SCANDINAVIAN PULP, PAPER AND BOARD
TESTING COMMITTEE

SCAN-C 33:80
Accepted 1980

Fluff

Specific volume and absorption properties

1 Scope

This SCAN-test Method describes the preparation of test pieces of fluff and a procedure for their use in determining the specific volume and the absorption properties with respect to water (absorption time and absorption capacity) of the fluff.

The Method is applicable to all kinds of fluff, including that prepared in the laboratory, made from chemical or mechanical pulp.

Note – The test can be performed with other liquids than water, such as synthetic urine. If such modifications are used, the result may not be reported as having been obtained by this Method.

2 References

ISO 187	Paper, board and pulps – Standard atmosphere for conditioning and testing and procedure for monitoring the atmosphere and conditioning of samples
SCAN-G 2	Statistical treatment of test results
ISO 3310-1	Test sieves – Technical requirements and testing – Part 1: Test sieves of metal wire cloth

Note – SCAN-test has withdrawn a number of test methods and refers instead to the corresponding ISO and/or EN Standards.

3 Definitions

For the purpose of this Method, the following definitions apply:

3.1 *Specific volume* – Volume per unit mass.

Note – Fluff is a very compressible material and the volume must therefore be determined under specified conditions of compression.

3.2 *Absorption time* (of fluff) – Time required for a standard test piece of fluff to become completely saturated by absorbed water when tested under specified conditions.

3.3 *Absorption capacity* (of fluff) – Ratio of the mass of water taken up by a standard test piece of fluff, under specified conditions, to the initial mass of the test piece weighed in conditioned air.

4 Principle

Cylindrical test pieces of fluff, having a mass of 3 g and a diameter of 50 mm, are prepared in a special test piece former.

A test piece is placed in a vertical position, *Figure 1*. A load of 500 g is applied. The height of the cylinder is measured and the specific volume is calculated.

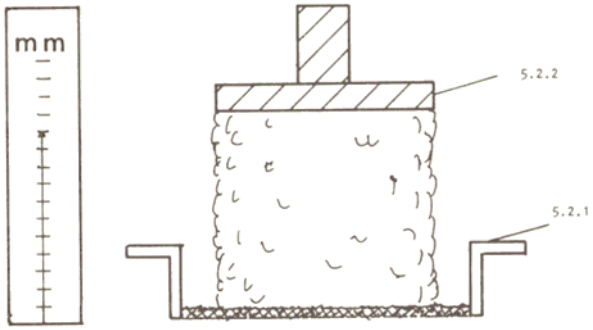

Figure 1. Determination of specific volume
5.2.1 Dish with perforated bottom
5.2.2 Load, 500 g

The test piece is then allowed to absorb water from below, *Figure 2*. The time required for the water to penetrate the upper surface of the test piece is measured and reported as the absorption time. The absorption capacity is determined by weighing the soaked test piece.

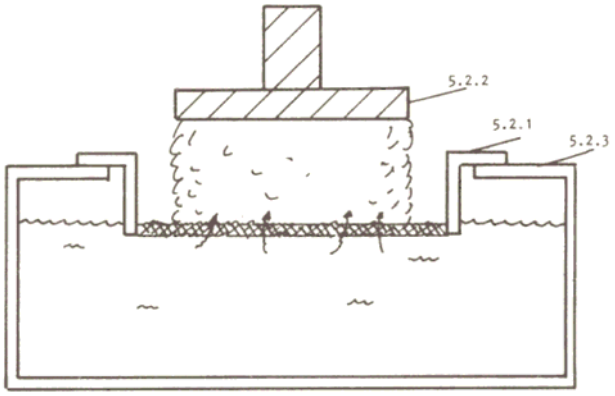

Figure 2. Determination of absorption time
5.2.1 Dish with perforated bottom
5.2.2 Load, 500 g
5.2.3 Container for water

5 Apparatus

5.1 *Test piece former*, in principle as shown in *Figure 3*. The apparatus is connected to a vacuum cleaner so that a stream of air is maintained from the inlet tube (5.1.8) to the outlet (5.1.6). Fluff is introduced through the inlet tube and will be disintegrated in the funnel (5.1.1). It passes the restrictor (5.1.2) and forms a plug on top of the wire screen (5.1.4). The plug is used as the test piece.

Note 1 – Test apparatus that complies with this Method is manufactured by the Paper and Fibre Research Institute, PFI AS, Trondheim, Norway.

The test piece former consists of the following parts:

5.1.1 *Conical funnel* of stainless steel as shown in *Figure 3*. Its lower part is cylindrical and the upper conical part has aside tube for the introduction of fluff. Its top is closed by a lid of transparent polyacrylic plastic.

5.1.2 *A restrictor*, to be placed between the mouth of the funnel and a test piece tube, having a circular opening 10 mm in diameter.

5.1.3 *Test piece tubes*, made of transparent polyacrylic plastic, 50 mm wide (inner diameter) and 100 mm long. The tubes are open at both ends. Each tube has 6 holes, 2,5 mm in diameter, evenly spaced around the circumference at a distance of 10 mm from the top end.

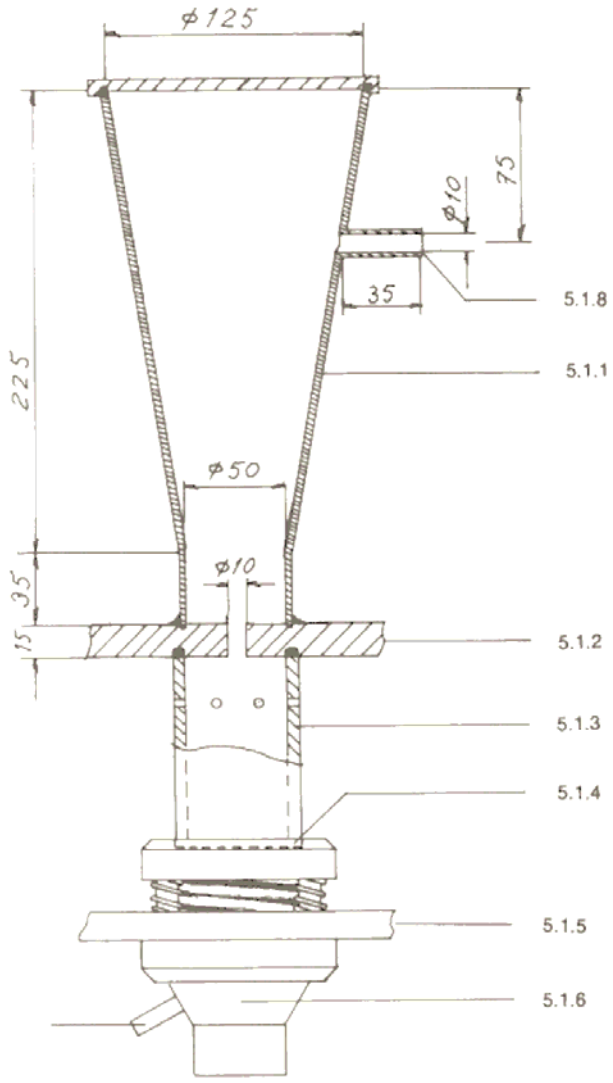

Figure 3. Test piece former

5.1.1 Funnel
5.1.2 Restrictor
5.1.3 Test-piece tube
5.1.4 Wire screen
5.1.5 Holder
5.1.6 Outlet to the vacuum
5.1.7 Outlet to the manometer
5.1.8 Inlet to the funnel

5.1.4 *Wire screen*, consisting of a metal wire sieve cloth, aperture 180 µm as specified in ISO 3310-1, mounted in a circular frame. The wire sieve cloth should be made of phosphor bronze. It corresponds to wire No 80 as specified in ASTM E 11.

5.1.5 *Holder* for mounting the above parts vertically on top of each other in the following order, from the top:
the funnel,
the restrictor ,
a test piece tube,
the wire screen and
a hose to the vacuum cleaner.

The design should allow an easy interchange of test piece tubes. There should be no considerable air leaks.

5.1.6 *Vacuum cleaner* with adjustable suction capacity set so that the difference between ambient pressure and that measured below the wire is about 14 kPa when the wire is covered with, for instance, a piece of plastic foil. The dust bag of the vacuum cleaner should be emptied regularly.

5.1.7 *Manometer* for determining the air pressure below the wire.

5.2 *Absorption tester*, in principle as shown in *Figure 1* and *Figure 2* (See Note to 5.1). The absorption tester consists of the following parts:

5.2.1 *A shallow circular dish*, having a plane, perforated bottom, somewhat wider than the outer diameter of the test piece tube. Alternatively, the dish may have a bottom made of a coarse wire screen.

5.2.2 *A cylindrical load*, having a diameter 0,5 mm less than the inner diameter of the test piece tubes and a total mass of 500 g. The load may consist of a disk with central handle.

5.2.3 *A container for water*, provided with an arrangement to keep the water level constant or large enough to ensure that the water level does not change noticeably during an absorption test, see *Figure 4*.

5.2.4 *Automatic timer* for determining the absorption time.

Note 2 – An example for the construction of an automatic device is given in the Annex.

5.2.5 *A device for measuring the height* of the test piece with an accuracy of 1 mm.

6 Preparation of test piece

Condition the fluff samples at 23 °C and 50 % relative humidity as described in ISO 187 and keep them in the conditioning atmosphere throughout the test.

Weigh the empty test piece tube. Place it in the test piece former and start the vacuum cleaner. Add through the inlet tube approximately 3,3 g of fluff in small portions, each about 1 cm^3 in volume.

Stop the vacuum cleaner and remove the test piece tube with its test piece. Place it, without the wire screen, with its bottom down on a balance. With a pair of forceps remove fluff from the test piece until its conditioned mass is 3,0 g. Keep the test piece in its tube. Prepare at least five test pieces from each sample to be tested.

7 Procedure

The bottom of the shallow dish (5.2.1) shall be moist at the start of the test. Moisten it with water, and remove excess water with a sponge. Place the test piece tube on the shallow dish (5.2.1) and gently place the load (5.2.2) on top of the fluff. Then remove the test piece tube carefully by lifting it, *Figure 1*. After 30 s, measure and record the height of the test piece to the nearest 0,5 mm.

Fill the container (5.2.3) with water at 23 °C. Adjust the water level so that the bottom of the test piece barely reaches the water, *Figure 2 and 4*. At the moment the test piece comes into contact with the water, the timer (5.2.4) starts. When the water has penetrated the test piece the timer stops. Record the absorption time. Allow the test piece to absorb water for at least 30 s more and then lower the water level. Allow the wet test piece to drain for 30 s, remove the load and weigh the wet test piece to the nearest 0,1 g.

8 Calculation

Inspect the results obtained for each sample and reject extreme results as described in SCAN-G 2. Calculate the mean values for the height, the absorption time and the absorption capacity.

Calculate the specific volume from the expression

$$X = \frac{A\,h}{10w} = 0{,}655h \qquad [1]$$

where

- X is the specific volume, in cubic centimetres per gram (1 cm^3/g = 1 dm^3/kg);
- A is the bottom area of the test piece, in cm^2. (This is 19,64 cm^2, because the diameter is 50 mm);
- w is the mass of the dry test piece, in grams, determined in conditioned atmosphere (the mass is 3,0 g);
- h is the height of the test piece when compressed, in millimetres.

Calculate the absorption capacity from the expression

$$Y = \frac{b - w}{w} \qquad [2]$$

where
Y is the absorption capacity, in grams per gram;
b is the mass of the wet test piece, in grams.

9 Report

The test report should include reference to this Method and the following particulars:
(a) date and place of testing;
(b) identification and description of the sample tested;
(c) the number of replicates carried out;
(d) the test result for the:
specific volume, in cubic centimetres per gram, to the nearest 0,5 unit;
absorption time, in seconds, to two significant figures;
absorption capacity, in grams per gram, to one decimal place;
(e) any departure from the procedure described in this SCAN-test Method or any other circumstances that might have affected the test results.

ANNEX – AUTOMATIC TIMER

A suitable arrangement for automatic measurement of the absorption time is shown in *Figure 4*. The system consists of three electrodes (5.2.4.1) which are mounted in the load (5.2.2), an electrode logic unit (5.2.4.2), a counter (5.2.4.3) and a microswitch (5.2.4.4). The microswitch starts the counter at the moment the water level reaches the bottom of the test piece. The electrode logic unit stops the counter when the test piece has become thoroughly wetted and all three electrodes are in contact with water .

The mounting scheme of the electrodes is shown in Figure 5.

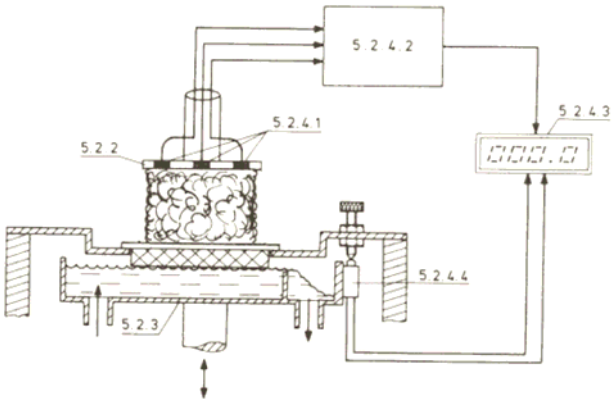

Figure 4. Apparatus for determining the absorption time

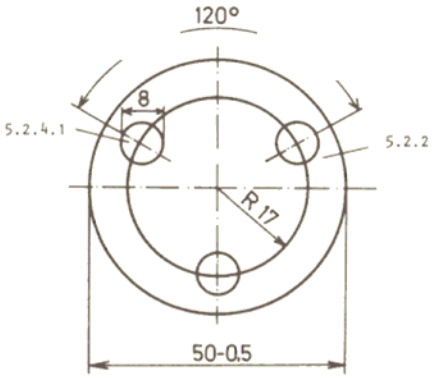

Figure 5. Mounting of the electrodes in the load

5.2.2 Load
5.2.3 Container with water, its vertical position is adjustable
5.2.4.1 Electrodes
5.2.4.2 Electrode logic unit
5.2.4.3 Counter
5.2.4.4 Microswitch

SCAN-test Methods are issued and recommended by KCL, PFI and STFI-Packforsk for the pulp, paper and board industries in Finland, Norway and Sweden.
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SE-114 86 Stockholm, Sweden.