FEDERATION EUROPEENNE DE LA MANUTENTION
SECTION II
CONTINUOUS HANDLING

FEM
2 581

original D
edition E
November 1991

PROPERTIES OF BULK MATERIALS

CONTENTS

1 - FOREWORD

The handling and the storage of bulk materials represent a large proportion of all industrial activities, in particular because there is a great variety of bulk materials and because these are handled in extremely different branches by means of equipment and methods which are also extremely different.

This is why Section II of the FEM decided to embark an as complete a study as possible of the properties of the bulk materials to be handled, since an exact knowledge of these materials in necessarily the starting point for any serious study of a handling and/or storing problem.

By definition, bulk materials are composed of a mixture of at least two phases, i.e. solid matter and gas. Normally, liquids are also incorporated in the form of moisture content. Solid matters in a bulk material consist of fine or rough particles, or of large lumps or of combinations.

In practice, bulk materials are known in the form of, for example, dust, powders, flour, grains, granulates, groats, clots and pellets.

Because of their extremely varied origin, nature, grain size distribution, processing, etc. bulk materials have very diverse physical characteristics, some of which (e.g. grain size, grain shape) can be defined and measured in a general way, while others (e.g. friction coefficient, cohesion) are dependent on the maximum physical conditions (e.g. moisture, temperature, mechanical stresses) and the mode of handling (mechanical handling, pneumatic handling, storage) and must therefore be measured in each of the corresponding maximum conditions.

.../

The FEM documents try to take account of these special features and are therefore divided in three groups of leaflets, viz. :

- a leaflet on the general properties of bulk materials to identify and compare bulk materials,
- three leaflets on the bulk materials properties which are of special importance for a determined mode of handling,
- leaflets on the influence of the properties of bulk materials on the configuration of some machines.

All the existing FEM documents on the properties of bulk materials are listed in the following table.

2 - FEM DOCUMENTS ON THE PROPERTIES OF BULK MATERIALS

Structure of the document FEM 2 581 :

FEM 2 581 - Properties of bulk materials

FEM 2 582 : General properties of bulk materials and their symbolization

(Properties of bulk materials not dependent on the mode of handling and used to idendify and compare bulk materials)

Specific characteristics of bulk materials

FEM 2 181 : Mechanical handling
FEM 2 381 : Silo storage
FEM 2 481 : Pneumatic handling

(Important properties of bulk materials for a given mode of handling)

Influence of the properties of bulk materials on the design and manufacturing of certain machines

FEM 2 123 : Bucket elevators	Mechanical handling
FEM 2 124 : Troughed belt conveyors	
FEM 2 125 : Horizontal and slightly inclined screw conveyors	
FEM 2 126 : En-masse conveyors/elevators	
FEM 2 127 : Vibrating conveyors	
FEM 2 128 : Bucket-wheel reclaimers	
FEM 2 321 : Silos	
FEM 2 421 : Pneumatic handling	

FEDERATION EUROPEENNE DE LA MANUTENTION
SECTION II
CONTINUOUS HANDLING

FEM
2 582

original D
edition E
November 1991

GENERAL PROPERTIES OF BULK MATERIALS AND THEIR SYMBOLIZATION

CONTENTS

1 - INTRODUCTION

For a general description of bulk materials applicable to the greatest possible number of handling processes - such as mechanical handling, pneumatic handling, storage in silos, etc. - it is advisable to use, to define and to quantify with characteristics values only the properties which are revealing, which can be used and/or are necessary or useful for all handling processes.

Most of the properties of bulk materials are not invariable, but are governed in each process by the existing maximum conditions. For the general description of the properties of bulk materials, it is necessary to use as a basis a state common to all the subsequent handling processes. For this reason, the delivery state, which is the condition of the bulk material before being submitted to a handling or storage process, has been selected for the general description of bulk materials.

Users and manufacturers already know many materials properties through practical experience and do not need to carry out specific measurements. If measurements are necessary for specific properties of bulk materials, it may be necessary for users and manufacturers to agree on the measuring method.

When using symbolization, the user shall always bear in mind that when a symbol is transmitted by telex, fax or data processing, etc. it may well be forgotten or improperly represented. To handle bulk materials safely, additional attention should therefore be paid, in particular with toxic, explosive, combustible, corrosive, perishable, radioactive materials, etc. Symbolization does not include any quantitative data on such properties, nor specifications for the necessary safety measures.

2 - SYMBOLIZATION

For the general symbolization of a bulk material, details on the characteristic values and the following properties of the bulk material should be available :

.../