International Standard 5311

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Fertilizers — Determination of bulk density (tapped)

Engrais — Détermination de la masse volumique après tassement

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (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 authorized 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 5311 was developed by Technical Committee ISO/TC 134, *Fertilizers and soil conditioners*.

The first edition (ISO 5311-1980) had been approved by the member bodies of the following countries :

Australia	Iran	Portugal
Brazil	Ireland	Romania
Bulgaria	Israel	South Africa, Rep. of
Czechoslovakia	Italy	Thailand
Egypt, Arab Rep. of	Kenya	Turkey
Ethiopia	Korea, Rep. of	United Kingdom
France	Mexico	USSR
Germany, F. R.	Netherlands	Yugoslavia
Hungary	New Zealand	
India	Poland	

No member body had expressed disapproval of the document.

This second edition, which cancels and replaces ISO 5311-1980, incorporates draft Amendment 1, which was circulated to the member bodies in March 1982 and has been approved by the member bodies of the following countries :

Austria	Israel	Poland
China	Italy	Portugal
Czechoslovakia	Kenya	South Africa, Rep. of
Egypt, Arab Rep. of	Korea, Rep. of	Sri Lanka
France	Mexico	United Kingdom
Germany, F. R.	Netherlands	USA
Hungary	New Zealand	USSR

No member body expressed disapproval of the document.

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Fertilizers — Determination of bulk density (tapped)

0 Introduction

The bulk density (tapped) of a fertilizer, together with the bulk density (loose), provides information relative to the required size of packaging materials, store-houses, stock-rooms etc. Generally, it ranges up to 10 % above the bulk density (loose), and sometimes it may exceed this value; like the bulk density (loose), it depends on the actual density, form of surface and the particle size of the fertilizer.

1 Scope and field of application

This International Standard specifies two methods for the determination of the bulk density (tapped) of solid fertilizers :

— the machine tapping method (method 1);

— the hand tapping method (method 2).

These methods are applicable to dry fertilizers only. If the fertilizer has absorbed moisture during transport or storage, it is necessary to dry it in an environmental chamber, with constant low humidity, prior to the determination.

Neither method is suitable for materials which contain a large proportion of particles exceeding 5 mm in diameter.

Method 2 is applicable only to spherical granules and to prills. It is not applicable to sharp-edged grains.

NOTE — Because of the differences in tapping technique, the two methods will not necessarily give the same value for the bulk density (tapped).

2 Reference

ISO 3944, *Fertilizers — Determination of bulk density (loose).*

3 Definition

bulk density (tapped) of a fertilizer : The mass per unit volume of a fertilizer after being poured into a container and compacted.

The bulk density (tapped) is expressed in grams per cubic centimetre (g/cm^3).

4 Sampling[1)]

The laboratory sample shall be sufficient for at least two determinations.

5 Method 1 — Machine tapping method

5.1 Principle

Pouring of the fertilizer from a specified funnel into a specified measuring cylinder of known volume, tapping by means of a tapping machine, and weighing of the contents of the cylinder.

5.2 Apparatus

5.2.1 Balance, capable of weighing to the nearest 1 g.

5.2.2 Apparatus for determination of bulk density (loose), according to ISO 3944, with a collar of transparent plastic and a measuring-cylinder holder with guide clamp (see the figure).

5.2.3 Tapping machine, having a camshaft the cams of which lift the guide clamp, measuring-cylinder holder and measuring cylinder once per revolution. The rotational frequency of the camshaft shall be 250 ± 15 min^{-1}.

5.2.4 Spatula, approximately 120 mm × 20 mm, or other suitable scraper.

1) An International Standard on the sampling of fertilizers is in preparation.

5.3 Procedure

Pour into the closed funnel of the apparatus (5.2.2) a quantity of the fertilizer greater than that needed to fill the measuring cylinder.

Fully open the slide of the funnel so that the contents discharge into the measuring cylinder in 6 to 12 s.

NOTE — If the fertilizer does not flow freely, keep the outlet clear by inserting a rod of 3 to 4 mm diameter into the opening.

Remove the measuring cylinder from its holder, slip on the plastic coller and add by hand a quantity of fertilizer such that, after tapping, the fertilizer still remains several centimetres above the top of the measuring cylinder.

Place the measuring cylinder firmly in its holder in the tapping machine, and tap 2 500 times.

Remove the measuring cylinder from the tapping machine, remove the collar, and scrape away the surplus fertilizer heaped on the measuring cylinder by means of the spatula (5.2.4).

Weigh the contents of the measuring cylinder to the nearest 0,1 % of the total mass.

Carry out two determinations, in rapid succession, on the same test portion.

6 Method 2 — Hand tapping method

6.1 Principle

Pouring of the fertilizer from a specified funnel into a specified measuring cylinder of known volume, tapping the walls of the cylinder by hand, and weighing of the contents of the cylinder.

6.2 Apparatus

6.2.1 Balance, capable of weighing to the nearest 1 g.

6.2.2 Apparatus for the determination of bulk density (loose), according to ISO 3944.

6.2.3 Spatula, approximately 120 mm × 20 mm, or other suitable scraper.

6.2.4 Rod, made of wood, plastic or similar material, about 200 mm long and about 10 mm in diameter.

6.3 Procedure

Pour into the closed funnel of the apparatus (6.2.2) a quantity of the fertilizer greater than that needed to fill the measuring cylinder.

Open the slide of the funnel so that the contents discharge into the measuring cylinder in 20 to 25 s. During the discharge, tap the sides of the measuring cylinder gently two to three times per second with the rod (6.2.4) to ensure compaction of the material.

NOTE — If the fertilizer does not flow freely, keep the outlet clear by inserting a rod of 3 to 4 mm diameter into the opening.

Close the slide of the funnel, then twice raise the measuring cylinder 2 to 3 mm and drop it to complete the compaction. Scrape away the surplus fertilizer heaped on the measuring cylinder by means of the spatula (6.2.3).

Remove the measuring cylinder from below the funnel and weigh its contents to the nearest 0,1 % of the total mass.

Carry out two determinations, in rapid succession, on the same test portion.

7 Expression of results

7.1 Method of calculation and formula

The bulk density (tapped) D_t of the fertilizer is given, in grams per cubic centimetre, by the formula

$$D_t = \frac{m}{V}$$

where

m is the mass, in grams, of the test portion;

V is the capacity up to the brim, in cubic centimetres, of the measuring cylinder.

Take as the result the arithmetic mean of the two determinations if the requirement concerning repeatability (see 7.2) is satisfied.

7.2 Repeatability

The difference between the results of two determinations carried out in rapid succession by the same operator shall not exceed 0,01 g/cm^3.

8 Test report

The test report shall include the following particulars :

a) the reference to the method used;

b) the result and the method of expression;

c) any unusual features noted during the determination;

d) any operation not included in this International Standard or the International Standard to which reference is made, or regarded as optional.

Dimensions in millimetres

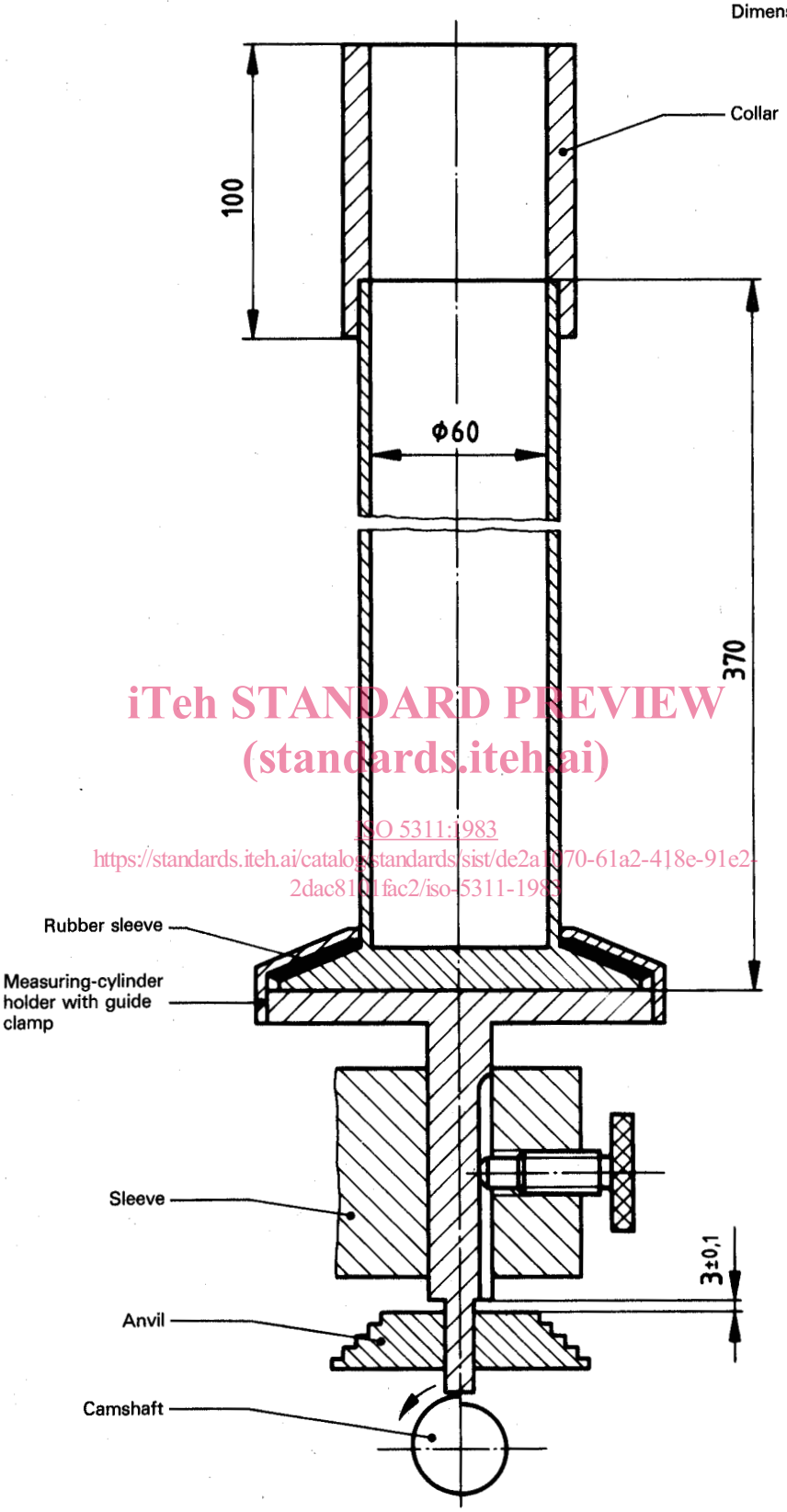

Figure — Apparatus for the determination of bulk density (tapped) by machine tapping