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Continuous mechanical handling equipment — Classification and symbolization of bulk materials

Engins de manutention continue — Classification et symbolisation des matériaux en vrac

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FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (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 set up 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 3435 was developed by Technical Committee ISO/TC 101, *Continuous mechanical handling equipment*, and was circulated to the member bodies in November 1975.

It has been approved by the member bodies of the following countries :

Belgium	Italy	Sweden
Bulgaria	Mexico	Turkey
Finland	Romania	United Kingdom
France	South Africa, Rep. of	U.S.S.R.
Germany	Spain	Yugoslavia

The member bodies of the following countries expressed disapproval of the document on technical grounds :

Australia
Czechoslovakia

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Continuous mechanical handling equipment — Classification and symbolization of bulk materials

1 SCOPE AND FIELD OF APPLICATION

This International Standard establishes a classification and symbolization of bulk materials in order to assist communication between manufacturers and users of handling equipment.

The object of the classification is to secure from enquirers for mechanical handling equipment an accurate description of the material to be handled in respect of any specific project; for this purpose the user will be asked to complete a questionnaire, common to all manufacturers, covering the points indicated below.

NOTE — It may prove helpful to provide a sample of the product.

2 GRANULARITY

The granularity of the material is described by two characteristic properties, namely the lump size and the lump form.

2.1 Lump size (grading)

The majority of bulk materials contain lumps (or grains) of various gradings, of which it is necessary to know, with a reasonable approximation, the limiting values and relative proportions in the mass to be handled, so as to determine safely the various features of the equipment to be used.

The size of the lump is denoted by the longest edge, d, of the cuboid in which it can be contained.

Materials are distinguished as classified or non-classified.

a) *Classified materials*

These are materials for which the ratio between the sizes of the biggest and the smallest lump is less than or equal to 2,5 (this includes materials of a single dimension) :

$$\frac{d_{max}}{d_{min}} \leqslant 2,5$$

b) *Non-classified materials*

These are materials for which the same ratio is greater than 2,5 :

$$\frac{d_{max}}{d_{min}} > 2,5$$

Classified materials are adequately defined by the values d_{max} and d_{min}.

Non-classified materials, however, require in most cases a complete grading analysis, made by sections in which the extreme ratios of the lump sizes should not exceed 2,5. The grading inscription shall at least indicate the proportion (by mass) of the lumps between 0,8 d_{max} and d_{max}, d_{max} being the size of the biggest lump which can be found in the material.

Important note — Whatever the grading or its description might be, an indication shall be made as to whether it can be considered as a regular average. If the grading differs over a period of time, the limits of probable variations and their duration shall be defined, especially if repeated periods are anticipated where concentrations of big lumps will occur.

In all cases, particularly in respect of big lump sizes, the maximum dimensions of the largest pieces shall be stated.

The size of a piece is the minimum rectangular parallelepiped in which it can be contained :

- the length d is the greatest dimension;
- the thickness is the smallest dimension;
- the width is the intermediate dimension.

Moreover, for sieving, screening or other special cases, such as vibratory or pneumatic handling, where the precise grading has to be known, the user shall supply a complete size distribution analysis.

2.2 Lump form (shape)

Six different forms, symbolized by roman numerals, are distinguished :

I – sharp edged, with the three dimensions similar (for example cube);

II – sharp edged, with one of the three dimensions clearly greater than the other two (for example prism, blade);

III – sharp edged, with one of the three dimensions clearly smaller than the other two (for example plate, shell);

IV – round edged, with the three dimensions similar (for example sphere);

V – round edged, with one of the three dimensions clearly greater than the other two (for example cylinder, rod);

VI – fibrous – stringy – curly – linked.

3 COHESION

The cohesion is symbolized by an arabic numeral from "1" to "6" :

1 – product can be suspended in air and flows as freely as a liquid;

2 – free-flowing product, angle of repose, α, being such that $0 < \alpha \leqslant 30°$;

3 – product flows normally, angle of repose, α, being such that $30° < \alpha \leqslant 45°$;

4 – product is slow flowing, angle of repose, α, being such that $45° < \alpha \leqslant 60°$;

5 – compact product, angle of repose, α, being greater than $60°$;

6 – non-collapsible product, entangled, susceptible to arching, resistant to separation.

The angle of repose, α, is the angle between the horizontal and the side of the conical pile formed by the product when it falls freely and evenly from a small height.

4 PROPERTIES OF MATERIAL (PECULIARITIES)

Each property of the material is symbolized by a small letter from "n" to "x", designating one of the following eleven properties affecting ease of handling :

Symbol	Properties	Examples
n	Packs under pressure or naturally, due to humidity, etc.	Hydrated lime, powdered sugar, prepared foundry sand
o	Abrasive	Coke, quartz, furnace slag
p	Corrosive	Common salt
q	Easily damaged	Soap flakes
r	Explosive	Coal dust or sugar dust
s	Flammable	Wood shavings
t	Dusty	Cement
u	Wet (indicate, between parentheses, the percentage of moisture by anhydrous mass of the product)	Slime or slurry
v	Sticky	Wet clay
w	Hygroscopic	Plaster of Paris, common salt, ammonium nitrate
x	Noxious	Household refuse

Any material having none of the above-mentioned properties will have no symbol.

Several letters may be assigned together if the product has the corresponding properties.

NOTE – Properties not indicated above shall be specified in full.

5 BULK DENSITY

The bulk density is the ratio of the mass expressed in metric tons to the volume expressed in cubic metres, of the material in bulk as fed to the handling equipment.

The bulk density is symbolized by the number corresponding to this ratio, for example for coal, 0,8 t/m^3.

6 TEMPERATURE

The temperature of the material shall be indicated preferably in degrees Celsius.

When the temperature is variable, two figures shall be given : the minimum temperature and the maximum temperature.

No indication of temperature shall be made for material which is at ambient temperature.