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Cheese — Determination of rheological properties by uniaxial compression at constant displacement rate

*Fromage — Détermination des propriétés rhéologiques par
compression uniaxiale à vitesse constante de translation*

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Contents

	Page
Forewords.....	iv
1 Scope.....	1
2 Normative references.....	1
3 Terms and definitions.....	1
4 Principle.....	1
5 Apparatus.....	2
6 Sampling.....	3
7 Procedure.....	4
7.1 Thermal equilibration of test samples.....	4
7.2 Test portion.....	4
7.2.1 Location.....	4
7.2.2 Direction.....	5
7.2.3 Geometry.....	5
7.2.4 Cutting.....	5
7.2.5 Delay.....	6
7.3 Test conditions.....	6
7.3.1 Relative deformation.....	6
7.3.2 Crosshead speed.....	6
7.3.3 Number of compression cycles.....	6
7.3.4 Number of test portions.....	7
7.3.5 Measuring temperature.....	7
7.3.6 Nature of the interface between test portion and plates.....	7
8 Analysis of the compression curves.....	7
8.1 Data representation and calculation.....	7
8.1.1 Data representation.....	7
8.1.2 Calculation of stress and strain.....	8
8.2 Parameters characterizing the compression curves.....	9
8.2.1 General.....	9
8.2.2 Modulus of deformability.....	9
8.2.3 Apparent fracture point.....	9
8.2.4 Apparent fracture work.....	10
8.3 Expression of results.....	11
9 Precision.....	11
9.1 Interlaboratory test.....	11
9.2 Repeatability.....	11
9.3 Reproducibility.....	11
10 Test report.....	12
Annex A (normative) Non-standard sample conditions.....	13
Annex B (informative) Examples of compression curves.....	15
Annex C (informative) Results of interlaboratory trial with one sample.....	17
Bibliography.....	18

Forewords

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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 34, *Food products*, Subcommittee SC 5, *Milk and milk products*, and the International Dairy Federation (IDF). It is being published jointly by ISO and IDF.

This second edition cancels and replaces the first edition (ISO/TS 17996:2006 | IDF/RM 205:2006), which has been technically revised, with the following changes:

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

IDF (the International Dairy Federation) is a non-profit private sector organization representing the interests of various stakeholders in dairying at the global level. IDF members are organized in National Committees, which are national associations composed of representatives of dairy-related national interest groups including dairy farmers, dairy processing industry, dairy suppliers, academics and governments/food control authorities.

ISO and IDF collaborate closely on all matters of standardization relating to methods of analysis and sampling for milk and milk products. Since 2001, ISO and IDF jointly publish their International Standards using the logos and reference numbers of both organizations.

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Cheese — Determination of rheological properties by uniaxial compression at constant displacement rate

1 Scope

This document specifies a method for the determination of rheological properties by uniaxial compression at constant displacement rate in hard and semi-hard cheeses.

The method provides standard conditions for sampling and testing, for data representation and general principles of calculation.

NOTE Sampling can be difficult with some cheese varieties, e.g. caused by shortness, brittleness, stickiness and soft consistency. In these cases, reliable results cannot be achieved.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at <https://www.iso.org/obp>

— IEC Electropedia: available at <https://www.electropedia.org/>

3.1

rheological properties

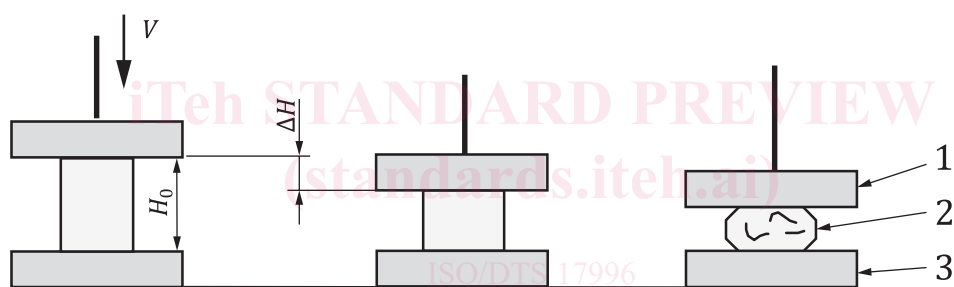
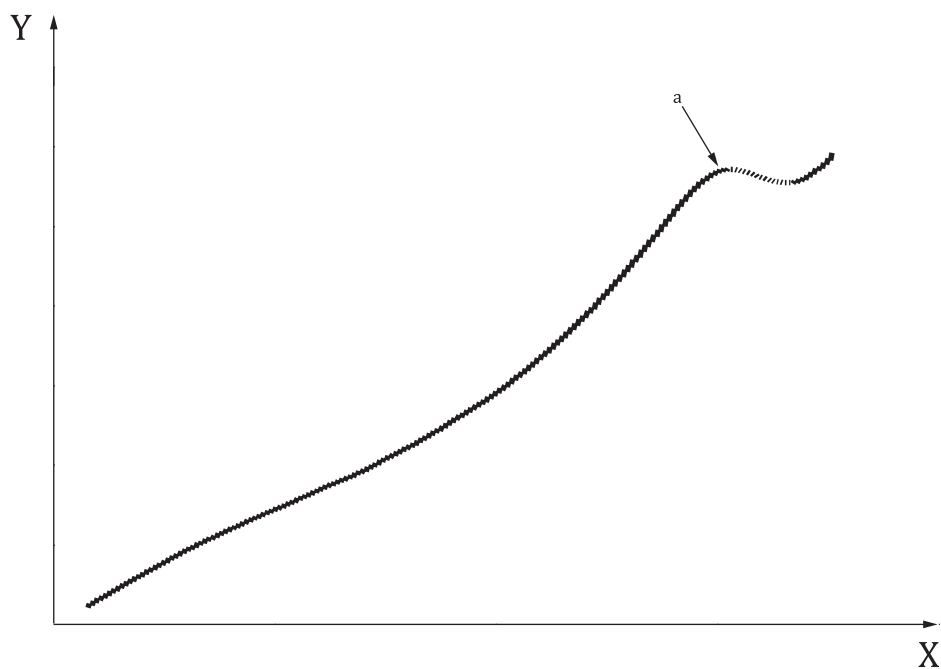
deformation under compression of the test sample

Note 1 to entry: to entry. In accordance with the procedure specified in this document.

4 Principle

A cylindrical test sample, of defined dimensions, is compressed at a constant crosshead speed with a compression tool up to a relative deformation sufficient to determine the apparent fracture point. The force, which is the resistance of the cheese sample during compression, is measured with a load cell. The displacement may be measured either from the position of the cross head or calculated from the elapsed time multiplied by the displacement rate.

A schematic representation of the principle of the test is given in [Figure 1](#).



Key		
X	displacement	V
Y	force	H_0
1	compression tool	ΔH
2	sample	a
3	fixed base	
		V
		H_0
		ΔH
		a

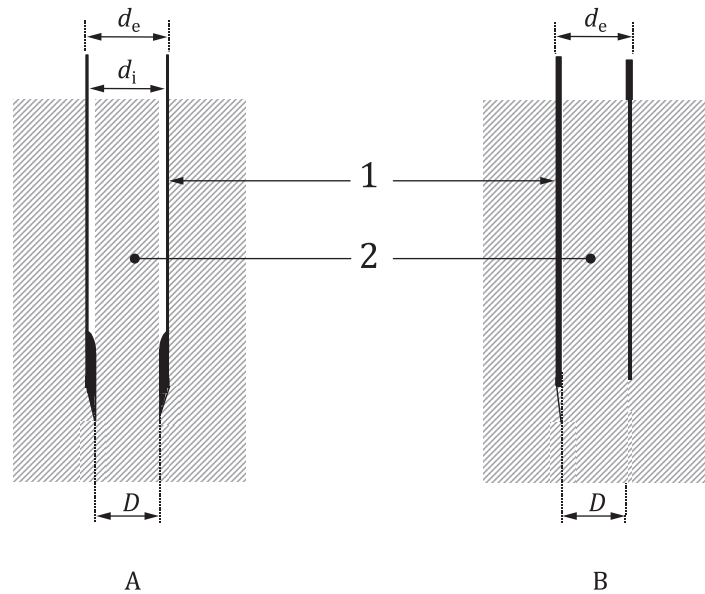
Figure 1 — Schematic principle of uniaxial compression at constant displacement rate

5 Apparatus

Usual laboratory equipment and, in particular, the following.

5.1 Cork-borer, such as that shown in [Figure 2](#) as an example.

It is recommended to mount the cork-borer on a drill-stand in order to drive it slowly and steadily through the test sample.



Key

- 1 cork borer
- 2 cheese plug

Example A: d_e external diameter ($d_e = 25$ mm)
 d_i internal diameter ($d_i = 23$ mm)
 D cutting head diameter ($D = 20$ mm)

Example B: d_e external diameter ($d_e = 16,5$ mm)
 D cutting head diameter ($D = d_i$ is the internal diameter of 15,3 mm)

Figure 2 — Cork-borers for cutting cylindrical cheese plug

5.2 Parallel-wire cutting device, with a wire of diameter less than or equal to 0,4 mm and with a system to keep the two wires parallel to each other and perpendicular to the plug. It should also include a mechanically driven cutting system to cut the test sample to the required height.

5.3 Measuring cell, with a support and compression plate of the same stiff material, with smooth and parallel surfaces, e.g. stainless steel, aluminium or polytetrafluoroethylene (PTFE), of diameter larger (by 20 %) than that of the deformed test portion when at maximum compression. The load cell capacity shall have a reasonable relationship to the expected maximum force.

5.4 Compression instrument, providing compression functions typically consisting of two (or one) vertical columns on a platform and a crosshead connected perpendicular to these columns. This crosshead is driven vertically up and down by a motor. The load cell is typically directly connected to this crosshead and fixed to the compression tool (top plate) as shown in [Figure 1](#). The fixed base in [Figure 1](#) (bottom plate) is connected to the platform.

6 Sampling

A representative sample should have been sent to the laboratory. It should not have been damaged or changed during transport or storage.

Sampling is not part of the method specified in this document. A recommended sampling method is given in ISO 707 | IDF 50^[1].

7 Procedure

7.1 Thermal equilibration of test samples

If the storage temperature of the loaf of cheese is above that of the measuring temperature, then the loaf of cheese shall be equilibrated at the measuring temperature for at least 50 h before further preparation of the test sample because of the slow crystallization of milk fat in the cheese.

If the storage temperature of the loaf of cheese is below that of the measuring temperature, before any preparation, store the loaf of cheese at the measuring temperature for at least 12 h. If there are specific difficulties that can occur during the sample preparation at the measuring temperature, then sample at the lower storage temperature and then equilibrate the test samples to the measurement temperature. In this case, the sample thermal equilibration time may be less than 12 h.

NOTE Examples of specific sampling difficulties are that the cheese is hard to cut, or a heated loaf of cheese changes the storage regime and therefore stops the use of the unsampled portions of the loaf of cheese for future measurements.

The following shall be avoided:

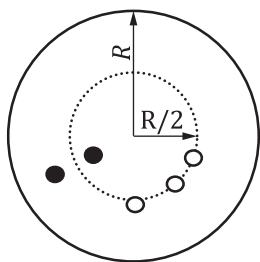
- a) dehydration of the test sample during the period of thermal equilibration;
- b) deformation of the test sample due to its own mass.

7.2 Test portion

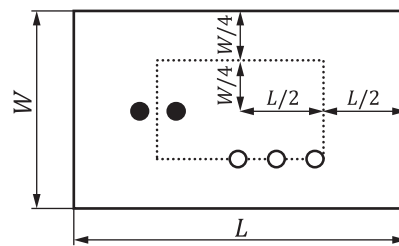
7.2.1 Location

Take the test portion from the loaf of the cheese with a plug about half a radius, either along a circle of a cylindrical cheese, or along one side of a rectangular cheese (see [Figure 3](#)).

Cut the test portion in the plug in the area representing around half of the length (see [Figure 4](#), plug A). If the height of cheese is sufficient, two portions can be taken as shown in [Figure 4](#), plug B and plug C.



a) Cheese with cylindrical form

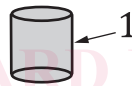
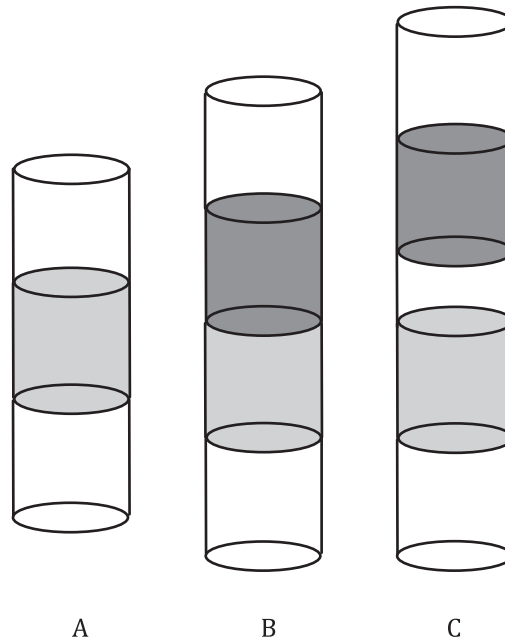


b) Cheese with parallelepipedal form

Key

- R radius
- W width
- L length
- plug in case 1
- plug in case 2

Figure 3 — Location of plug for cheese sampling



Key

1 sample

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Figure 4 — Three types of sampling in plug

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7.2.2 Direction

The standard direction for taking the test portion is parallel to the pressure axis in cheese making. See [Annex B](#) for non-standard sampling conditions.

7.2.3 Geometry

The shape of the test portion shall be a cylinder with initial height/diameter ratio (h_0/d_0) of between 1,1 and 1,5.

The initial height, h_0 , of the test portion shall range from 12,5 mm to 25 mm. The diameter, d_0 , for a given height follows the above-mentioned ratio.

7.2.4 Cutting

Remove the rind or the plastic cover. Take a test portion using a cork-borer (5.1) with shapes shown in [Figure 2](#). For sticky cheeses, samples are easier to take with corer A than corer B. For cheese varieties showing shortness or brittleness, form B as shown in [Figure 2](#) is more appropriate than form A. It is recommended to use a cork-borer mounted on a drill-stand in order to drive it slowly and steadily through the test sample.

If it is difficult to obtain a good cylindrical form, it is recommended to use mineral oil of low viscosity (e.g. Vaseline®¹⁾ oil) to lubricate the cork-borer. Do not test samples with cracks, holes or other visible defects.

1) Vaseline® is an example of a suitable product available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of this product.