

1. -----IND- 2018 0333 CZ- EN- ----- 20180803 --- --- PROJET

Executive summary for the EC (not part of this legislation)

Grain testers for determining the bulk density of cereals, oilseeds and pulses are placed on the market and put into use in the Czech Republic as specified measuring instruments following type approval and initial validation pursuant to Act No 505/1990 on metrology, as amended.

The subject of this notified regulation is to lay down metrological and technical requirements for these measuring instruments. This regulation also stipulates tests for type approval and verification.

*(End of executive summary.)*

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## PUBLIC DECREE

As the authority with substantive and territorial jurisdiction in the matter of laying down metrological and technical requirements for a specified measuring instrument and determining test methods for type approval and verification of the specified measuring instrument pursuant to § 14(1) of Act No 505/1990, on metrology, as amended (hereinafter the 'Metrology Act'), and in accordance with the provisions of § 172 et seq. of Act No 500/2004, the Code of Administrative Procedure (hereinafter the CAP), the Czech Metrology Institute (hereinafter the 'CMI') commenced ex officio proceedings on 14 June 2016 pursuant to § 46 of the CAP, and, based on supporting documents, issues the following:

### I.

#### DRAFT GENERAL MEASURE

number: 0111-OOP-C058-16

**stipulating metrological and technical requirements for specified measuring instruments 'grain testers' and test methods for type approval and verification of these specified measuring instruments**

### 1 Basic definitions

For the purposes of this general measure, the terms and definitions according to VIM and VIML<sup>1</sup> and the following apply:

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<sup>1</sup> TNI 01 0115 International Vocabulary of Metrology—Basic and General Concepts and Associated Terms (VIM) and International Vocabulary of Legal Metrology (VIML) are part of the technical harmonisation compendium 'Terminology in the field of metrology', which is publicly available at [www.unmz.cz](http://www.unmz.cz).

## 1.1 grain tester

a mechanical or electrical, manual or automatic device for measuring the volume of grain under specific conditions in order to determine the 'mass per hectolitre' of cereals, oilseeds and pulses; the device must be verified pursuant to this Measure of a General Nature (hereinafter the 'Measure') and must comply with its requirements.

A grain tester determines the hectolitre weight of cereals, oilseeds and pulses in ranges stipulated by the manufacturer or in the measuring instrument's type-approval certificate.

### 1.1.1 mechanical grain tester

a mechanical device containing a measuring and filling container and accessories needed for their use, for example an alignment knife, a slider or ring for the measuring container, etc. The device must permit adjustment.

The manner in which the grain is poured into the measuring container may cause measurements using a variety measuring instruments to differ and lead to measurement errors. It is therefore necessary to ensure that these measuring instruments are of suitable design, size, shape and material.

### 1.1.2 automatic grain tester

an automatic device, stand-alone or part of other measuring instruments—multi-parameter grain analysers

Measurement is based on calculation of a calibration curve, the ability to shift and tilt it, and monitoring of measuring instrument drift. The resulting measurement of bulk density is displayed directly in  $\text{kg}\cdot\text{hl}^{-1}$ .

## 1.2 mass per hectolitre (bulk density)

specification of bulk density, i.e. the weight to volume ratio of grain after controlled pouring into a measuring container under precisely stipulated conditions, or using a calculation formula<sup>2</sup>; it is expressed in  $\text{kg}\cdot\text{hl}^{-1}$

## 1.3 concurrence among grains

a method to establish continuity between grain testers

# 2 Metrological requirements

## 2.1 Specified operating conditions

Grain testers are used under the following specified operating conditions:

Ambient temperature:	at least +10 °C to +30 °C.
Relative humidity:	a maximum of 85 %.
Cereals:	must be free of coarse admixtures and contaminants <sup>3</sup> , and the temperature of the measured cereal must be the same as the ambient temperature around the measuring instrument.

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<sup>2</sup> ČSN EN ISO 7971-3:2010. Cereals—Determination of bulk density, called mass per hectolitre—Part 3:Routine method, Annex A

<sup>3</sup> ČSN 46 1011-6 Testing of cereals, pulses and oilseeds—Part 6:Testing of cereals—Determination of grain admixtures and impurities content

Vibration: the grain tester must be placed on a flat and solid foundation in order to prevent vibration and shaking.

The grain tester must be protected from extreme temperatures, air humidity and dust.

All parts of the grain tester must be marked with a serial number and must not be interchanged. In the event of any deformation or damage, they must be discarded. Parts must be clean during measurement. The measuring instrument must be assembled in a precise manner, and with serial numbers easily accessible and visible to operators.

## 2.2 Rated measurement range

Table 1 specifies the bulk density measurement range for individual crops.

**Table 1— - Rated measurement range**

Crop	From [kg·hl <sup>-1</sup> ]	To [kg·hl <sup>-1</sup> ]
Wheat	61.6	88.1
Barley	44.9	81.6
Rye	35.3	66.1
Oats	54.8	84.7

The manufacturer may specify a different measurement range, and a different range may also be specified for other crops.

## 2.3 Maximum permissible error

### 2.3.1 Maximum permissible error of a grain tester

The maximum permissible error of a grain tester is  $\pm 0.3$  kg·hl<sup>-1</sup> for bulk volume of  $< 70$  kg·hl<sup>-1</sup>.

The maximum permissible error of a grain tester is  $\pm 0.4$  kg·hl<sup>-1</sup> for bulk volume of  $\geq 70$  kg·hl<sup>-1</sup>.

### 2.3.2 Repeatability limit

Repeatability  $\Delta p_i$ —the difference between the highest and lowest bulk volume value after repeated measurement of an identical sample must not exceed 0.3 kg·hl<sup>-1</sup>.

## 3 Technical requirements

All components must be made with resistant and durable material. Components must not deform during use.

It is necessary to take into account the fact that the measurement result is influenced by the manner of pouring and cutting off the measured content in the measuring container, the density of cereals and space between grains, and their size and shape. Repeated measurement of cereal samples reduces the coefficient of friction between grains and increases bulk density.

Examples of two types of mechanical grain testers are given in Annex 1 and 2.

### 3.1 Mechanical grain tester

The mechanical device must comprise a measuring and filling container and accessories needed for their use, for example a slider and a knife.

### 3.2 Automatic grain tester

Appropriate calibration curves and recommended volumes of cereals for measurement are stipulated for various types of cereals.

The device must make it possible to clearly select, shift and tilt the calibration curve.

### 3.3 Scales

Scales must comply with requirements for non-automatic scales<sup>4</sup> and the following requirements:

- Accuracy class II scales with corresponding weighing capacity:
- for 1 L grain testers  $\geq$ , scales with  $d = 0.1$  g,  $e = 10d$  are used;
- for 1 L grain testers  $<$ , scales with  $d = 0.01$  g,  $e = 10d$  are used.

### 3.4 Measuring instrument security and fraud protection

The locations where a mechanical as well as automatic grain tester measuring instrument must be secured against unauthorised changes are specified in its type-approval certificate.

### 3.5 Transport and storage

During transport and storage, the grain tester must be protected from physical damage and corrosion.

## 4 Measuring instrument labelling

### 4.1 Markings on the measuring instrument

The following information must be indicated on the measuring instrument:

- a) the nominal volume of the measuring container or hopper;
- b) the type-approval mark;
- c) the manufacturer or the manufacturer's trademark on the measuring container, the year of manufacture;
- d) the word 'up' on the top surface of the knife (if the measuring instrument includes a knife);
- e) the serial number (on all parts of a mechanical grain tester: the measuring container, the hopper or on the filler and flange, the knife, on the reinforced centre of the upper side of the slider; on the data plate of an automatic grain tester; the data plate can also apply to the measuring instrument, with which for example a multi-parameter hygrometer is combined).

### 4.2 Placement of the official mark

The official mark is placed on the data plate, and in the case of a mechanical grain tester also on the measuring container and other components. Security labels are used to secure points of entry that influence accuracy (adjustment elements) and correct measurement.

## 5 Type approval of the measuring instrument

Measuring instrument testing during type approval includes:

- a) an external inspection;
- b) measurement of the dimensions and weight of measuring instrument components according to technical documentation;
- c) accuracy and repeatability tests.

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<sup>4</sup> Government Regulation No 121/2016 on conformity assessment of non-automatic scales when being placed on the market

## 5.1 Number of sample measuring instruments for testing

Three sample measuring instruments are tested.

## 5.2 External inspection

During the external inspection, the measuring instrument's condition, data plate, and serial numbers are checked, and that all components are intact.

All internal surfaces must be clean and bear no signs of damage.

## 5.3 Measurement of the dimensions and weight of all measuring instrument components

The dimensions and weight of the tested measuring instrument's components are tested, for example in accordance with Annex P.1 or P.2 or the manufacturer's technical documentation.

## 5.4 Accuracy and repeatability tests

### 5.4.1 Test equipment requirements

Required reference standards, measuring instruments, and aids:

- a primary reference standard or secondary reference standard with class I or II bulk density;
- highly accurate scales  $d = 0.01$  g for volumes  $\leq 1$  L,  $d = 0.1$  g for volumes  $> 1$  L;
- a slide gauge with a 0–250 mm range and resolution of at least 0.1 mm;
- a slide depth gauge with a 0–300 mm range and resolution of at least 0.1 mm;
- a registration thermometer (with accuracy  $\pm 1$  °C) with a hygrometer (with maximum relative humidity error  $\pm 5$  %), for measuring laboratory conditions;
- grain screens with appropriately sized openings for the type of cereal<sup>5</sup> (e.g. 2.00 mm for wheat);
- a hygrometer for cereals, measurement range 5 %–45 % with a 0.1 % scale interval;
- a series of samples of cereals, oilseeds and pulses for which the grain tester is declared, free of admixtures and contaminants (maximum admixture and contaminant content of 2 %), free of mould and other changes, with the following bulk density:
  - for wheat: 3 samples of food-grade or hard wheat for each bulk density range: 72–78 kg/hl and 77–83 kg/hl;
  - for barley: 3 samples of barley for each bulk density range: 61–67 kg/hl and 67–73 kg/hl;
  - for other crops, sets of 3 samples each are used for bulk density values 15 %–30 % from the measurement range limits;

for the aforementioned series of cereal, oilseed and pulse samples, the following also applies:

- the minimum difference in bulk density between two samples used is at least 5 kg/hl;
- the relative humidity of samples is in the range 9–14 %.

Reference standards and measuring instruments must have valid, traceable calibration. If the measuring instrument being tested uses a knife to measure off volume, the grain sample must not be used for testing more than 50x.

### 5.4.2 Reference conditions

During testing, the temperature of the laboratory environment must be within the range  $(20 \pm 5)$  °C, and air humidity must not exceed 60 %. The rate of temperature fluctuations must not exceed 1 °C/h.

Prior to testing, the measuring instruments and test samples are given at least 10 hours to adjust to the laboratory environment.

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<sup>5</sup> ČSN 46 1011-6 Testing of cereals, pulses and oilseeds—Part 6: Testing of cereals—Determination of grain admixtures and impurities content

### 5.4.3 Determining repeatability and measuring instrument errors

Measurement of metrological parameters using the method of direct continuity by grain is used to determine repeatability  $\Delta p_i$  and error  $\Delta p_{i,2-m}$  of the grain tester under test for each sample of cereals by comparing averages from two measurements on the tested grain tester  $\Delta p_i$  with the bulk density value  $p_{im}$  determined by a secondary class I or II bulk density reference standard or a primary reference standard.

**Repeatability**  $\Delta p_i$  is calculated as follows:

$$\Delta p_i = |p_{i1} - p_{i2}| \quad (1)$$

**The average of 2 measurements**  $\bar{p}_i$  is calculated as follows:

$$\bar{p}_i = \frac{p_{i1} + p_{i2}}{2} \quad (2)$$

**The error of the tested measuring instrument**  $\Delta p_{i,2-m}$  is calculated using the following relationship:

$$\Delta p_{i,2-m} = |p_{i,m} - \bar{p}_i| \quad (3)$$

where:  $p_{i1}, p_{i2} \dots$  is a measurement of the bulk density of a cereal sample using the tested measuring instrument;

$\bar{p}_i \dots$  is the average of 2 measurements of the bulk density of one cereal sample using the tested measuring instrument;

$p_{im} \dots$  is the bulk density of the cereal sample determined by the reference standard;

$\Delta p_{i,2-m} \dots$  is the error of the tested measuring instrument.

## 5.5 Criteria for compliance with requirements

### 5.5.1 Measurement of measuring instrument components

Measured component dimension and weight values are compared with values in the manufacturer's technical documentation or in Tables 1 and 2 in Annex 1 or Figure 2 in Annex 2. The values and design of individual components must agree with specified values.

### 5.5.2 Accuracy test—determining measuring instrument error

The maximum error of each cereal sample must not exceed the maximum permissible error specified in Article 2.3.1.

### 5.5.3 Determining repeatability

The repeatability value must not exceed the repeatability limit specified in Article 2.3.2.

## 6 Initial verification

### 6.1 Visual inspection

The visual inspection serves to check whether the grain tester submitted for verification conforms to the approved type in accordance with Article 5.2 and whether it has not been physically damaged.

## **6.2 Measurement of dimensions and weight**

Measurement is performed pursuant to Article 5.3.

## **6.3 Functional tests**

An accuracy and repeatability test pursuant to Article 5.4.1 is performed.

- for wheat:1 sample of food-grade or hard wheat for each bulk density range:72–78 kg/hl and 77–83 kg/hl;
- for barley:1 sample of barley for each bulk density range:61–67 kg/hl and 67–73 kg/hl;
- for other crops, one sample of each is used with a bulk density 15 %–30 % from the outer limit of the measurement range of values;
- the minimum difference between two samples used is at least 5 kg/hl;
- the relative humidity of samples is in the range 9–14 %;
- if the measuring instrument being tested uses a knife to measure off volume, the grain sample must not be used for testing more than 50x.

## **6.4 Criteria for compliance with requirements**

Criteria pursuant to Article 5.5 apply.

## **7 Subsequent verification**

During subsequent verification, an external inspection is performed pursuant to Article 6.1 and an accuracy and repeatability test pursuant to Article 6.3.

During subsequent verification the maximum permissible error and repeatability error pursuant to Article 2.3 must be met.

## **8 Examination at the request of a concerned person in accordance with § 11a**

Users of legally controlled measuring instruments shall, at the request of a person who may be affected by inaccurate measurement, request examination of the legally controlled measuring instrument. The grain tester must meet the metrological requirements specified in Chapter 5.4.3 of this Measure.

Re-examination consists of the following tests:

- a) accuracy test—determining measuring instrument error;
- b) determining repeatability.

In the evaluation, the maximum permissible errors pursuant to Article 2.3 are used.

## **9 Notified standards**

For the purposes of specifying the metrological and technical requirements for measuring instruments and specifying the testing methods for their type approval and verification stemming from this general measure, the CMI shall notify Czech technical standards, other technical standards or technical documents of international or foreign organisations, or other technical documents containing more detailed technical requirements (hereinafter referred to as ‘notified standards’). The CMI will publish a list of these notified standards attached to the relevant measures, together with the general measure, in a manner accessible to the public (on [www.cmi.cz](http://www.cmi.cz)).

Compliance with notified standards or parts thereof shall be considered, to the extent and under the conditions defined in a general measure, as compliance with those requirements defined in this measure to which these standards or parts thereof apply.

Compliance with notified standards is one way of demonstrating compliance with the requirements. These requirements may also be met by using another technical solution guaranteeing an equivalent or higher level of protection of legitimate interests.

## **II. G R O U N D S**

Pursuant to § 14(1)(j) of the Metrology Act, the CMI has issued this Measure of a General Nature toward the implementation of § 6(2), § 9(1) and (9), and § 11a(3) of the Metrology Act, laying down metrological and technical requirements for specified measuring instruments and tests for type approval and verification of specified measuring instruments— grain testers.

Decree No 345/2002 specifying the measuring instruments for mandatory verification and measuring instruments subject to type approval, as amended, classifies this type of measuring instrument as one subject to verification under Item 2.1.6 in the Annex 'List of Specified Measuring Device Types'.

This legislation (Measure of a General Nature) will be announced in accordance with Directive (EU) 2015/1535 of the European Parliament and of the Council of 9 September 2015 laying down a procedure for the provision of information in the field of technical regulations and of rules on Information Society services.

## **III. I N S T R U C T I O N S**

In accordance with § 172(1), in conjunction with § 39(1) CAP, the CMI has stipulated a time limit for comments of 30 days as of the date of posting on the official notice board. Comments submitted after this time limit will not be considered.

The persons concerned are hereby invited to comment on this draft Measure of a General Nature. With a view to the provisions of § 172(4) CAP, the comments shall be submitted in writing.

In accordance with § 174(1) CAP in conjunction with § 37(1) CAP, it must be clear who is making the comments, which measure of a general nature they concern, how it contradicts legislation or how the measure of a general nature is inaccurate, and they must be signed by the person making them.

The supporting documents for this draft general measure may be consulted at the Czech Metrology Institute, Legal Metrology Department, Okružní 31, 638 00 Brno, after making arrangements by telephone.

This general measure shall be posted for 15 days.

**RNDr. Pavel Klenovský m.p.**  
Director-General

Person responsible for accuracy: Mgr. Tomáš Hendrych



Posted on:1 June 2018

Signature of the authorised person confirming Mgr.Tomáš Hendrych m.p.  
posting:

Removed on:

Signature of the authorised person confirming  
removal:

## **Annex 1**

### **A description of the measuring instrument and use of a 1 L grain tester model 1938 and a ¼ L tester**

#### **1 Measuring instrument description**

The measuring instrument comprises the following parts (see Figure 1):

- a) hopper;
- b) filler;
- c) measuring container with ring, slider and knife.

The assembled measuring instrument is secured in the mounting flange on the base plate.

##### **1.1 Hopper**

- must be made of metal;
- must be cylindrical with vertical walls, sealed on the bottom end by a flat bottom;
- the upper edge must have a reinforced flange to counter deformation;
- the hopper for a 1 L tester must have a line along the circumference of its interior marking a volume of 1 350 ml, located at least 1 cm and at most 3 cm from the open end of the cylinder;
- the hopper for a ¼ L tester must have a line along the circumference of its interior marking a volume of 400 ml, located at least 1 cm and at most 3 cm from the open end of the cylinder.

##### **1.2 Filler**

- must be made of metal;
- must be cylindrical with vertical walls, open at both ends;
- its bottom must make it possible for it to be mounted on the ring on the upper part of the measuring container; the connection must be secure;
- it must be capable of containing the full amount of grain measured out by the hopper.

##### **1.3 Measuring container with ring**

- a 1 L or ¼ L volume is demarcated by the inner surface of the container walls, the upper surface of the inserted slider, and the bottom surface of the inserted knife; the maximum allowable relative error of the content is  $\pm 0.003$  L for a 1 L and  $\pm 0.003$  L for a ¼ L grain tester;
- the wall of the measuring container must be made from a drawn brass or seamless stainless steel pipe;
- it must be cylindrical with vertical walls, open at the top, the measuring edge must be reinforced and perpendicular to the container axis;
- a ring must be attached above the measuring edge with the same diameter as the container, at a distance that permits the knife to be inserted easily without excessive play;
- the bottom of the measuring container must be level and perpendicular to the container's axis, with openings for air to escape during measurement;
- the bottom edge must be reinforced; the reinforcement is of one piece with three mounting legs welded to the wall of the measuring container.

###### **1.3.1 Slider**

- must be made of brass sheet metal with a smooth surface, shaped like a closed cylinder, with vertical walls and horizontal ends;
- inside it must be reinforced so that an official mark can be affixed without damage or deformation.

###### **1.3.2 Knife**

- the knife edge must be made of hardened steel sheet metal, with straight and parallel surfaces;
- when fully inserted, it must cover the entire cross-section of the measuring container;
- the knife blade must be v-shaped, open in the direction of insertion;
- the sharp edge must run through the centre of the thickness of the sheet metal blade.

### 1.6 Flange

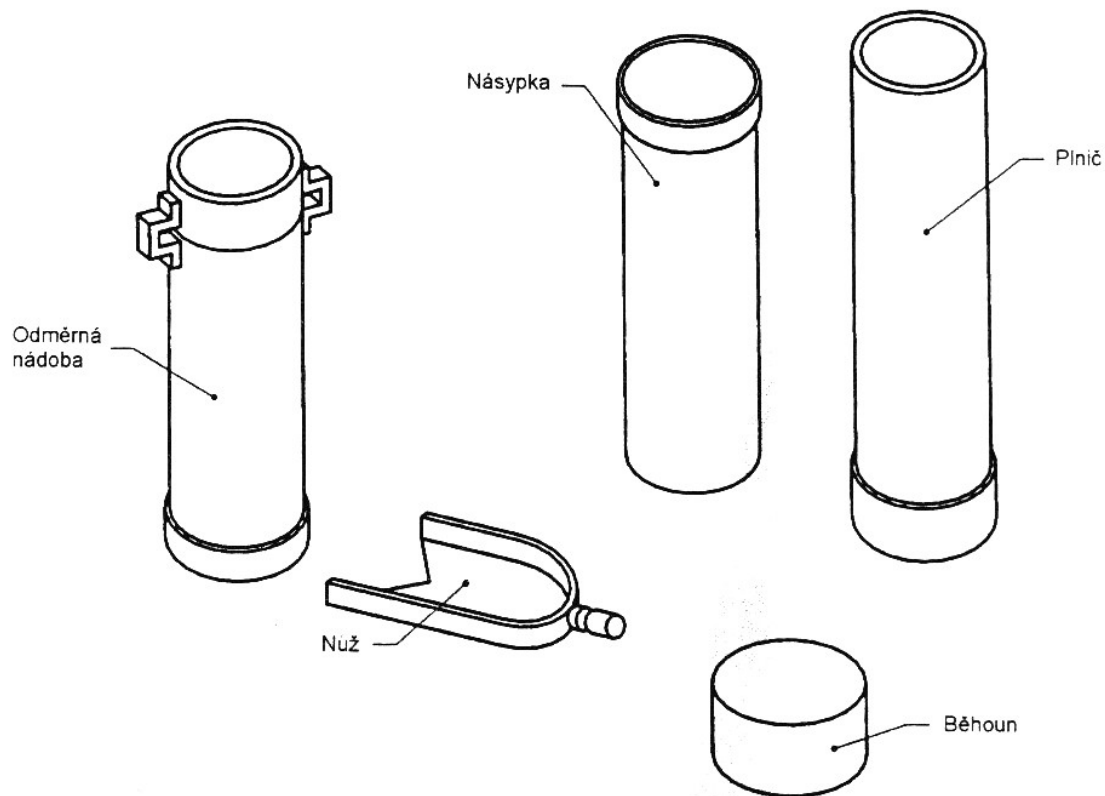
- must be metal and ensure a secure connection with the measurement container with a simple rotation;
- it must be securely attached to a mounting plate or transport crate made of hard wood;
- the mounting plate or crate must have levelling screws to place the measuring instrument in a stable vertical position.

## 2 Scales

- must comply with Article 3.3 of this Measure;
- accuracy class II balance scales that are equipped with a counterweight to balance out the empty measuring container and slider may be used.

Other details are provided by relevant technical standards<sup>6</sup>.

## 3 Measuring instrument drawing and dimensions



**Figure 1—A depiction of the parts of a 1 L grain tester model 1938 and a ¼ L grain tester**

Odměrná nádoba	Measuring container
Nuž	Knife
Násypka	Hopper
Plnič	Filler

<sup>6</sup> ČSN EN ISO 7971-3:2010. Cereals—Determination of bulk density, called mass per hectolitre—Part 3:Routine method, Annex A Informative description of the dimensions and use of a KERN device  
ČSN 99 4178 GRAIN TESTERS, Secondary reference standards of order 1 and 2 and operating measuring instruments, Technical requirements, Article 15

Běhoun	Slider
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### 3.1 1 L grain tester model 1938

One-litre model 1938 grain testers must meet requirements pursuant to the following table.

**Table 1—Dimensions of individual parts of a 1 L grain tester, model 1938**

<b>Hopper</b>	inner diameter	$(86 \pm 0.2)$ mm
	volume up to line	$(1\ 350 \pm 10)$ ml
<b>Filler</b>	inner diameter	$(79 \pm 0.1)$ mm
	wall thickness	$(1 \pm 0.2)$ mm
	height above inserted slider	$(280 \pm 2)$ mm
<b>Slider</b>	diameter	$(87.5 \pm 0.1)$ mm
	height	$(40 \pm 0.2)$ mm
	weight	$(450 \pm 2)$ g
<b>Knife</b>	angle on edge	$(90 \pm 2)^\circ$
	sheet metal thickness	$(1 \pm 0.05)$ mm
	angle length	$(3 \pm 0.5)$ mm
<b>Measuring container</b>	inner diameter	$(88.2 \pm 0.1)$ mm
	wall thickness	$(1.2 \pm 0.5)$ mm
	inner height above slider	$(163.7 \pm 0.1)$ mm
	bottom thickness	$(4.5 \pm 0.1)$ mm
	number of openings in bottom	85
	diameter of openings in bottom	$(3 \pm 0.1)$ mm
	distance between bottom and flange	$(6 \pm 0.1)$ mm
	outer reinforcement of upper edge— thickness	$(2.5 \pm 0.5)$ mm
	outer reinforcement of upper edge— height	$(6 \pm 1)$ mm
	height of legs	$(9 \pm 0.1)$ mm
	diameter of legs	$(6 \pm 0.1)$ mm
<b>Measuring container ring</b>	inner diameter	$(88.2 \pm 0.1)$ mm
	height	$(40.5 \pm 0.1)$ mm
<b>Flange</b>	diameter of ring for attachment	$(80 \pm 0.1)$ mm

### 3.2 Quarter-litre grain tester

Quarter-litre grain testers must comply with requirements in Table 2.

**Table 2—Dimensions of individual parts of a ¼ L grain tester**

<b>Hopper</b>	inner diameter	(52.0 ± 0.2) mm
	wall thickness	(1.0 ± 0.2) mm
	volume	(0.40 ± 0.01) L
<b>Filler</b>	inner diameter	(50.0 ± 0.2) mm
	wall thickness	(0.88 ± 0.12) mm
	height above inserted slider	(210 ± 1) mm
<b>Slider</b>	diameter	(52.5 ± 0.1) mm
	height	(23.0 ± 0.5) mm
	weight	(90 ± 1) g
<b>Knife</b>	angle on edge	(90 ± 2) °
	sheet metal thickness	(1 ± 0.05) mm
	angle length	(3 ± 0.5) mm
<b>Measuring container</b>	inner diameter	(53.2 ± 0.2) mm
	wall thickness	(0.88 ± 0.12) mm
	Permitted deviation from circularity	(0.10 ± 0.05) mm
	Volume	(0.250 ± 0.001) L
	bottom thickness	(3.0 ± 0.1) mm
	number of openings in bottom	25
	diameter of openings in bottom	(3.0 ± 0.1) mm
	distance between bottom and flange	(5.75 ± 0.75) mm

#### 4 Grain tester measurement procedure

The test sample of grain is poured freely from the sampler into the hopper up to the volume line.

The measured-out grain is poured from the hopper into the filler from a height of about 4 cm into the centre of the filler; pouring takes about 12 seconds for a 1 L tester and about 8 seconds for a ¼ L tester. During this time the operator must not touch the filler.

While holding the measuring container in order to keep it steady, the knife is pulled out with a quick motion. This releases the slider and it falls into the measuring container along with the grain.

The knife is then placed into the slit in the measuring container and is inserted completely with a quick motion. This cuts off a volume of 1 L (¼ L) of grain in the measuring container. No vibrations must occur during use until the grain is separated in the measuring container. If the knife is slowed down by cutting grains, the measurement must be repeated.

The measuring container and filler are removed from the flange, excess grain above the knife is poured out, and the filler is removed. Depending on the taring method, the measuring container is weighed with or without the knife; the measured-out grain may also be poured into another container and weighed.

Before every subsequent measurement, the measuring container, slit, and slider must be cleaned of all contaminants, and the grain remnants above the knife are mixed with the grain from the measuring container.

## 5 Expressing results

1 L grain tester

for wheat:  $0.1002 \cdot m + 0.53$

for barley:  $0.1036 \cdot m - 2.22$

for rye:  $0.1017 \cdot m - 0.08$

for oats:  $0.1013 \cdot m - 0.61$

for malt:  $100 \cdot m$

where  $m$  is the mass of the cereal sample measured out by the tester.

To calculate mass per hectolitre of wheat, barley, rye and oats, the 1 L grain tester model 1938 is equipped with calculation tables created using the above formulas.

Additional details are provided in the relevant technical standard<sup>7</sup>.

## 6 Measuring instrument security and fraud protection

The position of the flange with respect to the measuring container must be protected from unauthorised changes.

## 7 Transport and storage

During transport and storage, the grain tester must be protected from physical damage and corrosion.

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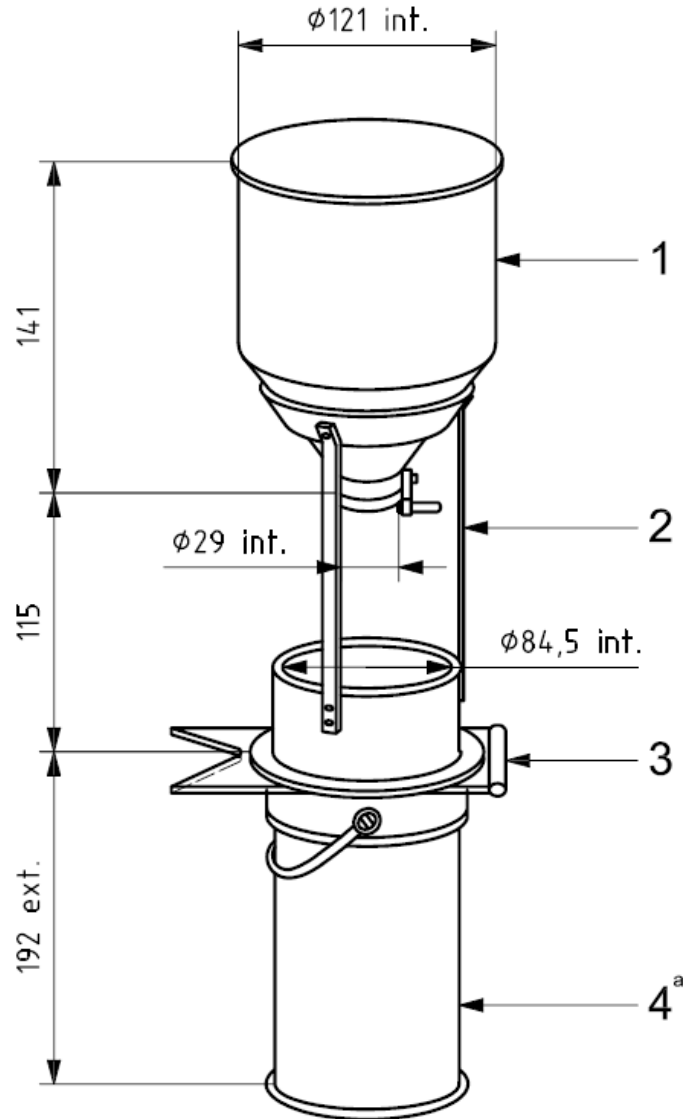
<sup>7</sup>CSN EN ISO 7971-2 Cereals—Determination of bulk density, called mass per hectolitre—Part 3:Routine method, Annexes A, B

**Annex 2**

**A description of the measuring instrument and use of a 1 L 'Niléma litre' grain tester**

**1 Measuring instrument drawing and dimensions**

The measuring instrument comprises the parts shown in Figure 2.



121 int.	121 int.
192 ext.	192 ext.

Legend:

- 1 - hopper
- 2 - spacer rulers
- 3 - knife
- 4- measuring container with ring

The volume of the measuring container is 1 L.

Figure 2—Drawing of a Niléma litre grain tester. Dimensions are given in millimetres.

### 1.1 Hopper

- a hopper with a conical outlet with a closure that directs grain flow;
- connecting the spacer ruler to the ring of the measuring container, which allows the knife to move horizontally in the slit.

### 1.2 Measuring container

- must be a co-axial cylinder with vertical walls, volume 1 L, open at both ends.

### 1.3 Knife

- a flat knife with a sharp 'v' edge, open in the direction of insertion.

## 2 Scales

- must comply with Article 3.3 of this Measure of a General Nature;
- accuracy class II balance scales that are equipped with a counterweight to balance out the empty measuring container may be used.

Other details are provided by relevant technical standards<sup>8</sup>.

## 3 Grain tester measurement procedure

Scales (1.1.3) are used to weigh the empty measuring container to the nearest 1 g.

The test sample of grain is poured freely without compaction into the hopper up to its volume line or to its edge.

The hopper closure is opened and the grain is allowed to pour into the measuring container.

The knife is inserted carefully and quickly into the slit in the measuring container ring. It is necessary to hold the container firmly in place to prevent vibrations and shaking that would compact the grain.

The measuring container is weighed with the cut-off volume of grain to the nearest 1 g.

## 4 Expressing results

Bulk density  $p$ , expressed in  $\text{kg}\cdot\text{hl}^{-1}$  is given by the following formula:

$$p = \frac{m}{1000} \times \frac{100}{V} = \frac{m}{10V} \quad (4)$$

where:  $m$  ..... the mass of the cereal sample measured out by the tester in grams, calculated using the following formula:

$$m = (m_1 - m_0) \quad (5)$$

where:  $m_0$  .... the mass in grams of the empty measuring container;

$m_1$  ... the mass in grams of the measuring container with the measured-out grain.

Additional details are provided in the relevant technical standard<sup>9</sup>.

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<sup>8</sup> ČSN EN ISO 7971-3:2010. Cereals—Determination of bulk density, called mass per hectolitre—Part 3: Routine method, Annex A Informative description of the dimensions and use of a KERN device  
ČSN 99 4178 GRAIN TESTERS, Secondary reference standards of order 1 and 2 and operating measuring instruments, Technical requirements, Article 15



## **5 Measuring instrument security and fraud protection**

The position of the spacer rulers with respect to the measuring container must be protected from unauthorised changes.

## **6 Transport and storage**

During transport and storage, the grain tester must be protected from physical damage and corrosion.

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<sup>9</sup> ČSN EN ISO 7971-2 Cereals—Determination of bulk density, called mass per hectolitre—Part 3:Routine method, Annexes A, B