National Association of Commodity Cargo Superintendents and Surveyors
- National Farmers' Union
- Natural Resources Institute
- Silsoe Research Institute
- United Kingdom Agricultural Supply Trade Association Ltd.

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Contents

	Page
Committees responsible	Inside front cover
National foreword	ii
1 Scope	1
2 Normative references	1
3 Principle	1
4 Reagents	1
5 Apparatus	1
6 Sampling	2
7 Procedure	2
8 Expression of results	6
9 Precision	8
10 Test report	9
Annex A (normative) Conversion table	10
Annex B (informative) Bibliography	11
Table 1 — Volume of sodium chloride solution to be added as a function of the moisture content of the flour	3
Table A.1	10
Figure 1 — Alveograph (old model)	5
Figure 2 — Alveograph (new model)	6
Figure 3 — Curves obtained by using a water pressure gauge	7
Figure 4 — Curves obtained on the printer of the integral RCV 4 computer	7
Publication(s) referred to	Inside back cover

National foreword

This Part of BS 4317 has been prepared under the direction of the Agriculture and Food Standards Policy Committee. It is identical with ISO 5530-4:1991 “Wheat flour — Physical characteristics of doughs — Part 4: Determination of rheological properties using an alveograph”, published by the International Organization for Standardization (ISO), and in the preparation of which the United Kingdom played a full part.

Cross-references

International Standard	Corresponding British Standard
ISO 712:1985	BS 4317 <i>Methods of test for cereals and pulses</i> Part 3:1987 <i>Determination of moisture content of cereals and cereal products (routine method)</i> (Identical)
ISO 2170:1980	BS 5333 <i>Methods for sampling cereals and pulses (as milled products)</i> (Identical)

A British Standard related to ISO 660:1983, referred to in clause 4 and Annex B for information only, is BS 684 “Methods of analysis of fats and fatty oils”, Section 2.10:1988 “Determination of acidity”. Method 5 of BS 684-2.10:1988 is technically equivalent to ISO 660:1983.

Additional information. With reference to clause 4, water complying with grade 3 of BS 3978 “Specification for water for laboratory use” is suitable.
With reference to 4.1, in the UK it is considered that it is more appropriate to use analytical reagent grade sodium chloride because food grade sodium chloride often contains additives in order to make it free flowing.
With reference to 7.3.1, paragraph 3, in the UK it is considered that it is more accurate to use a 25 ml burette graduated in 0.1 ml divisions.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 12, 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

This part of ISO 5530 specifies a method, using an alveograph, for determining certain rheological properties, in particular, the maximum overpressure p , the index of swelling G , the average abscissa at rupture l and the deformation energy W . The method is applicable to doughs made from wheat flour (*Triticum aestivum* Linnaeus).

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this part of ISO 5530. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this part of ISO 5530 are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 712:1985, *Cereals and cereal products — Determination of moisture content* (Routine reference method).

3 Principle

Preparation of a dough of constant moisture content from wheat flour and sodium chloride solution under specified conditions. Preparation of test pieces of specified thickness from the dough. After a period of rest, biaxial extension of the test pieces by inflating them into the form of a bubble. Plotting of the variation in pressure inside the bubble as a function of time. Assessment of the properties of the dough from the shape and area of the diagrams obtained.

4 Reagents

Use only reagents of recognized analytical quality, unless otherwise specified, and distilled or demineralized water or water of equivalent purity.

4.1 Sodium chloride, solution, prepared as follows.

Dissolve 25 g of sodium chloride, food grade, in the water and make up to 1 000 ml.

4.2 Refined vegetable oil, low in polyunsaturates, with an acid value less than 0,4 (see ISO 660), such as olive oil or groundnut oil; store in a dark place in a stoppered container and replace regularly (every 3 months). Alternatively, *paraffin oil* (also known as vaseline oil), sold by pharmacists under the name of *petrolatum liquidum* (liquid paraffin), which is a purified mixture of natural, liquid, saturated hydrocarbons obtained from petroleum, with an acid value less than or equal to 0,05. Use paraffin oil with the lowest possible viscosity [not more than 60 mPa s (60 cP) at 20 °C].

5 Apparatus

Usual laboratory equipment and, in particular, the following.

5.1 Alveograph¹⁾, with a temperature regulator, and having the following characteristics.

NOTE 1 Unless otherwise specified in the text, the characteristics given apply to both the old and the new model.

— Rotational frequency of the mixer blade: $(60 \pm 1) \text{ min}^{-1}$

NOTE 2 Some older models have a rotational frequency of the mixer blade of $(59 \pm 1) \text{ min}^{-1}$. This different frequency will not, however, have any effect on the results.

— Height of the sheeting guides: $(12,0 \pm 0,1) \text{ mm}$

— Diameter of the sheeting roller

large diameter: $(40,0 \pm 0,1) \text{ mm}$

small diameter: $(33,3 \pm 0,1) \text{ mm}$

— Inner diameter of the dough cutter: $(46,0 \pm 0,5) \text{ mm}$

— Diameter of the opening in the moving plate (diameter of the portion of the test piece subjected to inflation): $(55,0 \pm 0,1) \text{ mm}$

— Theoretical distance between the fixed and moving plates after clamping (equal to the thickness of the test piece before inflation): $(2,67 \pm 0,01) \text{ mm}$

— Volume of the pear-shaped rubber bulb: $(18 \pm 2) \text{ ml}$

— Linear speed of the periphery of the recording drum: $(5,5 \pm 0,1) \text{ mm/s}$

¹⁾ This part of ISO 5530 has been drawn up on the basis of the *Alveographe Chopin*, which is the only apparatus of this type presently available. It takes into account both the older hydraulic model (see Figure 1) and the new constant-flow air generator model (see Figure 2). The manufacturer also offers an integrated computer for the display and printing of the values W , p , l and p/l ; the computer also provides automatic detachment of the piece of dough (volume of air, 18 ml).

The manufacturer provides, with the apparatus, a burette graduated in percentages for the moisture content of flour, a knife/spatula, a planimetric scale and a scale for measuring the index of inflation and various sets of instructions for use.

Different types of pressure gauges may be supplied with the alveograph: the traditional type with $K = 1,1$ (see 8.2) and others with $K = 1,6$ (old model) and $K = 2,0$ (new model) for flours where the pressure p may rise to 132 mm ($K = 1,1$), 192 mm ($K = 1,6$) or 240 mm ($K = 2,0$).

Old model

— Volume of the burette between the marks 0 and 25: (625 ± 10) ml

— Flow-time in the burette between the marks 0 and 25: $(23,0 \pm 0,5)$ s

New model

— Flow rate of air generator after adjustment of load loss created by the calibrated nozzle No. 12 C: (96 ± 2) l/h

5.2 Burette, of 160 ml capacity, graduated in 0,25 ml intervals, or a *burette*, graduated directly in percentages of moisture content of the flour from 11,6 % to 17,8 % (accuracy 0,1 %).

5.3 Balance, accurate to 0,5 g.

5.4 Timer

5.5 Planimeter and/or *planimetric scale*

6 Sampling

Sampling should have been carried out in accordance with ISO 2170.

7 Procedure

NOTE 3 Unless otherwise stated in the text, the operations specified apply to both the old and the new model.

7.1 Preliminary checks

7.1.1 Both models

Before each test, check that the temperatures of the mixer and the alveograph are $(24,0 \pm 0,2)$ °C and $(25,0 \pm 0,2)$ °C respectively. Regulate the thermostat a sufficient time before use so that the mixer and alveograph have stabilized at these temperatures. Also check these temperatures while the apparatus is in use.

If the temperature of the mixer rises above 25 °C, follow the manufacturer's instructions for methods of cooling it.

7.1.2 Old model

7.1.2.1 Check regularly that the apparatus is sealed (no hydraulic leakage or air leakage).

7.1.2.2 Check that the water level in the burette is at index mark 0.

7.1.2.3 Check regularly the rate at which water rises in the burette. The time for water to flow between index marks 0 and 25 shall be $(23 \pm 0,5)$ s.

7.1.3 New model

7.1.3.1 Check regularly that the apparatus is sealed (no air leakage).

7.1.3.2 Using the calibrated nozzle No. 12 C, adjust the flow rates to obtain the following pressure readings:

— adjustment of the air generator: 92 mm pressure on the chart of the water pressure gauge or the computer display;

— adjustment of the flow-rate valve: 60 mm pressure on the chart of the water pressure gauge or the computer display.

7.1.4 Both models

Use the timer to check the rotation time of the recording drum, which shall be exactly 60 s for one revolution with a current of frequency 50 Hz (or of 60 Hz for apparatus with a motor of this type) (or 55 s from stop to stop). This corresponds to a linear chart travel of 302,5 mm in 55 s.

7.2 Preliminary operations

7.2.1 Determine the moisture content of the flour by the method specified in ISO 712.

7.2.2 Check that the temperature of the flour and that of the sodium chloride solution (4.1) is (20 ± 5) °C. The apparatus shall be used in a room where the temperature is between 18 °C and 22 °C and the relative humidity is (65 ± 15) %.

7.2.3 Determine from Table 1 the volume of sodium chloride solution (4.1) to be used in 7.3.1 to prepare the dough.

The values given in Table 1 have been calculated to obtain constant hydration of the dough, i.e. a dough made from 50 ml of sodium chloride solution (4.1) and 100 g of flour with a moisture content of 15 %.