



Packaging — Estimating the filled volume using the flat dimensions —

Part 1: Paper sacks

Emballages — Évaluation du volume de remplissage à partir des dimensions plates — Partie 1: Sacs en papier

At its first meeting in 1975, Sub-committee 2, *Sacks*, of Technical Committee ISO/TC 122, *Packaging*, agreed to create a working group (WG 1) to study methods of relating the flat dimensions of a paper sack to its capacity and if feasible, to make a recommendation for a method. At the very beginning it was pointed out that the volume of a sack is not an exact property, nor is it unique. It is dependent upon the product, the method of filling and any treatment after filling. Nevertheless, a relation between the dimensions and volume was considered to be worth seeking, even if it were to be an arbitrary one.

It became evident very early that establishing the desired relation would be impracticable without a wide range of experiments which were then carried out in France under the direction of the convener of the group. However, difficulties in establishment of the rate of filling and the assessment of the apparent density of the filling material were considerable and so it was impossible to recommend any accurate method.

As the work carried out by the working group was extensive and in any case gave valuable information, the sub-committee decided to publish the work as a Technical Report (type 3). This part of ISO/TR 8281 comprises all the individual results of measurement for paper sacks which can be treated further; for example different kinds of nomograms could be established on the basis of these results.

0 Introduction

This part of ISO/TR 8281 deals with paper sacks. Plastics sacks (of thermoplastic flexible film) will form the subject of ISO/TR 8281/2.

1 Scope and field of application

This part of ISO/TR 8281 establishes empirical equations for relating the flat dimensions of paper sacks to their capacity. The experimental methods used are also described.

2 Reference

ISO 6591/1, *Packaging — Sacks — Description and method of measurement — Part 1: Paper sacks*.¹⁾

1) At present at the stage of draft.

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3 Principle

The general sequence used throughout was

- a) determination of the mass of the empty sack;
- b) measurement of the flat dimensions of the sack;
- c) filling and closure of the sack;
- d) assessment of the filled sack for degree of filling and, when necessary, addition or removal of contents until the sack was filled with the correct quantity of contents;
- e) measurement of the filled dimensions of the sack;
- f) determination of the degree of flexing of the filled sack by measuring the amount of sag when the sack was held up by opposite corners;
- g) determination of the mass of the filled sack;
- h) calculation of the volume of the sack, V , by the equation

$$V = \frac{m}{\rho}$$

where

m is the mass of contents (total mass minus tare of sack);

ρ is the bulk density of the contents.

4 Filling material

Polyethylene granules were used throughout as filling material.

The bulk density and granule size varied from occasion to occasion and information on density and size analysis is given in table 1.

Table 1 — Filling materials

Type of sack	Type of filling material	Density kg/l	Particle size analysis (mesh)					
			4 mm	3,15 mm	2,5 mm	2 mm	1,6 mm	1,6 mm
Open mouth pasted valved sewn	Polyethylene cubic granules	0,542	5,7 %	93,5 %	1,35 %	0,1 %		0,1 %
Valved pasted	Polyethylene cubic granules	0,565						
Open mouth sewn	Polyethylene cylindrical granules	0,6	49 %	37,4 %	12,2 %	1,4 %	—	—

5 Test sacks

The test sacks were hand made, either two plies of 100 g/m² paper or three plies of 70 g/m² paper, their dimensions being based on sack sizes in general use and taking into account paper deckles.

6 Procedure

6.1 Filling method

Valve sacks were filled using a small hopper containing a filling spout and means of using compressed air to assist the flow of the granules.

Open mouth sacks were filled manually or by using a small gravity hopper.