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Water vapor permeability of sheet materials at -18°C (0°F)

Scope and significance

This method is for the determination of water vapor permeability of paper, paperboard, and flexible packaging materials under storage conditions at -18°C (0°F). It is generally suitable for sheet materials up to 125 µm (5 mils) thick. The method has been developed because of increased emphasis on frozen-food production, and because no existing procedure gives results which correlate with those at -18°C. [TAPPI T 448 “Water Vapor Transmission Rate of Sheet Materials at Standard Temperature and Humidity” is suitable at temperatures of 23°C (73°F) and 50% relative humidity, and TAPPI T 464 “Gravimetric Determination of Water Vapor Transmission Rate of Sheet Materials at High Temperature and Humidity” applies at 38°C (100°F) and 90% RH.]

In general, packaging materials used for storage at -18°C should be capable of protection against an appreciable loss of moisture for periods up to 1 or 2 years. The final selection of materials for such storage is probably best done by actual package storage tests for the full length of time required. This method is a simplified and rapid method which has been shown to give results indicative of behavior during long-term storage. Many of the packaging materials are based on cellulose, including paper, paperboard, cellophane, and glassine. The time required for these materials to reach moisture equilibrium when exposed at -18°C may be several weeks or months. The assumption is made in this procedure that equilibrium is reached, for practical purposes, in the 7-day initial conditioning period.

Safety precautions

There are no additional safety precautions for this method.

Approved by a Working Group of TAPPI in accordance with the Useful Method Guidelines

Definition

The rate of water vapor permeability of a sheet at -18°C is the weight of water vapor transmitted per unit of area per unit of time under constant conditions of water vapor pressure differential. In this procedure, this is reported as grams of water per square meter per 24 hours at -18°C , and at a relative humidity in equilibrium with cracked ice on one side of the membrane and a relative humidity in equilibrium with calcium chloride on the other.

Apparatus

1. *Inner box.* A heavy-walled (not less than 2.0 mm or 14 gage), sealed metal box in which the test dishes are placed, in groups four high, with at least a 25 mm (1 in.) clearance between the top of one specimen and the bottom of the test dish above, and with approximately 50 mm (2 in.) spacing between the top and bottom samples and the box. The metal box may hold any number of such units, with each rack of four surrounded on the sides by coarsely cracked ice. This is best done by use of 6 mm (0.25 in.) mesh screen surrounding the racks holding the specimen. The tightly sealed box will minimize the temperature variation from the outside storage cabinet by reducing convection currents, and the ice will provide essentially saturated air at -18°C . The inner box is shown in Figs. 1 and 2.

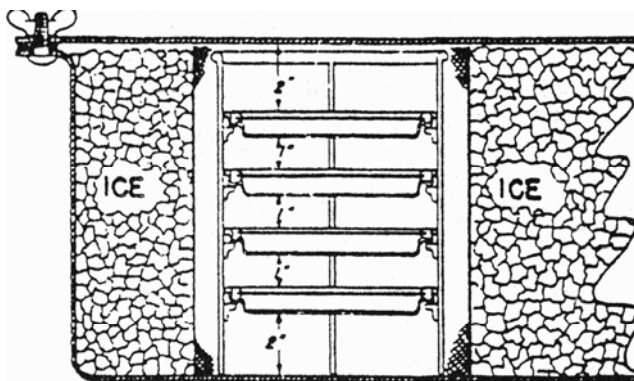


Fig. 1. Side view.

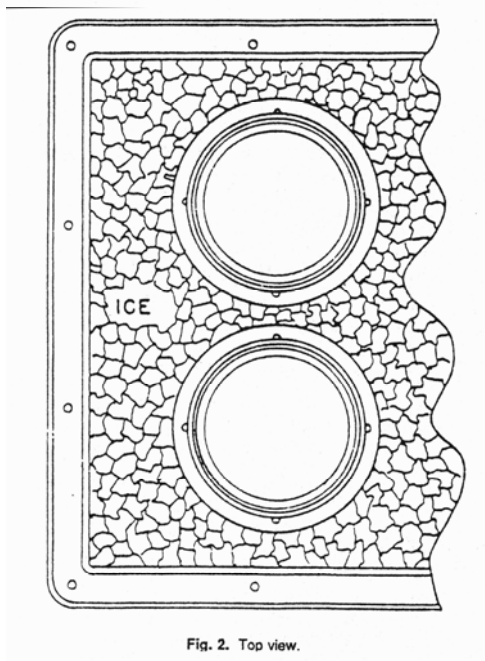


Fig. 2. Top view.