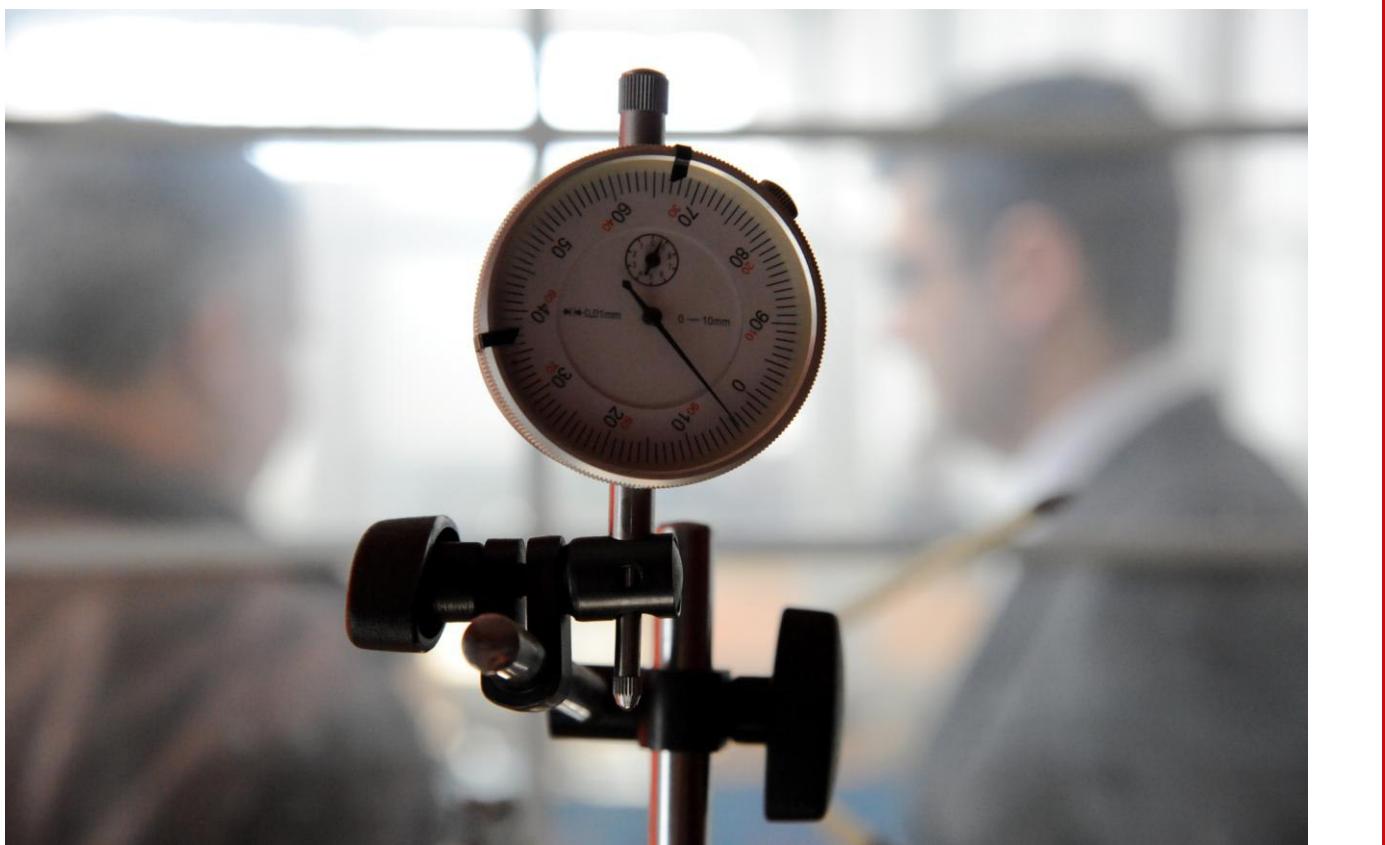


Technical Inputs



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GB/T 5503-2009

Inspection of grain and oils -- Determination of broken kernels

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Registered offices

Bonn and Eschborn, Germany

Regional Economic Cooperation and Integration in Asia

China Office

TaYuan Diplomatic Office
14 Liangmahe South Street, Chaoyang District
10600 Beijing, PR China
T +86-10-8532-5344
F +86-10-8532-5744

Office Mongolia

Naiman Zovkhi Building
Seoul Street 21
Ulaanbaatar 14251, Mongolia

rcl-asia@giz.de
www.giz.de

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Text

Shenzhen Institute of Standards and Technology (SIST), Shenzhen, PR China

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National Standard of People's Republic of China

GB/T 5503-2009

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Inspection of grain and oils -- Determination of broken kernels

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Foreword

This standard is a revised version of GB/T 5503-1985: Inspection of grain and oils -- Determination of broken kernels.

The main technical modifications in this standard compared with GB/T 5503-1985 are as follows:

- Terms and definitions added;
- Sample preparations added;
- Instrument test for the content of broken kernels in rice added.

This standard replaced GB/T 5503 -- 1985 from the implementation date.

This standard is proposed by the State Administration of Grain.

This standard is under jurisdiction of the National Standardization Technical Committee of Grain and Oil.

The organizations of drafting the standard are Henan University of Technology, Hubei province grain and oil products quality supervision and inspection station, Zhengzhou Huafu Instrument Development Co., Ltd., Nanjing University of Finance, and Chengdu grain storage science institute of State Bureau of Grain Reserves.

Main drafters of this standard are Yang Hongwei, Xiong Ning, Wu Cunrong, Tang Huaijian, Huo Quangong, Zhou Xianqing, Wang Zhiming, Liu Yong, Li Guangyu, Wu Guiping, Shen Erbo, Wan Zhongmin, Yang Huiping, Wang Xingjuan, and Dong Deliang.

This standard replaces the previous versions of the following standards:

- GB/T 5503-1985.

Inspection of grain and oils -- Determination of broken kernels

1 Scope

This standard specifies the terms and definitions, instruments and equipment, sample preparation, determination procedures, and result calculation of broken kernels in main rice grains. This standard is applicable to determination of broken kernels in rice, sorghum rice, millet, broomcorn millet and husked millet.

2 Normative Reference Documents

The following standards contain provisions which, referred by this standard, constitute provisions of this standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies. However, it is encouraged for each party entering agreement according to this standard to decide whether to use the latest versions of these documents. In addition, the latest versions of all reference documents without dates are applicable to the standard.

- GB 1354 Rice
- GB 5491 Inspection of grain and oilseeds Methods for sampling and sample reduction
- GB/T 5494 Inspection of grain and oils -- Determination of foreign matter and unsound kernels of grain and oilseeds
- GB/T 11766 Millet
- GB/T 13356 Broomcorn millet
- GB/T 13358 Husked millet

3 Terms and Definitions

The terms and definitions specified in GB 1354, GB/T 11766, GB/T 13356 and GB/T 13358 as well as the following terms and definitions are applicable to this standard.

3.1 Broken milled sorghum kernel

Broken kernels of sorghum rice filtered by a circular sieve with a hole diameter of 1.5 mm but remaining on a circular sieve with a hole diameter of 1.0 mm.

4 Principles

By combining sieving method with handpicking method, sort out broken kernels from samples, weigh the broken kernels and calculate the amount of broken kernels. Image processing technology can also be applied to obtain the images of rice grains, determine the sizes of the rice grains and distinguish whole kernels, large broken kernels and small broken kernels, automatically calculate the amount of broken kernels and small broken kernels in rice.

5 Apparatus

- 5.1 **Scale:** with a precision of 0.01 g
- 5.2 **Filter:** with a rotating speed of 110-120 r/min, able to be automatically controlled and rotate clockwise or anti-clockwise in 1 min interval
- 5.3 **Sieves:** circular sieves with a hole diameter of 1.0 mm, 1.2 mm, 1.5 mm and 2.0 mm, each

- equipped with a base and a lid
- 5.4 **Sampling board:** a flat rectangular wooden or plastic board, 2 mm thick and with a long edge made into an oblique opening for ease of sampling
- 5.5 **Electrical rice separator**
- 5.6 **Watch glass, analysis plates, tweezers, etc.**
- 5.7 **Broken rice tester:** with the image collecting and processing functions and a resolution ratio of not less than 200 dpi

6 Sampling Preparation

6.1 Sample Preparation

Sort out and divide samples according to requirements in GB 5491 and remove foreign matters from samples according to requirements in GB/T 5494.

6.2 Samples for Testing

Divide the samples with foreign matters removed into four pieces and weigh 10 g (m , accurate to 0.01 g) as samples for testing.

7 Procedures

7.1 Inspection of Broken Kernels in Rice

7.1.1 Inspection of Small Broken Kernels in Rice

Install the circular sieves with a hole diameter of 2.0 mm and 1.0 mm from top to bottom. Then place the samples in the sieve with a hole diameter of 2.0 mm and cover the sieve lid. Install the sieves on the filter (see 5.2) for automatic filtering, or place the sieves on a flat and smooth surface, hold them with hands, and rotate them clockwise and anti-clockwise respectively for 1 min at a speed of 100 r/min. The rotation amplitude is controlled within 8-10 cm more than the diameter of the sieves.

Still the filter for a while, collect the broken kernels remaining on the sieve with a hole diameter of 1.0 mm and those in the holes, and weigh them (m_1), accurate to 0.01 g.

7.1.2 Inspection of Broken Kernels in Rice

After inspection of small broken kernels, transfer the broken kernels remaining on the sieve with a hole diameter of 2.0 mm and those in the holes into the electrical rice separator (see 5.5). Adjust the inclination angle of the rice bucket to optimize the separation effect and then run the separator for 2 min. Transfer the whole kernels and the broken kernels into two analysis plates respectively. Tap the separator cartridge slightly with a wooden stick and transfer the rice grains remaining in the separator cartridge into the analysis plate of the broken kernels. Sort out rice grains not less than 3/4 of the average length of the whole kernel from the plate of the broken kernels and place them into the plate of the whole kernels. Sort out the rice grains less than 3/4 of the average length of the whole kernel from the plate of the whole kernels and place them into the plate of the broken kernels. Weigh the broken kernels separated previously together with the small broken kernels in 7.1.1 (m_2), accurate to 0.01 g.

If no electrical rice separator is available, transfer the broken kernels remaining on the sieve with a hole diameter of 2.0 mm and those in the holes into an analysis plate, sort out the rice grains less than 3/4 of the average length of the whole kernel, and weigh them together with the small broken kernels in 7.1.1 (m_2), accurate to 0.01 g.

7.1.3 Image Processing Determination of Broken Kernels in Rice

Turn on the broken rice tester (see 5.7) and switch to normal working mode with the guidance of user manual. Weigh rice of no less than 10 g (m) for testing according to the operation requirements of the tester. Check the analyses and calculation of ratios of small broken kernels and broken kernels in the rice conducted by tester automatically.

If manual weighing method is applied for calculation, weigh the small broken kernels (m_1) and the combination of large broken kernels and small broken kernels (m_2) after the tester automatically distinguish and separate large broken kernels from small broken kernels in the rice. Then, according to formulas (1) and (2) below, calculate the ratios of small broken kernels and broken kernels in the rice respectively.

7.2 Inspection of Broken Kernels in Millet, Sorghum Rice, Broomcorn Millet and Husked Millet

Install the circular sieves with a hole diameter of 1.5 mm (1.2 mm for millet) and 1.0 mm from top to bottom. Place the samples in the sieve with a hole diameter of 1.5 mm (1.2 mm for millet) and cover the sieve lid. Install the sieves on the filter for automatic filtering, or place the sieves on a flat and smooth surface, hold them with hands, and rotate them clockwise and anti-clockwise respectively for 1 min at a speed of 100r/min. The rotation amplitude is controlled within 8-10 cm more than the diameter of the sieve.

Still the filter for a while, collect the broken kernels remaining on the sieve with a hole diameter of 1.0 mm and those in the holes and weigh (m_3), accurate to 0.01 g.

8 Calculation of Results

8.1 Calculation of the Ratios of Small Broken Kernels and Broken Kernels in Rice

Calculate the ratio (X_1) of small broken kernels in rice according to formula (1):

$$X_1 = m_1/m \times 100\% \quad \text{----- (1)}$$

Where:

- X_1 : ratio of small broken kernels;
- m_1 : weight of small broken kernels, in the unit of g;
- m : weight of samples, in the unit of g.

Calculate the ratio (X_2) of broken kernels in rice according to formula (2):

$$X_2 = m_2/m \times 100\% \quad \text{----- (2)}$$

Where:

- X_2 : ratio of broken kernels;
- m_2 : weight of broken kernels, in the unit of g;
- m : weight of samples, in the unit of g.

The average values of two test results are regarded as the final results, accurate to 0.1. The absolute difference between two test results shall not exceed 0.5%.

8.2 Calculation of the Ratios of Broken Kernels in Millet, Sorghum Rice, Broomcorn Millet and Husked Millet

Calculate the ratios (X_3) of broken kernels in millet, sorghum rice, broomcorn millet and husked millet according to formula (3):

$$X_3 = m_3/m \times 100\% \quad \text{----- (3)}$$

Where:

- X_3 : ratio of broken kernels;

- m_3 : weight of broken kernels, in the unit of g;
- m : weight of samples, in the unit of g.

The average values of two test results are regarded as the final results, accurate to 0.1. The absolute difference between two test results shall not exceed 0.5%.

Registered offices

Bonn and Eschborn, Germany
T +49 228 44 60-0 (Bonn)
T +49 61 96 79-0 (Eschborn)

Dag-Hammarskjöld-Weg 1-5
65760 Eschborn, Germany
T +49 61 96 79-0
F +49 61 96 79-11 15

E info@giz.de
I www.giz.de

Regional Economic Cooperation and Integration in Asia**Office China**

Ta Yuan Diplomatic Office
14 Liangmahe South Street, Chaoyang District
100600 Beijing, PR China

Office Mongolia

Naiman Zovkhis Building
Seoul Street 21,
Ulaanbaatar 14251, Mongoli

E rcl-asia@giz.de