INTERNATIONAL STANDARD

ISO 4174

Second edition
1998-02-15

Cereals, oilseeds and pulses — Measurement of unit pressure loss in one-dimensional air flow through bulk grain

Céréales, graines oléagineuses et légumineuses — Mesurage des pertes de charge unitaires dans un écoulement d'air unidimensionnel à travers une charge de grains

Reference number
ISO 4174:1998(E)

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 4174 was prepared by Technical Committee ISO/TC 34, *Agricultural food products*, Subcommittee SC 4, *Cereals and pulses.*

This second edition cancels and replaces the first edition (ISO 4174:1980), which has been technically revised.

Annex A of this International Standard is for information only.

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Printed in Switzerland

Introduction

Application of the law proposed by Kozeny-Carman for flows within a porous medium has been considered for grain (in particular for cereals and pulses), and such application appears to be sufficiently well verified.

The value of the unit pressure loss depends on the dimensions, porosity, moisture content and apparent density of the grain at a specific point, as well as the temperature, relative humidity, density and entering velocity of the air.

Experiments carried out by dimension categories allow two parameters to be eliminated: the moisture content and the shape (granulometry). The parameters that remain enable the characteristic coefficients of the medium to be determined: porosity and specific area. The results obtained may be used to predict the pressure losses for various densities at a specific point.

Cereals, oilseeds and pulses — Measurement of unit pressure loss in one-dimensional air flow through bulk grain

1 Scope

This International Standard specifies a method of measuring unit pressure loss in one-dimensional air flow through bulk grain, permitting calculation of the total pressure loss of a ventilation unit. This is equal to the sum of the pressure losses

a) in the ventilation system (ducts, etc.);

b) in the grain (which is the subject of this International Standard);

c) due to the passage of the air from the duct into the grain.

The pressure losses in the ventilation system and those due to the passage of the air from the duct into the grain can be considered as negligible in relation to the pressure losses in the grain if the air flow velocity does not exceed the following limits:

— 8 m/s to 10 m/s in the main duct;

— 4 m/s to 5 m/s in the secondary duct;

— 0,25 m/s when entering the grain.

If, for economic reasons, air velocities are higher than those indicated above (up to 30 m/s in the main duct), then, following pertinent literature, the pressure loss caused by the air distributing and discharging system has to be calculated.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this International Standard 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 3507:1976, *Pyknometers.*

3 Principle

An air flow through a mass of grain under uniform conditions gives rise to a pressure loss per metre of the grain passed, which can be expressed as a function of the velocity at which the air enters the grain.

The flow equation, which gives the unit pressure loss through the grain, is determined from the experimental curve.

4 Apparatus

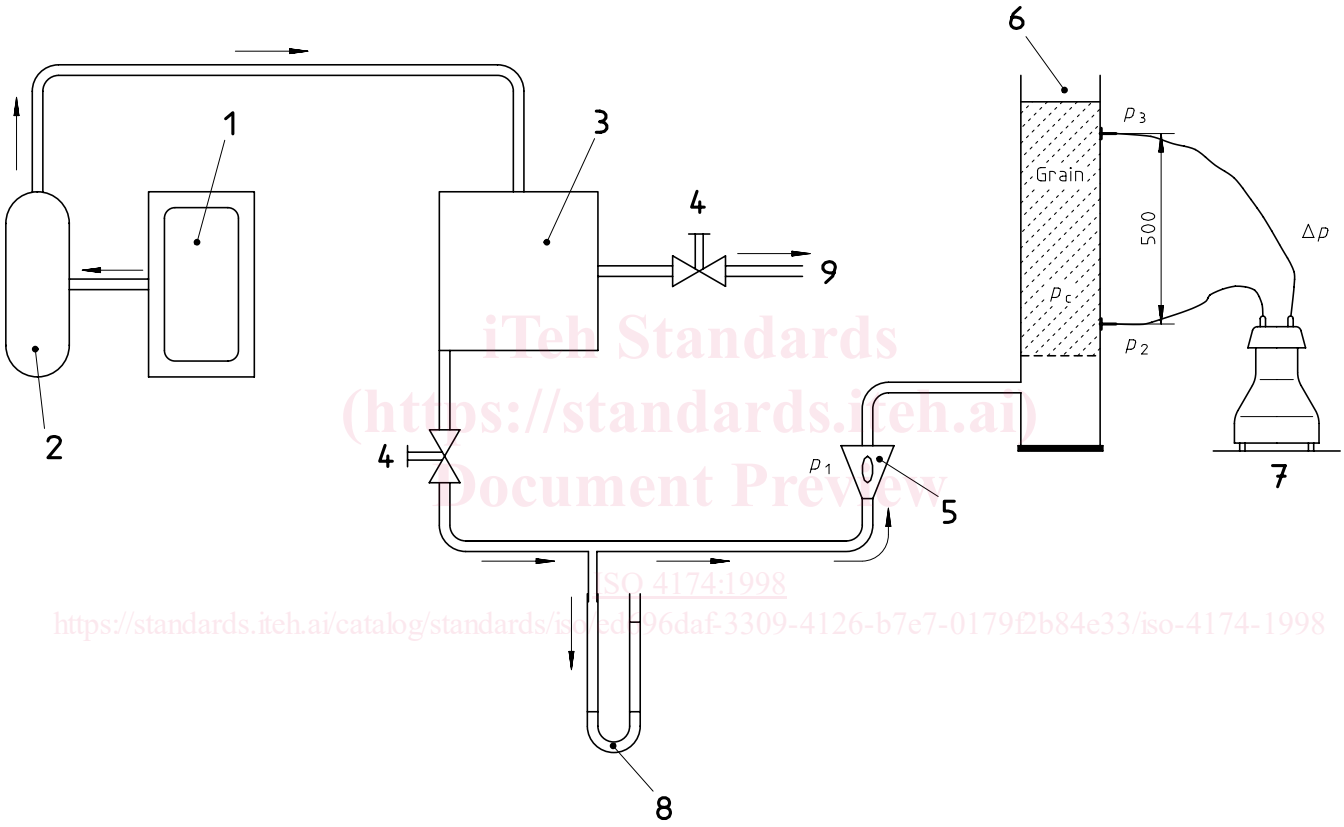
4.1 Device for measuring unit pressure losses (see figure 1)

The grain is placed in a smooth-wall cell consisting of a cylindrical tube with two pressure taps in its wall, 500 mm apart, each comprising two tubes with an internal diameter of 1 mm in contact with the grain. There is a pressure chamber at the base and a fine mesh on which the grain can be packed.

A fan, pump or compressor forces the air into a shock-absorbing bottle. The air then passes into a pressure chamber fitted with a needle-valve tap which can be opened and closed to adjust the air flow through the grain. The air flow is measured by a flow meter (e.g. a rotary meter).

Finally, the air pressure before the flow meter is measured by a manometer (e.g. manometric U-tube), and the pressure loss over 500 mm by a micromanometer (e.g. a miniscope) with an accuracy of ± 0,1 Pa.

Dimensions in millimetres



Key

1 Fan, pump or compressor (e.g. 3 m^3/h delivery)

2 Shock-absorbing bottle (e.g. 1,5 dm^3 capacity)

3 Pressure chamber (e.g. 25 dm^3 capacity)

4 Needle valve

5 Flow meter

6 Measuring cell

7 Miniscope

8 Manometer U-tube

9 To free air

Figure 1 — Diagram of apparatus for measuring unit pressure losses

4.2 Thermometer equipped with recorder, to measure and to record the temperature of the air entering the grain.

4.3 Ventilated psychrometer, or another device with equivalent accuracy (e.g. capacitive hygrometer or dew-point meter), to measure and to record the wet- and dry-bulb temperatures of the air during the test.