INTERNATIONAL STANDARD

ISO 5530-4

Third edition
2002-08-15

Wheat flour (*Triticum aestivum* L.) — Physical characteristics of doughs —

Part 4: Determination of rheological properties using an alveograph

*Farines de blé tendre (*Triticum aestivum *L.) — Caractéristiques physiques des pâtes —*

Partie 4: Détermination des caractéristiques rhéologiques au moyen de l'alvéographe

Reference number
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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 3.

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 part of ISO 5530 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 5530-4 was prepared by Technical Committee ISO/TC 34, *Food products*, Subcommittee SC 4, *Cereals and pulses*.

This third edition cancels and replaces the second edition (ISO 5530-4:1991), which has been technically revised.

ISO 5530 consists of the following parts, under the general title *Wheat flour (*Triticum aestivum *L.) — Physical characteristics of doughs*:

— *Part 1: Determination of water absorption and rheological properties using a farinograph*

— *Part 2: Determination of rheological properties using an extensograph*

— *Part 3: Determination of water absorption and rheological properties using a valorigraph*

— *Part 4: Determination of rheological properties using an alveograph*

Annexes A and B of this part of ISO 5530 are for information only.

Introduction

The end use value of a wheat flour can be evaluated by a series of characteristics favourable to the manufacture of baked products such as bread, rusks and biscuits.

Among these characteristics, the viscoelastic (rheological) properties of the dough formed by hydration of the flour and subsequent mixing are important. An alveograph allows the principal parameters to be studied by subjecting a test piece of dough to biaxial extension similar to the deformation that occurs during fermentation.

Recording the pressure generated inside the bubble throughout the deformation of the test piece of dough until rupture provides information on the following:

— the resistance to deformation of dough or its strength (tenacity); this is expressed by the maximum pressure parameter (P);

— the extensibility or the possibility of the development of a bubble from a dough piece; this is expressed by the parameters of extensibility (L) or of swelling (G);

— the elasticity of the dough during biaxial extension; this is expressed by the elasticity index (I_e);

— the energy required to deform the dough bubble until rupture, which is proportional to the area of the alveogram (sum of the pressures throughout the deformation); this is expressed by the parameter W.

It is generally accepted that the strength P and the extensibility L should exceed a minimum level which can vary for particular end uses. This is expressed by the P/L ratio.

The alveograph is commonly used in the wheat and flour industry for

— selecting and assessing wheat varieties, and for commercial analysis of wheat batches,

— determining the above-mentioned viscoelastic properties of wheat flours with or without additives, in order to adjust them to the needs of the different processors, and

— blending different batches of wheats or flours in order to produce a batch with given values for those alveographic criteria complying with additive rules (W, P and L).

It is used both on the upstream side of the industry for the commercialization of wheats, and the selection and assessment of the varieties, and on the downstream side, in all of the baking industries (see Bibliography).

Wheat flour (*Triticum aestivum* L.) — Physical characteristics of doughs —

Part 4:
Determination of rheological properties using an alveograph

1 Scope

This part of ISO 5530 specifies a method, using an alveograph, for determining certain rheological properties of doughs obtained from "soft" or "hard" wheat flours (*Triticum aestivum* L.).

NOTE In some cases (see references [10] and [11]), the alveograph can be used for the determination of the characteristics of doughs obtained from semolinas of durum wheat (*Triticum durum* Desf.) with a particular methodology not considered in this part of ISO 5530.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 5530. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 5530 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 660, *Animal and vegetable fats and oils — Determination of acid value and acidity*

ISO 712, *Cereals and cereal products — Determination of moisture content — Routine reference method*

ISO 1042, *Laboratory glassware — One-mark volumetric flasks*

3 Principle

A dough with a constant water content is prepared from a wheat flour and salt water under specified conditions. Test pieces of dough with a predetermined thickness are prepared. The flattened dough pieces are inflated with biaxial extension to form a bubble. The pressure variations inside the bubble are plotted as a function of time. Assessment of the properties of the dough are obtained from the shape and area of the alveograms.

4 Reagents

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

4.1 Sodium chloride solution, obtained by dissolving (25 ± 0,2) g of sodium chloride in distilled water and diluting to 1 000 ml.

This solution shall not be stored for more than 15 days and its temperature shall be (20 ± 2) °C when used.

4.2 Refined vegetable oil, low in polyunsaturates, with an acid index value below 0,4 (determined according to ISO 660), such as peanut oil or olive oil.

This shall be stored in a dark place in a stoppered container and replaced regularly (every 3 months).

Alternatively, **paraffin oil** (also known as "vaseline oil"), with an acid index value less than or equal to 0,05, and the lowest possible viscosity [not more than 60 mPa·s (60 cP)] at 20 °C may be used.

4.3 Cleaner, capable of cleaning fatty surfaces at room temperature, and of eliminating dust and other soiling with high security[1)].

5 Apparatus

Usual laboratory equipment, and, in particular, the following.

5.1 Complete alveographic assembly.

Specifications of some accessories are given in Table 1.

5.1.1 Mixer (see Figure 1 for model types MA 82, MA 87 and MA 95 and Figures 2 and 3 for model type NG), with accurate temperature regulation, for the preparation of the dough sample.

5.1.2 Hydraulic manometer or **Alveolink** [see Figure 1b) for model types MA 82, MA 87 and MA 95 and Figures 2 and 3 for model type NG] to record the pressure/time curve.

5.1.3 Alveograph [2)] [see Figure 1c) for model types MA 82, MA 87 and MA 95 and Figures 2 and 3 for model type NG] for the biaxial deformation of the sample, with accurate temperature regulation.

It comprises two rest chambers, each one having five plates, for the relaxation of dough test pieces prior to deformation.

5.2 Burette, of 160 ml capacity, graduated in percentage of moisture content, accurate to 0,1 % [3)].

5.3 Balance, capable of weighing to the nearest 0,5 g.

5.4 Timer [4)].

5.5 Set of planimetric scales [5)].

5.6 Recording system, to record the test conditions specified in 7.2.2.

5.7 Volumetric flasks, of capacity 1 000 ml, class A according to ISO 1042.

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1) "Securclean ER" from ITECMA is an example of a suitable product available commercially. This information is given for the convenience of users of this part of ISO 5530 and does not constitute an endorsement by ISO of this product. Equivalent products may be used if they can be shown to give the same results.

2) This part of ISO 5530 has been drawn up on the basis of the CHOPIN alveograph, which is the only apparatus of this type presently available. It takes into account apparatus types MA 82, MA 87, MA 95 and the current NG alveograph type model.

3) This burette is supplied with the apparatus.

4) On model types MA 87, MA 95, the timer is incorporated in the mixer instrument panel. For the NG type, two timers are available on the instrument panel.

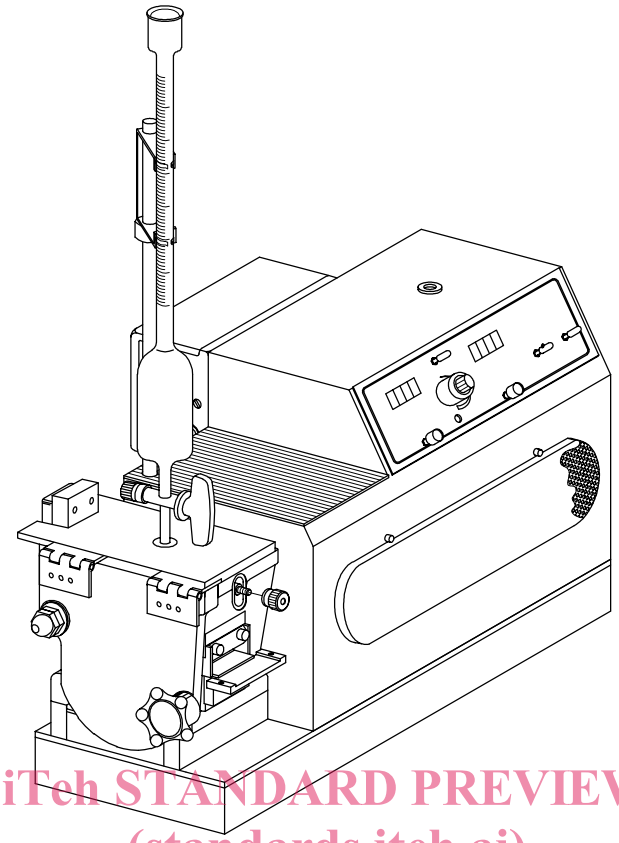
5) This set of scales is supplied with the apparatus.

Table 1 — Specifications for some of the accessories required for performing the test

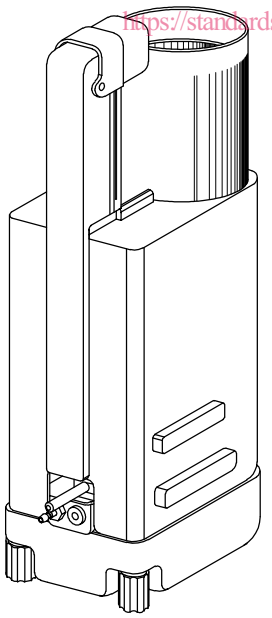
Rotational frequency of the mixer blade (s^{-1})	60 ± 2
Height of sheeting guides (mm)	12,0 ± 0,1
Sheeting roller, large diameter (mm)	40,0 ± 0,1
Sheeting roller, small diameter (mm)	33,3 ± 0,1
Internal diameter of dough cutter (mm)	46,0 ± 0,5
Orifice diameter of the top plate (which determines the effective diameter of the test piece which will be submitted to testing); see Figure 8 (mm)	55,0 ± 0,1
Theoretical distance between the fixed and moving plates after clamping (equal to the thickness of the test piece before inflation) (mm)	2,67 ± 0,01
Volume of air automatically injected for the detachment of the test piece prior to inflating the bubble (ml) [a]	18 ± 2
Linear speed of the periphery of the recording drum (mm/s)	5,5 ± 0,1
Air flow rate [b] ensuring inflation (l/h)	96 ± 2

[a] Older versions of the apparatus are equipped with a pear-shaped rubber bulb for manual injection of the 18 ml required for detachment.

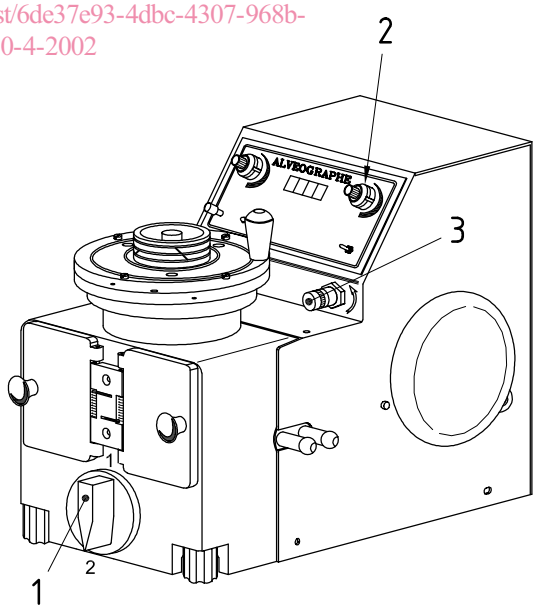
[b] To adjust the flow rate of the air generator used for inflating the bubble, install the 12C nozzle in order to create a defined pressure drop (a pressure corresponding to a height of 92 mm on the chart of the manometer). The air flow rate is set with the standardized pressure drop in order to obtain a pressure corresponding to a height of 60 mm on the chart of the manometer, i.e. 96 l/h ± 2 l/h (see Figures 2 and 3).



a) Mixer



b) Manometer

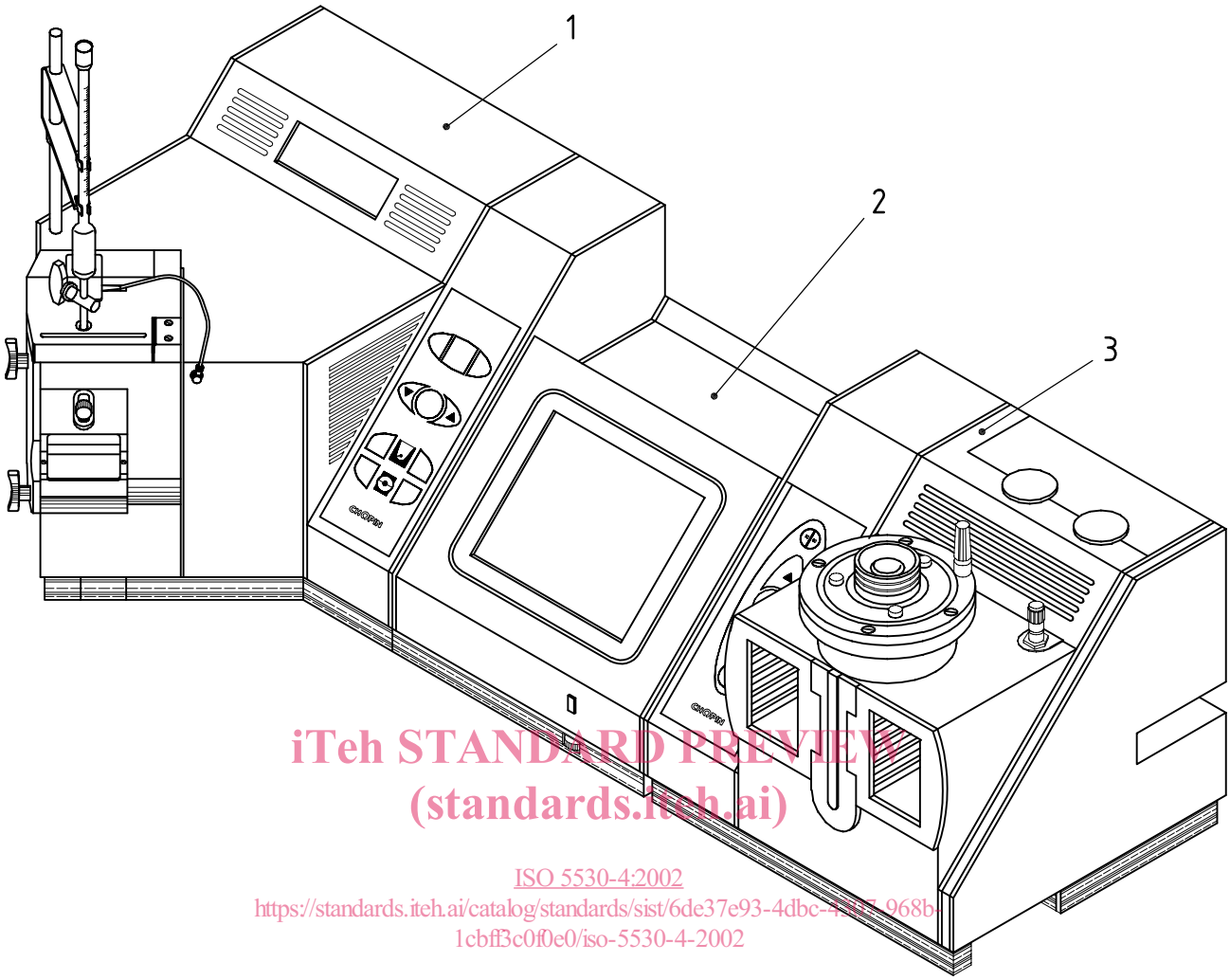


c) Alveograph

Key

1 Operating control A in position 2
2 Pump potentiometer
3 Micrometric valve for adjusting air flow

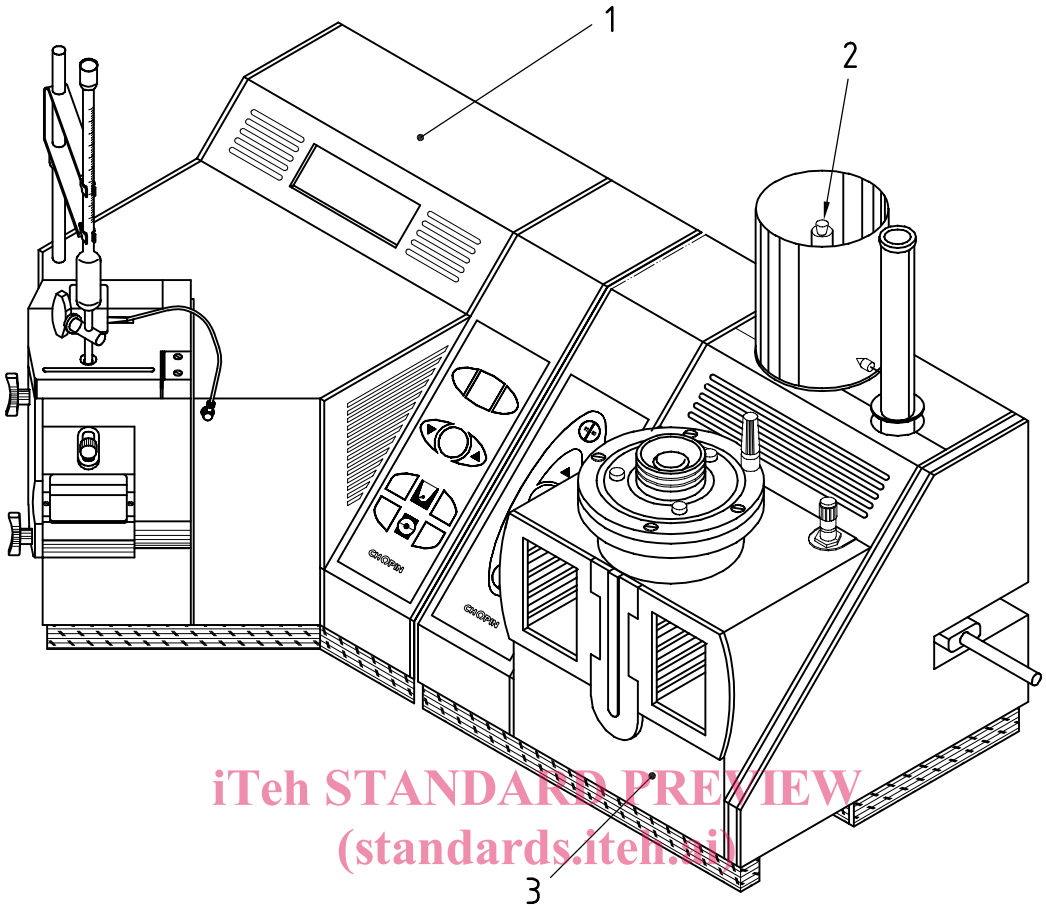
Figure 1 — Model types MA 82, MA 87 and MA 95 alveographic assemblies



Key

1 NG type mixer
2 NG type alveolink (recorder/integrator)
3 NG type alveograph (with Alveolink recorder/integrator)

Figure 2 — NG-type alveographic with Alveolink recorder/integrator



Key

1 NG type mixer
2 NG type manometer
3 NG type alveograph (with hydraulic recording manometer)

Figure 3 — NG-type alveographic assembly with hydraulic recording manometer

6 Sampling

Sampling is not part of the method specified in this part of ISO 5530. A recommended sampling method is given in ISO 13690 [1].

It is important that the laboratory receive a sample which is truly representative and has not been damaged or changed during transport or storage.

7 Procedure

7.1 Preliminary checks

7.1.1 Make sure the apparatus is clean (no dough residue in the mixer, in the extrusion aperture, etc.).

7.1.2 Make sure the register is closed to avoid flour losses and water leaks.