BRITISH STANDARD

BS EN
13299:2000

Fertilizers — Determination of flow rate

The European Standard EN 13299:2000 has the status of a British Standard

ICS 65.080

National foreword

This British Standard is the official English language version of EN 13299:2000.

The UK participation in its preparation was entrusted to Technical Committee CII/37, Fertilizers and related chemicals, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

The United Kingdom voted against the acceptance of this standard at the CEN Formal Vote stage because of discrepancies in the instructions in clauses **6** to **8** that might lead to confusion in the calculation of results. In particular, the variables appearing in the various equations, and the symbols by which they are represented, are inconsistent. It is the recommendation of the BSI technical committee that equations (2) and (3) are disregarded and that equation (4) is used directly.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled "International Standards Correspondence Index", or by using the "Find" facility of the BSI Standards Electronic Catalogue.

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 7 and a back cover.

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This British Standard, having been prepared under the direction of the Sector Committee for Materials and Chemicals, was published under the authority of the Standards Committee and comes into effect on 15 June 2000

ISBN 0 580 34283 2

Amendments issued since publication

Amd. No.	Date	Comments

EUROPEAN STANDARD NORME EUROPÉENNE EUROPÄISCHE NORM

EN 13299

February 2000

ICS 65.080

English version

Fertilizers – Determination of flow rate

Engrais – Détermination du taux d'écoulement

Düngemittel – Bestimmung der Fließkennzahl

This European Standard was approved by CEN on 12 December 1999.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

Ref. No. EN 13299:2000 E

Contents

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 260, Fertilizers and liming materials, 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 August 2000, and conflicting national standards shall be withdrawn at the latest by August 2000.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

The flow rate of a fertilizer provides a measure of comparison for the mass flow when flowing out of containers or during spreading.

1 Scope

This European Standard specifies a method for the determination of the flow rate of free flowing solid fertilizers. The method is not applicable to powder materials (< 0,5 mm) or liming materials.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 1236, *Fertilizers - Determination of bulk density (loose) (ISO 3944:1992 modified*).

ISO 3310-1, *Test sieves - Technical requirements and testing – Part 1 : Test sieves of metal wire cloth*.

3 Principle

Measurement of the time taken for 2 kg of fertilizer to flow from a calibrated funnel into a vessel placed on a balance.

4 Apparatus

4.1 **Balance**, with a capacity of at least 3,5 kg and capable of weighing to an accuracy of ± 1 g.

4.2 **Funnel**, as specified in EN 1236 made of stainless steel.

The slide of this funnel shall be such that the orifice is completely clear when the slide is in the open position.

4.3 **Collecting vessel**, capable of holding at least 3 kg of fertilizer, for example.

4.4 **Stop-watch**, with an accuracy of 0,1 s.

4.5 **Woven wire test sieves**, conforming to ISO 3310-1 with aperture sizes 3,55 mm and 4,0 mm.

4.6 **Glass balls**, for calibration of the funnel, conforming to the following requirements:

— Diameter: 4 mm ± 0,3 mm;

— Form: spherical;

— Material: glass of density 2,5 kg/dm^3;

— Surface: polished.

Before use, sieve the glass balls using the 4,00 mm and 3,55 mm sieves (4.5) and use only those which pass the 4,00 mm sieve and remain on the 3,55 mm sieve.

5 Test portions

Weigh two representative test portions of about 3 kg ± 100 g each, taken from the test sample.

6 Calibration of the funnel

6.1 Pour 3 kg ± 100 g of the sieved glass balls (4.6) into the closed funnel (4.2). Place the balance (4.1) under the funnel and stand the collecting vessel (4.3) on it. Simultaneously, fully open the slide of the funnel and start the stop-watch.

6.2 Stop the stop-watch when the balance indicates 2 kg and close the slide at the same time. Record the time to the nearest 0,1 s.

6.3 Weigh the actual amount of glass balls collected in the vessel to the nearest 1 g. The corrected flow time of exactly 2 kg of glass balls is calculated according to equation (1):

$$t_{b,2} = t_b \frac{2}{m_b} \qquad (1)$$

where:

$t_{b,2}$ is the corrected flow time, in seconds, of 2 kg of glass balls;

t_b is the measured flow time, in seconds, of 2 kg of the glass balls;

m_b is the weighed mass, in kilograms, of the glass balls.

6.4 Completely empty the funnel into the collecting vessel. Close the funnel and return all the balls to the funnel.

6.5 Repeat the calibration process. Calculate the arithmetic mean (t) of the two determinations of the time ($t_{b,2}$) taken for 2,0 kg of the glass balls to pass through the funnel.

7 Procedure

7.1 Repeat the procedure described in 6.1 and 6.2 using one of the test portions (clause 5) in place of the sieved glass balls.

7.2 Weigh the actual amount of fertilizer collected in the vessel to the nearest 1 g and calculate the time taken for exactly 2,0 kg to pass through the funnel.

7.3 Completely empty the funnel into the collecting vessel. Discard the contents.

7.4 Repeat the procedure described in 7.1 to 7.3 using the second of the two test portions.

8 Expression of results

8.1 Calculation of the calibration factor (*c*)

The calibration factor for the funnel is given by the equation:

$$c = \frac{10}{2\,\frac{60}{t}} = \frac{t}{12} \qquad (2)$$

where:

c is the calibration factor;

t is the measured flow time, in seconds;

10 is the assumed flow rate, in kilograms per minute, of the glass balls through a hypothetical standard funnel.

8.2 Calculation of the flow rate of the fertilizer

The flow rate of the fertilizer is given in kilograms per minute by the equation:

$$F = m_{\mathrm{f}} \left(\frac{60}{t_{\mathrm{f}}} \right) \times \overline{c} = \frac{120}{t_{\mathrm{f}}} \times \overline{c} \qquad (3)$$

where:

F is the flow rate, in kilograms per minute, of the fertilizer;

m_{f} is the weighed mass, in kilograms, of the fertilizer;

t_{f} is the measured flow time, in seconds, of the fertilizer;

$\overline{c}$ is the mean calibration factor.

For m_{f} = 2 the simplified equation (4) can be used:

$$F = 10\,\frac{\overline{t_{b,2}}}{t_{\mathrm{f},2}} \qquad (4)$$

where:

$\overline{t_{\mathrm{b},2}}$ is the mean flow time, in seconds, of 2 kg glass balls to pass through the funnel;

$t_{\mathrm{f},2}$ is the flow time, in seconds of 2 kg fertilizers to pass through the funnel.

Take as the result the arithmetic mean of the two determinations if the requirement concerning repeatability (9.1) is satisfied. If not, repeat the whole test.

9 Precision

9.1 General

The statistical information given here is only intended as a guideline to what can be expected. The values are based on collaborative studies which have been carried out on urea and NPK complex fertilizers.

9.2 Repeatability

The difference between two single results found on identical test material by one operator using the same apparatus within a short time interval should exceed the repeatability limit, *r*, expressed as a percentage, given by the equation:

$$r = 0{,}015\ F \qquad (5)$$

where:

F is the arithmetic mean of the two results;

on average not more than once in 20 cases in the normal and correct operation of the method. Both results should be considered suspect if the repeatability value *r* is exceeded.

9.3 Reproducibility

The difference between two single and independent test results found by two operators working in different laboratories using identical test materials should exceed the reproducibility limit, *R*, given by the equation:

$$R = 0{,}15\ F \qquad (6)$$

where:

F is the arithmetic mean of the two test results;

on average not more than once in 20 cases in the normal and correct operation of the method.

10 Test report

The test report shall contain the following:

— identification of the sample;

— sampling method;

— sample preparation;

— reference to the method used;

— the test result;

— any unusual features observed in the course of the determination;

— any operations not specified in this European Standard or regarded as optional.

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London
W4 4AL