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Physical characterization of press fabrics: basis weight, air permeability, void volume under loading and pressure uniformity

Introduction

This Technical Information Paper provides a means of measuring several fabric characteristics of new press fabrics. For on-machine monitoring of the press fabric, refer to TAPPI TIP 0404-19 “Press Section Monitoring.”

The characteristic properties covered in this TIP are (a) the basis weight or unit area weight, (b) the air permeability, (c) the void volume and (d) the pressure uniformity of a press fabric. The supplier typically performs these measures.

This revision combines information from earlier versions of TIP 0404-20 with material from withdrawn TIPs 0404-32 and 0404-34.

Basis weight of a press fabric

Scope

The purpose of this method is to note the conditions under which a press fabric is measured for size and basis weight. This procedure is intended for use either in the mill or in a laboratory. Use of these conditions will enable paper mills to compare fabrics from one company to those of another with respect to basis weight. This test is to be used for all fabrics regardless of position or product being made on the machine.

Summary

The weight and size of a press fabric are measured at manufacturing environment, under a tension of 2.1 kN/m (12 pli).

Significance

The basis weight is a measure of the mass of material, per unit area, contained in the structure of a press fabric. No direct correlation has been established between the basis weight and performance of the fabric across paper grades, however this characteristic may relate, to some extent, to other properties such as thickness, void volume, robustness, and compaction resistance. In actual use, the uniformity of mass distribution is usually a more critical parameter than the basis weight itself.

It may be worth noting that most press fabrics are sold by weight. Total weight is simply the basis weight per unit area multiplied by the total surface area of the fabric. Standard press fabric material behaves like paper in that some moisture is absorbed into the material at room conditions, thus measured weight of the press fabric will vary with storage conditions. Rather than wait for a newly finished press fabric to acclimatize before weighing and packaging, many fabric suppliers simply quote a normalized fabric weight based on a “bone-dry” (0% moisture content) weight plus 2% (moisture adjustment), which approximates the weight anticipated at typical room conditions. This may explain any discrepancy that is found between actual and quoted weight.

Test specimen

Weight is measured in the typical manufacturing environment. Length and width are to be the projected running size at a tension of 2.1 kN/m (12 pli).

Procedure

1. Measure the length to the nearest 10 cm (4 in) and width to the nearest 2.5 cm (1 in) for the fabric under a tension of 2.1 kN/m (12 pli).
2. Weigh the fabric to the nearest 230 g (0.5 lb).

Calculations

Calculate basis weight, BW, as follows:

$$BW = (M \times 100000) / (L \times W), \text{ g/m}^2$$

$$BW = (M \times 328) / (L \times W), \text{ oz/ft}^2$$

where

$$M = \text{weight, kg}$$

$$L = \text{length, m}$$

$$W = \text{width, cm}$$

Using Imperial units, the calculation would be as follows:

$$BW = (M \times 16) / [L \times (W / 12)], \text{ oz/ft}^2$$

where

$$M = \text{weight in lbs}$$

$$L = \text{length in feet}$$

$$W = \text{width in inches}$$

Conversion of oz/ft² to g/m² would be as follows:

$$\text{g/m}^2 = \text{oz/ft}^2 \times 305.15$$

Report

Report the width, length, weight and basis weight, and the test conditions (temperature and relative humidity).

Air permeability of a press fabric

Scope

Permeability is a measure of ease with which a fluid (or a gas) flows through a porous material. Air permeability of a press fabric is expressed as flow rate of air through a basis of a complex textile structure; i.e., a flux under specific pressure gradient. It should be recognized that similar net results can be obtained on drastically different fabric constructions. Air permeability test results should not be used without consideration of other performance parameters.

Summary

The method consists of measuring the volume of air passing through a known area of a press fabric under a pressure drop of 125 kPa (0.5 in. of water).

Significance

The correlation of press fabric air permeability to performance on the paper machine has not been established. Air permeability is significantly affected by the density of the press fabric and can drop in value as the result of manufacturer pre-compaction and fabric compaction during use on the paper machine. When comparing air permeability for fabrics of similar design, fabric density should be considered.

Apparatus

The apparatus¹ shall consist essentially of a muffled vacuum pump for drawing air through a known area of fabric, a circular orifice over which the fabric to be tested can be clamped, a means for adjusting the pressure drop across the fabric to a known amount, and a means of measuring the volume of air flowing through the fabric. The clamp shall effectively eliminate edge leakage. The apparatus shall be capable of testing fabrics of different thicknesses and of testing large pieces of fabric without cutting (1).

Test specimens

Fabrics should be tested at standard textile conditions of 21°C (70°F) and 65% RH. Five tests shall be taken at separate locations on the sample so that the test results will be representative. Test specimens shall be as widely separated as possible without cutting.

Procedure

1. Handle the test specimen carefully to avoid altering the natural state of the material.
2. Set the pressure drop across the fabric to 125 kPa (0.5 in. of water). Mount the test specimen between the clamp and the circular orifice with sufficient tension to draw the fabric smooth. It shall not be distorted in its own plane. Draw conditioned air through the calibrated flow meter. Select the correct measuring range so that the colored range indicator stabilizes in one of the green zones, and then record the reading of the flow meter. Express the air permeability of the fabric in m³ of air/min/m² of fabric (or ft³ of air/min/ft² of fabric)

Report

Report the average of the test results obtained at five locations on the fabric as air permeability. Indicate if the test condition varied from 21°C (70°F) and 65% RH.

¹ Suitable equipment is known to be manufactured by the Frazier Precision Instrument Company Inc. (<http://www.frazierinstrument.com>) and by TexTest Instruments <http://www.textest.ch/> Any other suppliers of this equipment may be listed in this TIP by contacting the TAPPI Standards Department.