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CONTINUOUS HANDLING

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DISCHARGE OF BULK MATERIAL FROM SILOS
DESCRIPTION AND ASSESSMENT OF DISCHARGE SYSTEMS

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1 - NOTE

This document is intended to illustrate the interrelationship between the properties of bulk material, silo operation and discharge system. It is intended to make clear to planners, manufacturers and operators of silo systems the criteria for selecting a suitable discharge system.

2 - INTRODUCTION

In order to permit a suitable discharge system to be selected, it is necessary to know the properties of the bulk material, the silo geometry and the tasks which the discharge system is required to perform.

The characteristics of bulk materials, such as for example grain size or temperature, must be taken into account when designing the discharge system. The flow capacity of the bulk material is of special importance (see document FEM 2 381). Since discharge systems should be well-matched to the bulk material to be discharged, it is recommended to describe the bulk material with great accuracy (see document FEM 2 581/2 582). The description of bulk material properties according to FEM 2 581/2 582 helps identify the bulk material and this identification may be helpful in looking for the appropriate discharge system.

When the silo geometry is known and the bulk material properties are known, it is possible to determine the flow capacity of the bulk material in the silo. If bulk material flow problems can be anticipated, it is necessary to use more sophisticated discharge systems. Additional facilities may be necessary.

The tasks which the discharge system is required to perform must be thoroughly investigated and settled. When doing this, it is necessary to allow for the requirements related to silo filling, mode of silo operation and downstream facilities.

3 - DEFINITIONS

Below, we shall explain various terms which are important in relation to discharge of bulk materials from silos. This should allow these terms to be understood and used in the same way by experts from different fields.

Shutting off, shut-off element

A shut-off element completely stops the flow of bulk material out of a silo.

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Activation

Owing to the introduction of additionnal energy, often coupled with additionnal air input, the bulk material flow properties are changed by reducing internal friction and wall friction, i.e. by reducing the bulk material mechanical strength and by eliminating solidification due to storage time.

Discharging

Discharging is the process of movement of the bulk material in the area of the discharge system. In general the bulk material flows from a larger silo cross-section to a smaller silo cross-section and flows out of the silo.

Discharge aid

Discharge aids, devices and machines are used to start, maintain and improve the discharge of bulk material flow out of the silo, if independent flow under the force of gravity cannot be achieved.

Discharge element

Discharge elements are devices and machines to which the bulk material flows freely. This can be made possible under the force of gravity or with discharge aids. Shutting off and feeding may be sub-functions of a discharge element.

Discharge system

The interaction of discharge aids and discharge elements is termed a discharge system.

Feeding

Feeding means a reproducible limitation to regulate the flow of bulk material out of the silo. The flow of bulk material is limited to the required target discharge rate by taking suitable measures. Dependent upon the facilities used, feeding is carried out either volumetrically or gravimetrically (see document 92/120).

4 - SELECTION OF A DISCHARGE SYSTEM

The procedure for selecting suitable discharge systems can be clearly illustrated with the aid of a flow chart.

However, choice is also influenced by the silo volume and mass flow. As far as these parameters are concerned, no value can be given for general information, as the manufacturers' experience plays a major role here.