International Standard 4112

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION•МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ•ORGANISATION INTERNATIONALE DE NORMALISATION

Cereals and pulses — Measurement of the temperature of grain stored in silos

Céréales et légumineuses — Mesurage de la température des grains entreposés en silos

First edition — 1979-05-15

UDC 633.1/.3 : 664.821 : 536.5 **Ref. No. ISO 4112-1979 (E)**

Descriptors : agricultural products, grains (food), food storage, silos, tests, temperature measurement, temperature rise, test equipment.

Price based on 3 pages

FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up 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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 4112 was developed by Technical Committee ISO/TC 34, *Agricultural food products*, and was circulated to the member bodies in March 1977.

It has been approved by the member bodies of the following countries :

Australia	India	Portugal
Austria	Iran	Romania
Canada	Ireland	South Africa, Rep. of
Chile	Israel	Spain
Czechoslovakia	Korea, Rep. of	Thailand
Egypt, Arab Rep. of	Mexico	Turkey
France	New Zealand	USA
Ghana	Peru	Yugoslavia
Hungary	Poland	

The member body of the following country expressed disapproval of the document on technical grounds :

United Kingdom

Printed in Switzerland

Cereals and pulses — Measurement of the temperature of grain stored in silos

0 INTRODUCTION

The physiological processes which occur within a mass of grain* are accompanied by the emission of heat. As a result, temperature rises may occur which reach a level above which serious permanent deterioration in the commercial, technological and food properties of the grain will take place. It is therefore necessary to detect and measure these temperature rises with a view to avoiding damage due to overheating.

In large capacity silos, such damage is often localized and affects only a small proportion of the grain stored. However, the consequences of any overheating, even if the latter is localized, are always serious since a large batch may have to be marketed at reduced prices or may even become unsaleable because of the presence of damaged grain. Because of the ever-increasing demand for grain of good quality which can be stored in large silos for long periods, it is very important to check the temperature of the grain frequently by having a large number of measuring points in order to allow detection of the slightest overheating at any point in the silo and at any time during the period of storage, and the application of proper remedial measures through appropriate means (for example, by ventilation with cold or cooled air).

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies a method of measuring the temperature of grain during storage in silos.

2 PRINCIPLE

Placing a series of thermometric probes throughout the mass of grain in a silo, to detect any overheating.

3 APPARATUS

The type of apparatus and installation shall be suitable for the size and shape of silo; for example :

— portable apparatus for low storage capacities;

— semi-fixed or retractable apparatus for flat-bottomed silos;

— permanent installation for vertical silos.

The apparatus shall comprise the following :

3.1 Thermometric probes, one or more, usually consisting of a tube (3.1.1) with one or more temperature-sensing devices (3.1.2) and their respective output conductors contained within it.

NOTE — Flat-bottomed silos, if emptied by means of a scraper, should be equipped with retractable thermometric probes. The connecting cables fixed to the steel structure of the silo may be linked by flexible wire to the probes installed for the duration of storage.

3.1.1 Tube, of appropriate length, and of diameter approximately 1 cm (see note below), made of glass fibre, metal, or other suitable material having the necessary strength and rigidity to resist the very high stresses which it will undergo when the silo is filled or emptied. (The probe shall resist forces up to 10 kN**.) Its small diameter has the effect of reducing the strain at the fastening points and simplifying the anchorage system.

NOTE — The diameter specified above may need to be increased in the case of very deep silos in order to provide sufficient rigidity.

3.1.2 Temperature-sensing device : thermosensitive element consisting of a thermistor or a thermocouple or a resistance thermometer or any other suitable electrical temperature-sensing device capable of detecting variations of temperature of the order of 0,5 °C in the range − 20 to + 70 °C.

* The term "grain" is used in the text of this International Standard to mean the grain both of cereals and of pulses.

** 10 kN ≈ 1 tf

3.2 Temperature-reading device, which may be supplemented by a recording instrument (see the annex).

4 PROCEDURE

4.1 Positioning the apparatus

The distribution of the thermometric probes (3.1) and the distance between the measuring points shall be decided upon at the time the installation is designed. It is important that one measuring point be 1 to 2 m below the surface of the grain.

Usually the measuring points are arranged in such a way that their radii of sensitivity, which are generally 3 to 5 m, describe intersecting spheres.

4.1.1 *Portable apparatus and semi-fixed or retractable apparatus*

Sink the thermometric probe (3.1) connected to the temperature-reading device (3.2) manually or mechanically into the mass of grain.

4.1.2 *Permanent installation*

Fix the thermometric probe (3.1) at the top and the base of the storage silo with the measuring points located at regular intervals in the probe.

4.2 Temperature readings

Read the temperatures at the various measuring points in the mass of stored grain. Carry out this operation at regular intervals, increasing the frequency of reading during periods when rapid changes are seen to be taking place.

5 TEMPERATURE RECORD

The temperature record shall mention the method and apparatus used, the temperatures read at the different measuring points, and the times when the temperatures were read. It shall also mention all operating conditions not specified in this International Standard, or regarded as optional, as well as any circumstances that may have influenced the readings. It shall include, if necessary, all information relating to the silo in question and to the product in storage.

ANNEX

READING INSTRUMENTS

Reading instruments differ according to the size of the installation :

a) in installations of smaller size, the reading instruments may be an electrical measuring appliance, graduated in degrees Celsius, giving the temperature and fitted with a group of switches to allow readings to be taken at the various measuring points;

b) in larger installations, a control cabinet may comprise

- a synoptic panel of the silo and its various storage compartments;
- sight glasses through which the various measuring points may be seen;
- reading, recording and warning units.

The recording of temperatures may be automated by the successive scanning of the measuring points according to a predetermined programme (every 6, 12 or 24 h), the various measurements being printed on paper.

The control cabinet may simply hold the reading instruments and indicators. However, it may be made more complex and include

- an analogue or digital indicator for either manual or automatic noting of temperatures;
- a variation indicator showing any fluctuation of the temperature in relation to a set value;
- a group of temperature-graduated buttons corresponding to each measuring point, and allowing a set value to be displayed, with a view to triggering, in the event of any excess over this set value, an automatic alarm signal which may be visual or audible.

The person responsible for the silo, having been warned in good time, will be able for instance to switch on ventilation in the compartment affected. This ventilation may also be switched on automatically in relation to a set value of temperature.