INTERNATIONAL STANDARD

ISO 5530-1

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Wheat flour — Physical characteristics of doughs —

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

Farines de blé tendre — Caractéristiques physiques des pâtes —
Partie 1: Détermination de l'absorption d'eau et des caractéristiques réhologiques aux moyens du farinographe

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.

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.

International Standard ISO 5530-1 was prepared by Technical Committee ISO/TC 34, *Agricultural food products*, Subcommittee SC 4, *Cereals and pulses*.

This part of ISO 5530 is based on Standard No. 115 of the International Association for Cereal Science and Technology (ICC).

This second edition cancels and replaces the first edition (ISO 5530-1:1988), which has been technically revised.

ISO 5530 consists of the following parts, under the general title *Wheat flour — 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 to C of this part of ISO 5530 are for information only.

International Organization for Standardization
Case postale 56 • CH-1211 Genève 20 • Switzerland
Internet central@iso.ch
X.400 c=ch; a=400net; p=iso; o=isocs; s=central

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Wheat flour — Physical characteristics of doughs —

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

1 Scope

This part of ISO 5530 specifies a method, using a farinograph, for the determination of the water absorption of flours and the mixing behaviour of doughs made from them.

The method is applicable to flour from wheat (*Triticum aestivum* L.).

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 the 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:—[1)], *Cereals and cereal products — Determination of moisture content — Routine reference method.*

3 Definitions

For the purposes of this part of ISO 5530, the following terms and definitions apply.

3.1 consistency
Resistance of a dough to being mixed in a farinograph at a specified constant speed.

NOTE — It is expressed in arbitrary units (farinograph units, FU).

3.2 water absorption (of flour)
Volume of water required to produce a dough with a maximum consistency of 500 FU, under the operating conditions specified in this part of ISO 5530.

NOTE — Water absorption is expressed in millilitres per 100 g of flour at 14 % (m/m) moisture content.

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1) To be published. (Revision of ISO 712:1985)

4 Principle

Measuring and recording, by means of a farinograph, the consistency of a dough as it is formed from flour and water, as it is developed, and as it changes with time.

NOTE — The maximum consistency of the dough is adjusted to a fixed value by adapting the quantity of water added. The correct water addition, which is called the water absorption, is used to obtain a complete mixing curve, the various features of which are a guide to the rheological properties (strength) of the flour.

5 Reagent

5.1 Distilled water, or water of equivalent purity.

6 Apparatus

Usual laboratory apparatus and, in particular, the following.

6.1 Farinograph[2], with a thermostat consisting of a constant temperature water bath (see annex A).

It shall have the following operating characteristics:

- slow blade rotational frequency: (63 ± 2) min^{-1} (rev/min); the ratio of the rotational frequencies of the mixing blades shall be 1,50 ± 0,01;

- torque per farinograph unit:

  a) for a 300 g mixer
  (9,8 ± 0,2) mN·m/FU [(100 ± 2) gf·cm/FU],

  b) for a 50 g mixer
  (1,96 ± 0,04) mN·m/FU [(20 ± 0,4) gf·cm/FU];

- chart speed: (1,00 ± 0,03) cm/min.

6.2 Burette

a) For a 300 g mixer, graduated from 135 ml to 225 ml in 0,2 ml divisions.

b) For a 50 g mixer, graduated from 22,5 ml to 37,5 ml in 0,1 ml divisions.

The time to flow from 0 ml to 225 ml or from 0 ml to 37,5 ml respectively shall be not more than 20 s.

6.3 Balance, capable of weighing to the nearest ± 0,1 g.

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[2] This part of ISO 5530 has been drawn up on the basis of the Brabender Farinograph. 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 apparatus. Other equipment may be used if it can be shown to give comparable results.

6.4 Spatula, made of soft plastic.

7 Sampling

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

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

8 Procedure

8.1 Determination of the moisture content of the flour

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

8.2 Preparation of apparatus

8.2.1 Turn on the thermostat of the farinograph (6.1) and circulate the water, until the required temperature is reached, prior to using the instrument. Before and during use, check the temperatures of the thermostat and of the mixing bowl, the latter in the hole provided for this purpose. The temperature of the mixing bowl shall be (30 ± 0,2) °C.

8.2.2 Uncouple the mixer from the driving shaft and adjust the position of the counterweight(s) so as to obtain zero deflection of the pointer with the motor running at the specified rotational frequency (see 6.1). Switch off the motor and then couple the mixer.

Lubricate the mixer with a drop of water between the back-plate and each of the blades. Check that the deflection of the pointer is within the range (0 ± 5) FU with the mixing blades rotating at the specified rotational frequency in the empty, clean bowl. If the deflection exceeds 5 FU, clean the mixer more thoroughly or eliminate other causes of friction.

Adjust the arm of the pen so as to obtain identical readings from the pointer and the recording pen.

Adjust the damper so that, with the motor running, the time required for the pointer to go from 1 000 FU to 100 FU is (1,0 ± 0,2) s.This should result in a bandwidth of approximately 60 FU to 90 FU.

8.2.3 Fill the burette (6.2), including the tip, with water at a temperature of (30 ± 0,5) °C.

8.3 Test portion

If necessary, bring the flour to a temperature of (25 ± 5) °C.

Weigh, to the nearest 0,1 g, the equivalent of 300 g (for a 300 g mixer) or 50 g (for a 50 g mixer) of flour having a moisture content of 14 % (m/m). Let this mass, in grams, be m; see table 1 for m as a function of moisture content.

Place the flour in the mixer. Cover the mixer, and keep it covered until the end of mixing (8.4.1) except, for the shortest possible time, when water has to be added and the dough scraped down (see A.2.2).

8.4 Determination

8.4.1 Mix at the specified rotational frequency (see 6.1) for 1 min or slightly longer. Start adding water from the burette into the right-hand front corner of the mixer within 25 s, when a whole-minute line on the recorder paper passes by the pen.

NOTE - In order to reduce the waiting time, the recorder paper may be moved forward during mixing of the flour. Do not move it backwards.

Add a volume of water close to that expected to produce a maximum consistency (9.1) of 500 FU. When the dough forms, scrape down the sides of the bowl with the spatula (6.4) adding any adhering particles to the dough, without stopping the mixer. If the consistency is too high, add a little more water to obtain a maximum consistency (9.1) of approximately 500 FU. Stop mixing and clean the mixer.

8.4.2 Make further mixings as necessary, until two mixings are available:

- in which the water addition has been completed within 25 s;

- the maximum consistencies (9.1) of which are between 480 FU and 520 FU; and

- the recording of which has been continued for at least 12 min after the end of the development time (9.2), if the degree of softening is to be reported.

Stop mixing and clean the mixer.

Table 1 — Mass of flour, in grams, equivalent to 300 g and 50 g at a moisture content of 14 % (m/m)

Moisture content	Mass m of flour equivalent to		Moisture content	Mass m of flour equivalent to	
% (m/m)	300 g	50 g	% (m/m)	300 g	50 g
9,0	283,5	47,3	13,6	298,6	49,8
9,1	283,8	47,3	13,7	299,0	49,8
9,2	284,1	47,4	13,8	299,3	49,9
9,3	284,5	47,4	13,9	299,7	49,9
9,4	284,8	47,5	14,0	300,0	50,0
9,5	285,1	47,5	14,1	300,3	50,1
9,6	285,4	47,6	14,2	300,7	50,1
9,7	285,7	47,6	14,3	301,1	50,2
9,8	286,0	47,7	14,4	301,4	50,2
9,9	286,3	47,7	14,5	301,8	50,3
10,0	286,7	47,8	14,6	302,1	50,4
10,1	287,0	47,8	14,7	302,5	50,4
10,2	287,3	47,9	14,8	302,8	50,5
10,3	287,6	47,9	14,9	303,2	50,5
10,4	287,9	48,0	15,0	303,5	50,6
10,5	288,3	48,0	15,1	303,9	50,6
10,6	288,6	48,1	15,2	304,2	50,7
10,7	288,9	48,2	15,3	304,6	50,8
10,8	289,2	48,2	15,4	305,0	50,8
10,9	289,6	48,3	15,5	305,3	50,9
11,0	289,9	48,3	15,6	305,7	50,9
11,1	290,2	48,4	15,7	306,0	51,0

Moisture content	Mass m of flour equivalent to		Moisture content	Mass m of flour equivalent to	
% (m/m)	300 g	50 g	% (m/m)	300 g	50 g
11,2	290,5	48,4	15,8	306,4	51,1
11,3	290,9	48,5	15,9	306,8	51,1
11,4	291,2	48,5	16,0	307,1	51,2
11,5	291,5	48,6	16,1	307,5	51,3
11,6	291,9	48,6	16,2	307,9	51,3
11,7	292,2	48,7	16,3	308,2	51,4
11,8	292,5	48,8	16,4	308,6	51,4
11,9	292,8	48,8	16,5	309,0	51,5
12,0	293,2	48,9	16,6	309,4	51,6
12,1	293,5	48,9	16,7	309,7	51,6
12,2	293,8	49,0	16,8	310,1	51,7
12,3	294,2	49,0	16,9	310,5	51,7
12,4	294,5	49,1	17,0	310,8	51,8
12,5	294,9	49,1	17,1	311,2	51,9
12,6	295,2	49,2	17,2	311,6	51,9
12,7	295,5	49,3	17,3	312,0	52,0
12,8	295,9	49,3	17,4	312,3	52,1
12,9	296,2	49,4	17,5	312,7	52,1
13,0	296,6	49,4	17,6	313,1	52,2
13,1	296,9	49,5	17,7	313,5	52,2
13,2	297,2	49,5	17,8	313,9	52,3
13,3	297,6	49,6	17,9	314,3	52,4
13,4	297,9	49,7	18,0	314,6	52,4
13,5	298,3	49,7			

NOTE — The values in this table were calculated using the following formulae:

a) for the mass, in grams, equivalent to 300 g at 14 % (m/m) moisture content:

$$m = \frac{25\,800}{100 - H}$$

b) for the mass, in grams, equivalent to 50 g at 14 % (m/m) moisture content:

$$m = \frac{4\,300}{100 - H}$$

where H is the moisture content of the sample, as a percentage by mass.

9 Expression of results

NOTE — To facilitate the calculations, a computer may be used. The farinograph has to be modified by adding an electrical output for transferring the data to the computer. With the appropriate software the computer evaluates the diagram according to 9.1 to 9.4, and documents the diagram and the results.

9.1 Calculation of water absorption

From each of the mixings with maximum consistencies between 480 FU and 520 FU, derive the corrected volume V_c, in millilitres, of water corresponding to a maximum consistency of 500 FU, by means of the following equations:

a) for a 300 g mixer:

$$V_c = V + 0{,}096(C - 500)$$

b) for a 50 g mixer:

$$V_c = V + 0{,}016(C - 500)$$

where

V is the volume, in millilitres, of water added;

C is the maximum consistency, in farinograph units (see figure 1), given by

$$C = \frac{c_1 + c_2}{2}$$

where

c_1 is the maximum height of the upper contour of the curve, in farinograph units;

c_2 is the maximum height of the lower contour of the curve, in farinograph units.

NOTE — In the relatively infrequent case where two maxima are observed, use the height of the higher maximum.

Use for the calculation the mean value of duplicate determinations of V_c, provided that the difference between them does not exceed 2,5 ml (for a 300 g mixer) or 0,5 ml (for a 50 g mixer) of water.

The farinograph water absorption, expressed in millilitres per 100 g of flour at 14 % (m/m) moisture content, is equal to

a) for a 300 g mixer:

$$\left(\overline{V}_c + m - 300\right) \times \frac{1}{3}$$

b) for a 50 g mixer:

$$\left(\overline{V}_c + m - 50\right) \times 2$$

where

$\overline{V}_c$ is the mean value of the duplicate determinations of the corrected volume, in millilitres, of water corresponding to a maximum consistency of 500 FU;

m is the mass, in grams, of the test portion derived from table 1.

Report the result to the nearest 0,1 ml per 100 g.

9.2 Calculation of dough development time

The dough development time is the time from the beginning of addition of water to the point on the curve immediately before the first signs of the decrease of consistency (see figure 1).

NOTE — In the relatively infrequent case where two maxima are observed, use the second maximum to measure the development time.

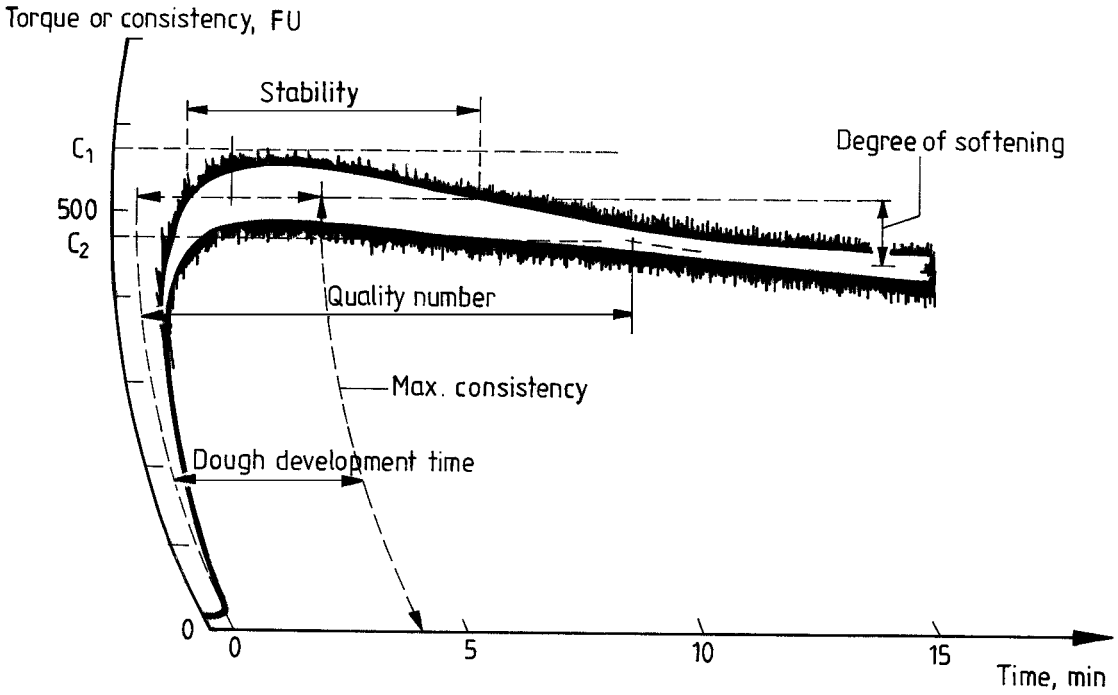

Figure 1 — Representative farinograph showing the commonly measured indices

Take as the result the mean dough development time from the two curves to the nearest 0,5 min, provided that the difference between them does not exceed 1 min for development times of up to 4 min, or 25 % of their mean value for longer development times.

9.3 Calculation of stability

Stability is defined as the difference in time, to the nearest 0,5 min, between the point at which the top of the curve first intercepts the 500 FU line and the point at which the top of the curve leaves the 500 FU line. This value, in general, gives some indication of the tolerance of the flour to mixing.

When the maximum consistency deviates from the 500 FU line (see 9.1), the line of this consistency should be used to read the interceptions.

9.4 Calculation of degree of softening

The degree of softening is the difference in height between the centre of the curve at the end of the dough development time and the centre of the curve 12 min after this point (see figure 1).

Take as the result the mean degree of softening from the two curves to the nearest 5 FU, provided that the difference between them does not exceed 20 FU for degrees of softening up to 100 FU, or 20 % of their mean value for larger values.

9.5 Other characteristics

9.5.1 The curve characteristics given in 9.1 to 9.4 are derived strictly from the recorded curve (figure 1).

9.5.2 In some countries, the quality number is calculated; this is the length, in millimetres, along the time axis, between the point of water addition and the point where the height of the centre of the curve has decreased by 30 FU compared to the height of the centre of the curve at the development time.