# SRI LANKA STANDARD ISO 4112: 2018
**(ISO 4112: 1990)**
**UDC 664.6**

# METHOD OF TEST FOR DETERMINATION OF THE TEMPERATURE OF CEREALS AND PULSES STORED IN BULK

**SRI LANKA STANDARDS INSTITUTION**

**Sri Lanka Standard**

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**SLS ISO 4112: 2018**
**(ISO 4112: 1990)**

**Gr. B**


**SRI LANKA STANDARDS INSTITUTION**
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**SRI LANKA**

Sri Lanka Standards are subject to periodical revision in order to accommodate the progress made by industry. Suggestions for improvement will be recorded and brought to the notice of the Committees to which the revisions are entrusted.

This Standard does not purport to include all the necessary provisions of a contract

# Sri Lanka Standard
# METHOD OF TEST FOR DETERMINATION OF THE TEMPERATURE OF CEREALS AND PULSES STORED IN BULK

## NATIONAL FOREWORD

This Sri Lanka Standard was approved by the Sectoral Committee on Agriculture and was authorized for adoption and publication as a Sri Lanka Standard by the Council of the Sri Lanka Standards Institution on 2018-02-23.

This Sri Lanka Standard is identical with **ISO 4112: 1990** Cereals and pulses - Guidance on measurement of the temperature of grain stored in bulk, published by the International Organization for Standardization (ISO).

ISO 4112: 1990 specifies a method for the determination of the temperature of grain stored in silos or any other bulk store.

## Terminology and conventions

The text of the International Standard has been accepted as suitable for publication, without deviation, as a Sri Lanka Standard. However, certain terminology and conventions are not identical with those used in Sri Lanka Standards. Attention is therefore drawn to the following:

a) Wherever the words “International Standard” appear referring to this standard, they should be interpreted as “Sri Lanka Standard”.

b) The comma has been used throughout as a decimal marker. In Sri Lanka Standards it is the current practice to use a full point on the baseline as the decimal marker.

c) Wherever page numbers are quoted, they are ISO page numbers.

The test temperature adopted in Sri Lanka is 27 ± 2 $^{0}$C and relative humidity 65 + 5 per cent is recommended.

# INTERNATIONAL STANDARD

**ISO 4112**

Second edition
1990-12-15

# Cereals and pulses — Guidance on measurement of the temperature of grain stored in bulk

*Céréales et légumineuses — Directives générales pour le mesurage de la température des grains entreposés en vrac dans les installations de stockage*

Reference number
ISO 4112:1990(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 4112 was prepared by Technical Committee ISO/TC 34, *Agricultural food products*.

This second edition cancels and replaces the first edition (ISO 4112:1979), of which the scope has been expanded to include all bulk stores.

Annex A of this International Standard is for information only.



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Case Postale 56 • CH-1211 Genève 20 • Switzerland

Printed in Switzerland

## Introduction

The physiological processes which occur within a mass of stored grain are accompanied by the emission of heat. As a result, the temperature of the grain may reach a level at 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 any overheating during storage and to take immediate remedial measures, such as ventilation and cooling, since late remedial measures will in most cases have no effect.

In bulk stores such damage is often in the initial stages localized and affects only a small proportion of the grain stored. However, such damage, although localized in the initial stages, may spread to other regions of the stored grain if not checked in time. The consequences of any overheating, even if it is localized, are always serious since a batch of the grain 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 and the prolonged periods of bulk storage, it is important to check the temperature of the grain frequently. The use of thermometric equipment, based on a large number of measuring points, is an appropriate technique to meet this objective.

The thermometric equipment is also necessary to enable correct cooling by ventilation to be carried out. Such cooling, using successive steps of 5 °C to 7 °C, can be economically employed in cold climates. At 0 °C the physiological activity of grain is insignificant even when its moisture content is close to the maximum recognized internationally.

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INTERNATIONAL STANDARD ISO 4112:1990(E)

# Cereals and pulses — Guidance on measurement of the temperature of grain stored in bulk

## 1 Scope

This International Standard gives guidance on the measurement of the temperature of grain stored in silos or any other bulk store.

## 2 Definitions

For the purposes of this International Standard, the following definitions apply.

2.1 **grain:** Cereal grains and/or seeds of pulses.

2.2 **bulk store:** Large store in which grain is stored unpackaged in large quantities.

## 3 Principle

Placing a series of thermometric probes throughout the mass of stored grain to detect or monitor changes in temperature.

## 4 Apparatus

The type of apparatus or installation shall be suitable for the size and shape of the store. For example, use

— a portable apparatus, for small stores;

— a semi-fixed or retractable apparatus, for horizontal stores, i.e. stores with extensive floor areas and limited height;

— a permanent installation, for vertical stores (silos).

The apparatus shall comprise the following parts.

4.1 **Thermometric probes**, one or more, usually consisting of a rigid tube or flexible cable (4.1.1) with one or more temperature-sensing devices (4.1.2), together with their respective output conductors, which are housed in the tube or cable. When the probe is buried in the mass of grain, its response time to reach a steady temperature reading shall not exceed 3 min.

The materials used to fabricate the thermometric probes shall be resistant to products employed for fumigation and to damage by rodents.

Horizontal stores, emptied by means of a scraper, shall be equipped with retractable thermometric probes.

NOTE 1 Flexible cables suspended in vertical stores should be anchored at the bottom of the store to prevent dislocation during loading.

4.1.1 **Rigid tubes** or **flexible cables**, of appropriate length and diameter, made of glass fibre, metal or other suitable material and, particularly for vertical stores, having the strength and rigidity to resist the very high tensile and compressive forces which occur when the store is filled and emptied.

NOTE 2 Forces on the tubes or cables increase with their diameter, depth of burial and with movement of the grain during loading and unloading. Tensile forces of up to 50 kN may occur. A small diameter has the effect of reducing the strain at fastening points and simplifying the anchorage system. Conversely, larger diameters give greater rigidity which is particularly important for very deep stores.

4.1.2 **Temperature-sensing device** (thermosensitive element), consisting of a thermistor, or thermocouple, or a resistance thermometer, or any other electrical temperature-sensing device capable of detecting changes in temperature of the order of 0,5 °C, with a working range up to 70 °C and a lower limit appropriate for the local ambient temperatures.

**4.2 Temperature-reading device**, which may be supplemented by a recording instrument (see annex A for further information).

**4.3 Thermometric apparatus** (for ventilated stores), placed at the air inlet to measure the temperature of the ventilation air.

## 5 Procedure

### 5.1 Positioning the apparatus

Owing to the low thermal diffusivity in stored grain and the fact that measuring points shall be sufficiently close to each other to detect localized temperature changes within a short time of their occurring, the measuring points should be no more than 3 m apart from each other in any direction.

If for economic or other reasons, however, measurements are made at spacings of more than 3 m, this shall be recorded in the temperature records.

For horizontal stores, the upper measuring points shall be 1 m to 2 m below the surface of the grain.

It is essential that several probes or cables be positioned in the plane of symmetry of the store.

NOTE 3 In stores of limited height, it may be sufficient that the temperature be determined 0,3 m below the surface of the grain, 0,5 m above the floor, and mid-way between these points.

For vertical stores, the measuring points shall be spaced at regular intervals along vertical probes or cables in the immediate proximity of the walls and of the top and bottom.

It is essential also that one probe or cable be positioned on the axis of symmetry of the store.

### 5.2 Temperature readings

#### 5.2.1 Frequency of readings

If the grain is in unfavourable storage conditions (high temperature and moisture content), read the temperatures at the measuring points in the mass of stored grain at frequent time intervals, for instance every 24 h. For favourable storage conditions (dry and cold grain), the frequency of readings may be reduced (for example, to once a week).

Persons responsible for storage facilities shall determine the frequency of temperature readings, taking into account the nature of the stored product, the moisture content of the product, the season of the year, the degree of insect infestation of the product, etc.

#### 5.2.2 Particular requirements for ventilated stores

Read and record the temperatures at the various measuring points in the mass of stored grain using the following procedure.

If the ventilation is not in operation, carry out an initial temperature reading and then ventilate the grain for 30 min to 45 min, depending on the height of the store. Measure the temperature of the ventilation air at the inlet.

NOTE 4 During this short period of ventilation, the air at any hot spot present rises, thus heating the upper probe(s).

Carry out a second temperature reading after ventilation, correcting the value obtained where necessary to take account of the temperature of the ventilation air. If the result obtained between the initial and second temperature readings is approximately 5 °C or above, a hot spot may be presumed to be present and there is a risk of damage.

Provisions shall be made (service contracts, reserves of spare parts) to ensure that the upper probes are never out of commission for longer than 24 h.

## 6 Temperature records

The temperature records shall indicate the apparatus used, the temperatures recorded at the various measuring points, and the times at which the temperatures were measured. They 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. They shall include, if necessary, all information relating to the store in question and to the nature of the product stored.

# Annex A
(informative)

## Temperature-reading devices

Reading devices differ according to the size of the installation.

In small installations, the reading device may be an electrical or electronic measuring appliance, graduated in degrees Celsius, giving the temperature reading and fitted with a thermometric probe which is pushed into the mass of grain at the required measuring points.

In larger installations, a control cabinet may be used.

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

- an analog or digital indicator for either manual or automatic reading and recording of temperatures;
- a variation indicator showing any fluctuation in the temperature in relation to a set value;
- pre-set controls which, when the temperature rises above a pre-set value, automatically activate visual or audible alarm signals and possibly ventilation;
- a synoptic panel of the storage facility and its various storage compartments;
- automated temperature control whereby the measuring points are scanned according to a predetermined programme (for example, every 6 h, 12 h or 24 h), the various measurements being printed on paper.

**UDC [633.1 + 635.65]:664.724:536.5**

**Descriptors**: agricultural products, grains (food), leguminous grains, storage, food storage, temperature measurements.

Price based on 3 pages

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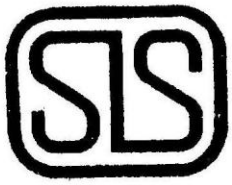


Printed at SLSI (Printing Unit)

## SRI LANKA STANDARDS INSTITUTION

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The principal objects of the Institution as set out in the Act are to prepare standards and promote their adoption, to provide facilities for examination and testing of products, to operate a Certification Marks Scheme, to certify the quality of products meant for local consumption or exports and to promote standardization and quality control by educational, consultancy and research activity.

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