

SLOVENSKI STANDARD

SIST EN 15587:2019

01-februar-2019

Nadomešča:

SIST EN 15587:2009+A1:2013

Žito in žitni proizvodi - Določanje nečistoč v pšenici (*Triticum aestivum* L.), pšenici durum (*Triticum durum* Desf.), rži (*Secale cereale* L.), tritikali (*Triticosecale Wittmack* spp) in krmnem ječmenu (*Hordeum vulgare* L.)

Cereal and cereal products - Determination of Besatz in wheat (*Triticum aestivum* L.), durum wheat (*Triticum durum* Desf.), rye (*Secale cereale* L.), triticale (*Triticosecale Wittmack* spp) and feed barley (*Hordeum vulgare* L.)

Getreide und Getreideerzeugnisse - Bestimmung von Besatz in Weizen (*Triticum aestivum* L.), Hartweizen (*Triticum durum* Desf.), Roggen (*Secale cereale* L.), Triticale (*Triticosecale Wittmack* spp.) und Futtergerste (*Hordeum vulgare* L.)

Céréales et produits céréaliers - Détermination du taux d'impuretés dans le blé (*Triticum aestivum* L.), le blé dur (*Triticum durum* Desf.), le seigle (*Secale cereale* L.), le triticale (*Triticosecale Wittmack* spp) et l'orge fourragère (*Hordeum vulgare* L.)

Ta slovenski standard je istoveten z: EN 15587:2018

ICS:

67.060

Žita, stročnice in proizvodi iz njih

Cereals, pulses and derived products

SIST EN 15587:2019

en,fr,de

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EUROPEAN STANDARD

EN 15587

NORME EUROPÉENNE

EUROPÄISCHE NORM

December 2018

ICS 67.060

Supersedes EN 15587:2008+A1:2013

English Version

Cereal and cereal products - Determination of Besatz in wheat (*Triticum aestivum L.*), durum wheat (*Triticum durum Desf.*), rye (*Secale cereale L.*), triticale (*Triticosecale Wittmack spp*) and feed barley (*Hordeum vulgare L.*)

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This European Standard was approved by CEN on 1 October 2017.

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European foreword

This document (EN 15587:2018) has been prepared by Technical Committee CEN/TC 338 “Cereal and cereal products”, the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2019, and conflicting national standards shall be withdrawn at the latest by June 2019.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 15587:2008+A1:2013.

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EN 15587:2018 (E)**1 Scope**

This European Standard specifies the term *Besatz* (impurities) and describes methods for the determination of its components. The term *Besatz* is used as a parameter for certain quality aspects in common wheat (*Triticum aestivum* L.), durum wheat (*Triticum durum* Desf.), rye (*Secale cereale* L.), triticale (*Triticosecale Wittmack* spp) and feed barley (*Hordeum vulgare* L.).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN ISO 5223, *Test sieves for cereals*

3 Terms and definitions

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

3.1**Besatz**

all matter of a sample of grain other than the basic cereal of unimpaired quality

Note 1 to entry: It comprises the four fractions: broken grains, grain impurities, sprouted grains and miscellaneous impurities.

Note 2 to entry: Live pests are not considered as *Besatz*. They are specified as a separate criterion.

Note 3 to entry: A schematic summary on *Besatz* is given in Annex C.

Note 4 to entry: Pictures of examples are given in [9].
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3.2**broken grains**

all grains belonging to the basic cereal and whose endosperm is partially uncovered, including grains damaged by threshing and grains from which the germ has been removed

Note 1 to entry: Grains damaged by pests or unsound are considered respectively as 3.3.3 and 3.5.2.

3.3**grain impurities**

fraction consisting of shrivelled grains, other cereals, grains damaged by pests, grains in which the germ is discoloured (only for common and durum wheat), mottled grains (only for durum wheat) and grains overheated during drying

Note 1 to entry: For common wheat, grains in which the germ is discoloured are disregarded up to 8 %.

3.3.1**shrivelled grains**

grains which after elimination of all other matter defined in this European standard pass through 20 mm slotted sieves with long rounded apertures of the following dimensions:

—	common wheat	2,0 mm
—	durum wheat	1,9 mm
—	rye	1,8 mm
—	triticale	1,9 mm
—	feed barley	2,2 mm

and grains damaged by frost and unripe grains (green)

Note 1 to entry: Frost damaged kernels can show the following appearance: black or brown discoloration, bleached or blistered, distinctly wax-like or candied surface. Frequently they have dark stripes showing through the sides of the kernel.

3.3.2**other cereals**

all cereals grains not belonging to the considered species, whatever their state, excepted unsound grains or part of unsound grains

Note 1 to entry: In a durum wheat sample, all common wheat grains and their grain dockage components are classified as other cereals and vice versa.

3.3.3**grains damaged by pests**

grains or part of grains belonging to the basic cereal which show visible damage due to attack by insects, rodents, mites or other pests

Note 1 to entry: Grains attacked by wheat midge (*Sitodiplosis mosellana*) are considered unsound grains (3.5.2) only when more than half the surface of the back of the grain is coloured grey to black as a result of secondary cryptogamic attack. Where discoloration covers less than half the surface of the back of the grain, they are classed as grains damaged by pests.

Note 2 to entry: Grains attacked by bug (*Eurygaster integriceps*, *Eurygaster maura*) are considered damaged by pest when they present a brighter spot with a more or less visible coloured point in the centre representing the scar of the bite. This spot often wrinkled, is of less consistency than the rest of the grain.

EN 15587:2018 (E)**3.3.4****grains with discoloured germ****mottled grains**

grains either

a) with discoloured germ in which the tegument covering the germ is coloured brown to brownish black and in which the germ is normal and not sprouted;

Note 1 to entry: If the germ is coloured with only one spot, the grain is considered sound.

Note 2 to entry: This fraction only exists for common wheat and durum wheat.

Note 3 to entry: For common wheat, only the fraction above 8 % is accounted for.

or

b) mottled which show a brown to brownish black discoloration elsewhere than on the germ itself, particularly in the crease

Note 4 to entry: If the coloration is only in the crease, grains are considered mottled only if the spot covers more than 1/4 of the length of the crease.

Note 5 to entry: This fraction only exists for durum wheat

3.3.5**grains overheated during drying**

grains showing a copper external color, clearly different from the rest of the sample, related to a rise in temperature but which kernels are sound with a normal color and a mealy or vitreous kernel

Note 1 to entry: Grains showing external signs of overheating and of which the kernels are coloured yellowish-grey to brownish-black are considered unsound.

3.4**sprouted grains**

grains in which the radicle or plumule is clearly visible to the naked eye

Note 1 to entry: Account should be taken of the general appearance of the sample when its content of sprouted grains is assessed.

Note 2 to entry: In some type of cereals the germ is protuberant, e.g. in durum wheat, and the germ tegument splits when the batch of cereals is shaken. These grains resemble sprouted grains but shall not be included in that group. Sprouted grains are only those where the germ has undergone clearly visible changes which make it easy to distinguish the sprouted grain from the normal grain.

3.5**miscellaneous impurities****(synonymous: Schwarzbesatz)**

fraction consisting of extraneous seeds, unsound grains, extraneous matter, husks, ergot, bunted grains and impurities of animal origin

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3.5.1**extraneous seeds**

seeds of plants, whether or not cultivated, other than cereals

Note 1 to entry: They comprise noxious and not noxious seeds. Noxious seeds mean seeds which are toxic to humans and animals. This group also includes seeds hampering or complicating the cleaning and milling of cereals and seeds affecting the quality of products processed from cereals.

Note 2 to entry: In some cases it may be necessary to distinguish between noxious seeds and not noxious seeds. An indicative list of noxious seeds is given in Annex A.

3.5.2**unsound grains**

grains of the species or another cereal rendered unfit for human or feed consumption, showing partly or totally damaged traces due to putrefaction, mildew, bacteria attack or other causes originating on the field (cryptogamic disease) or during the storage (poor conservation)

Note 1 to entry: Unsound grains also include grains damaged by spontaneous heat generation or too extreme heating during drying which are fully grown grains in which the tegument is coloured greyish-brown to black while the cross-section of the kernel is coloured-yellowish grey to brownish-black.

Note 2 to entry: Grains attacked by wheat midge are considered unsound grains only when more than half the surface of the back of the grain is coloured grey to black as a result of secondary cryptogamic attack. Where discoloration covers less than half the surface of the back of the grain, they need to be classed with grains damaged by pests.

Note 3 to entry: Grains affected with fusariosis are grains whose pericarp is contaminated with *Fusarium* mycelium; such grains look often slightly shrivelled, wrinkled and have pink or white diffuse patches with an ill-defined outline. Grains affected by fusariosis are the major source of mycotoxins.

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3.5.3**extraneous matter**

all matter in a sample of cereals retained by a sieve with apertures of 3,55 mm and passing through a sieve with apertures of 1,0 mm, and stones, sand, fragments of straw and similar impurities in the sample which pass through a sieve with apertures of 3,55 mm and are retained by a sieve with apertures of 1,0 mm

Note 1 to entry: Other cereals and particularly large grains of the basic cereal and ergot which are retained by a sieve with apertures of 3,55 mm are not extraneous matter.

3.5.4**husks**

glumes and grain husks

3.5.5**ergot**

sclerotia of *Claviceps purpurea*

3.5.6**bunted grains**

grains filled with a fetid-smelling dust comprising the spores of smuts (*Ustilago* spp.) or brown-black spores of bunt (*Tilletia* spp.)

EN 15587:2018 (E)**3.5.7****impurities of animal origin**

impurities originating from animals such as feathers, hairs, excrements, dead insects and fragment of insects

4 Principle

The principle of this method is to separate all the groups of *Besatz*, defined under 3.1, from the normal basic grains by sieving and manual selection.

5 Apparatus**5.1 Sample divider**

5.2 Balance, capable to weighing to the nearest 0,01 g

5.3 Set of sieves fitted with a cover and a receiver, the long rounded apertures 3,55 mm X 20,0 mm, 2,2 mm X 20,0 mm, 2,0 mm X 20,0 mm, 1,9 mm X 20,0 mm, 1,8 mm X 20,0 mm, 1,0 mm X 20,0 mm, in accordance with the specification of EN ISO 5223

5.4 Sieving machine (optional) allowing a forceful horizontal backward and forward movement of the sieves parallel to the length of the slots

5.5 Magnifying glass, illuminated

5.6 Forceps or horn spatula

5.7 Pots, for retaining components

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6 Sampling

It is important the laboratory receive a sample which is truly representative (ideally 1 kg or more) and has not been damaged or changed during transport and storage.

Sampling is not part of the method specified in this European Standard. Recommended sampling methods are given in EN ISO 24333.

7 Procedure (see diagram in Annex D)

Prepare by division a representative sample of around 250 g (*a*) and weigh it to the nearest 0,1 g.

This sample is sieved on a sieve column composed of one sieve with an aperture of 3,55 mm above a second sieve with an aperture of 1,0 mm and the receiver (5.3) for 30 s either with a sieving machine (5.4), or by hand. Sieving shall consist of horizontal movements parallel to the length of the slots (around one backward and forward movement per second).

Remove the ergots from the overtails of the 3,55 mm and 1,0 mm sieves (5.3) and weigh them to 0,01g accurately.

If ergot is more than 0,5 g/kg, research should be done on the whole sample or at least 1 Kg.

Other cereals, unthreshed grains and particularly large grains of the basic cereal, retained by the 3,55 mm sieve have to be isolated and added to the fraction retained by the 1,0 mm sieve.

Other matter retained by the 3,55 mm sieve,(5.3) and that passed through the 1,0 mm sieve (5.3), with stones, mud balls, straws, chaff and similar impurities from the overtails of the 1,0 mm slotted sieve (5.3).are weighted together to the nearest 0,01 g and are regarded as extraneous matter (3.5.3).

Impurities of animal origin should be counted, including those which passed through the sieve of 1,0 mm slotwidth (5.3). If necessary, a magnifying glass (5.5) should be used.

The count should be quoted separately in numbers per kg of common wheat, durum wheat, rye, triticale or feed barley as appropriate.

The remaining fraction retained by the 1,0 mm slotted sieve, added with other cereals, unthreshed grains and particularly large grains of the basic cereal retained by the 3,55 mm slotted sieve previously isolated, is divided with the sample divider (5.1) to obtain a sub sample (*c*) between 50 g and 100 g. Weigh it to the nearest 0,1 g.

This partial sample is spread out on a table and fractions defined in Clause 3 are extracted by means of forceps or a horn spatula (5.6).

In case multiple kinds of damages are observed, the damaged grain shall be added to the fraction with the highest importance for the overall quality (according to Annex B).

In rye samples with respect of natural variability of the colour of rye grains, grains with discoloured germ (3.3.4) are not picked out.

If the partial sample contains unthreshed grains of the basic cereals, remove the grains from the glumes by hand and add them to the fraction husks (3.5.4).

This sub sample without all the impurities is sieved for 30 s on a sieve (5.3) with an aperture of 2,0 mm for common wheat, 1,9 mm for durum wheat and triticale, 1,8 mm for rye, 2,2 mm for feed barley. All elements passing through are considered as shrivelled grains.

Weigh the *Besatz*-free overtails of the 1,0 mm sieve (*d*) and all the groups of *Besatz* to the nearest 0,01 g. If, for a partial sample, the sum (*s*) of broken grains (3.2), shrivelled grains (3.3.1), other cereals (3.3.2), grains damaged by pests (3.3.3), grains in which the germ is discoloured (3.3.4), grains overheated during drying (3.3.5), sprouted grains (3.4), extraneous seeds (3.5.1), unsound grains (3.5.2), husks (3.5.4), bunted grains (3.5.6) and the weight of the *Besatz*-free overtails of the 1,0 mm sieve (*d*) differs by more than 0,5 % from the sub sample weight (*c*), the determination is not valid and a new partial sample shall be analysed.

8 Expression of results

Express the content of extraneous matter (3.5.3) and the content of ergot (3.5.5) by using the formula given below as mass fraction in percent of the grains as received:

$$B_x = \frac{x \times 100}{a} \quad (1)$$

where

B_x is the % *Besatz* fraction;

a is the weight of average sample;

x is the weight of the *Besatz* group concerned.

Express the content of each fraction of *Besatz* (3.2 to 3.5.6 without 3.5.3 and 3.5.5) by using the formula given below as mass fraction in percent of the grains as received:

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$$Bx = x \times \frac{a - b}{a \times c} \times 100 \quad (2)$$

where

Bx is the % Besatz fraction;

x is the weight of the Besatz group concerned;

a is the weight of the average sample;

b is the weight of the extraneous matter (3.5.3) and ergot (3.5.5);

c is the weight of subsample from which Besatz will be removed

The calculation should be carried out to the nearest 0,01 %.

The percentages of grain impurities (3.3) and of Miscellaneous impurities (3.5) are calculated in summing the percentages of sub fractions constituting the fraction.

The percentage of Besatz (3.1) is calculated in summing the percentages of sub fractions broken grains (3.2), grain impurities (3.3), sprouted grains (3.4) and Miscellaneous impurities (3.5).

In the investigation report, quote to a precision of 0,1 %, with the exception of the extraneous seeds (3.5.1) unsound grains (3.5.2), ergot (3.5.5) and bunted grains (3.5.6), which shall be quoted to an accuracy of 0,01 %.

Report the impurities of animal origin (3.5.7) in numbers per kg of grain. If necessary specify the kind of impurity.

An example of calculation is given in Annex E.

9 Precision

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9.1 General

Details of an international interlaboratory test on the precision of the method are summarized in Annex F. The values derived from this test may not be applicable to concentration ranges and matrices other than those given.

The precision depends directly on the sample size. This should be taken into account for special questions.

The equations in the 9.2 to 9.4 have been elaborated using the data of the interlaboratory test, see Tables F.1, F.6, F.12 and F.13.

9.2 Repeatability

The absolute difference between two independent single test results, obtained using the same method on identical test material in the same laboratory by the same operator using the same equipment within a short interval of time, will not in more than 5 % of cases be greater than the repeatability limit r :

$$1) \text{ Broken grains: } r = 2,8 \times [(0,07 \times B_{\text{broken grains}}) + 0,15] \quad (3)$$

$$2) \text{ Sprouted grains: } r = 2,8 \times [(0,11 \times B_{\text{sprouted grains}}) + 0,10] \quad (4)$$

$$3) \text{ Grain impurities: } r = 2,8 \times [(0,03 \times B_{\text{grain impurities}}) + 0,33] \quad (5)$$

$$4) \text{ Miscellaneous impurities: } r = 2,8 \times [(0,06 \times B_{\text{miscellaneous impurities}}) + 0,12] \quad (6)$$