SLOVENSKI STANDARD
SIST EN 1235:1998/A1:2003

01-oktober-2003

Trdna gnojila - Sejalni preskus

Solid fertilizers - Test sieving

Feste Düngemittel - Siebanalyse

Engrais solides - Tamisage de contrôle

Ta slovenski standard je istoveten z: EN 1235:1995/A1:2003

ICS:

65.080 Gnojila Fertilizers

SIST EN 1235:1998/A1:2003 en

EUROPEAN STANDARD

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EUROPÄISCHE NORM

EN 1235:1995/A1

April 2003

ICS 65.080

English version

Solid fertilizers - Test sieving

Engrais solides - Tamisage de contrôle

Feste Düngemittel - Siebanalyse

This amendment A1 modifies the European Standard EN 1235:1995; it was approved by CEN on 17 January 2003.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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Foreword

This document (EN 1235:1995/A1:2003) has been prepared by the Technical Committee CEN/TC 260 "Fertilizers and liming materials", the secretariat of which is held by DIN.

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of an identical text or by endorsement, at the latest by October 2003, and conflicting national standards shall be withdrawn at the latest by October 2003.

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, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

Clause 1

Replace "Annex ZA gives further information on the expression of the results of test sieving" with "Annex ZA gives guidance on the interpretation of sieving test data".

Replace the existing annex ZA (informative) with the following text:

Annex ZA
(informative)

Interpretation of sieving test data

ZA.1 Determination of the size distribution

In the following, index sieve numbers n increase with increasing sieve aperture and index $_0$ refers to the receiver.

The material retained on receiver, x_0, and each of the individual sieves, x_n, given as mass fraction in percent, can be obtained from equation (ZA.1):

$$x_n = \frac{m_n}{m_\mathrm{t}} \times 100 \qquad \text{(ZA.1)}$$

where

m_n is the mass retained on sieve n, in grams;

m_t is the total mass of the test sample, in grams ($m_\mathrm{t} = m_0 + m_1 + ...m_i$).

ZA.2 Definition of the cumulative undersize

The cumulative undersize c_n, given as mass fraction in percent, is defined by equation (ZA.2):

$$c_n = \sum_{i=0}^{n-1} x_i \qquad \text{(ZA.2)}$$

where

c_n is the cumulative undersize for sieve n, given as mass fraction in percent;

x_i is the mass fraction in percent retained on sieve i.

ZA.3 Definition and determination of the mass median diameter d_{50}

The mass median diameter, d_{50}, is the theoretical sieve opening of such size that 50 % of the particles, by mass, are larger and 50 % are smaller.

The mass median diameter, d_{50}, in millimetres, can be obtained by equation (ZA.3):

$$d_{50} = z_n + \frac{(50 - c_n)}{(c_{n+1} - c_n)} \times (z_{n+1} - z_n) \qquad \text{(ZA.3)}$$

where

z_n is the nominal sieve aperture size for which the cumulative undersize is nearest but below 50 % (mass fraction), in millimetres;

z_{n+1} is the nominal sieve aperture size for which the cumulative undersize is nearest but above 50 % (mass fraction), in millimetres;

c_n is the cumulative undersize for sieve n, expressed as a mass fraction in percent;

c_{n+1} is the cumulative undersize for sieve n+1, expressed as a mass fraction in percent.

z_{n+1}-z_n should be of minimum value using appropriate sieves from the allowed sieve series.

This calculation of d_{50} assumes that there is a linear relationship between sieve sizes z_n and z_{n+1} and the cumulative undersizes c_n and c_{n+1}.

ZA.4 Definition and determination of the granulometric spread Δ_{xy}

Granulometric spread Δ_{xy} is the dimension, in millimetres, resulting from equation (ZA.4):

$$\Delta_{xy} = d_x - d_y \qquad \text{(ZA.4)}$$

where

d_x is the theoretical sieve aperture size in millimetres for which the cumulative undersize is x % (mass fraction);

d_y is the theoretical sieve aperture size in millimetres for which the cumulative undersize is y % (mass fraction);

with $x > y$ and both dimensions having been measured and calculated by the same method as the one used to determine the mass median particle diameter. For a correct interpretation of the results, there has to be at least one sieve with a sieve aperture size less than d_y, and one with a sieve aperture size above d_x.

However, it is more convenient to use a single definition for the granulometric spread. It is recommended that this is based on the spread over two standard deviations around the mass median. In this case the granulometric spread, in millimetres, is defined by equation (ZA.5):

$$\Delta = d_{84} - d_{16} \qquad \text{(ZA.5)}$$

where

d_{84} is the theoretical sieve aperture size in millimetres for which the cumulative undersize is 84 % (mass fraction);

d_{16} is the theoretical sieve aperture size in millimetres for which the cumulative undersize is 16 % (mass fraction).

NOTE The above is based on the assumption that, in general, for fertilizers, the particle size distribution is Gaussian. In some cases the Weibull distribution can be more accurate and the x and y dimensions can be changed.

ZA.5 Definition and determination of the Granulometric Spread Index GSI

The Granulometric Spread Index GSI_{xy} is defined as the ratio of granulometric spread to mass median particle diameter given by equation (ZA.6):

$$\text{GSI}_{xy} = \frac{\Delta_{xy}}{2d_{50}} \times 100 \qquad \text{(ZA.6)}$$

The determination relies therefore on the prior determination of d_{50} and Δ_{xy} as defined in ZA.3 and ZA.4.

However, for practical purposes, since a granulometric spread Δ (without indices) has been defined, it is appropriate that the same is applied to granulometric spread index which would then be defined as follows:

$$\text{GSI} = \frac{\Delta}{2d_{50}} \times 100 \qquad \text{(ZA.7)}$$

ZA.6 Practical calculation and approximations: the distribution curve

ZA.6.1 General

For practical purposes and in order to avoid numerous sieving, the interpretation of sieving data can be based on the cumulative size distribution curve. Such a curve can be smoothly plotted from the individual sieving results, either manually or by computer.

ZA.6.2 Manual plotting

An example of a manually smoothed plot is given in Figure ZA.1. Introduction of the theoretical sieve sizes d_{16}, d_{50} and d_{84} allows interpolation for corresponding cumulative masses.

ZA.6.3 Computer plotting

A computer may be used to plot a smooth curve through the points as in Figure ZA.1. In addition, a "curve" can be drawn as a linear graph using actual measurements and introducing the theoretical sieve sizes d_{16}, d_{50} and d_{84}, see Figure ZA.2.

Superimposition of the two graphs, which can be done with current spreadsheet software, gives the result in Figure ZA.3. The same software allows picking any one of the theoretical sieve sizes and modifying it so as to superimpose the linear diagram with the smoothed one thus giving directly the theoretical sieve sizes d_{16}, d_{50} and d_{84} as in Table ZA.1.

ZA.6.4 Example

The example given below is based on actual results.

NOTE These practical methods have the advantage of avoiding regression analysis for equation calculations necessary to establish the masses that would correspond to the theoretical sieve sizes d_{16}, d_{50} and d_{84} thus avoiding assumptions whether the particle size distribution is Gaussian or a Weibull.

Table ZA.1 — Actual sieve analysis

Sieve aperture size mm	Cumulative mass fraction passing a given sieve %
5,0	100,0
4,0	93,3
3,35	80,0
2,80	41,5
2,40	16,0
2,0	6,5
1,40	2,0

Instead of drawing the curve manually, there is, however, the possibility of using a computer simulation.

By taking the actual results and having drawn the interpolated smoothed curve as in Figure ZA.1, it is quite simple to use another set of numbers having both the actual sieve sizes and the three theoretical ones and draw a linear diagram as in Figure ZA.2. The superimposition procedure allows the operator to fit, in Figure ZA.3, the curve of Figure ZA.2 as nearly as possible to the curve of Figure ZA.1.

This gives the results following Table ZA.2:

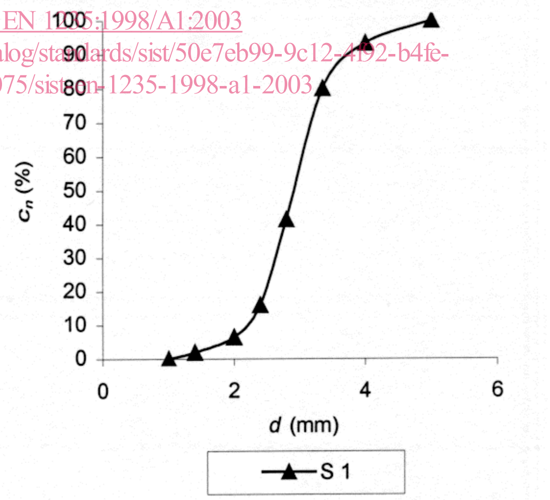
Table ZA.2 — Interpolated results

Series 1 (see Figure ZA.1)		Series 2 (see Figure ZA.2)	
Sieves	Cumulative percent	Sieves	Cumulative percent
1,4	2	1,4	2
2	6,5	2	6
2,4	16	2,4	16
2,8	41,5	2,8	41,5
3,35	80	2,9	50
4	93,3	3,35	80
5	100	3,43	84
-	-	4	93,3
-	-	5	100

Series 2:

d_{16} = 2,40; d_{50} = 2,90 and d_{84} = 3,43

⇒Δ = 1,03 and GSI = 17,76



Key

c_n cumulative undersize

d sieve opening

S 1 series 1

Figure ZA.1— Series 1