SCAN-CM 40:01
Revised 2001

SCANDINAVIAN PULP, PAPER AND BOARD
TESTING COMMITTEE

Wood chips for pulp production

Size distribution

0 Introduction

This SCAN-test Method replaces SCAN-CM 40:94, from which it differs in that the chip sample is divided in six classes instead of five.

The division of the sample into six classes in the new method leads to small but significant changes in the level of results compared to the earlier division into five classes. The sum, of the classes large accept chips and small accept chips, is usually somewhat greater than the accept chip class obtained by the earlier standard procedure and the amount of pin chips is somewhat less. The other classes are not influenced.

1 Scope

This Method describes the apparatus and procedure for the classification of wood chips, intended for the production of chemical and mechanical pulps. The method is applicable to the determination of the quality of wood chips with regard to chip size and fines content.

> *Note* – The chip size distribution is affected by many factors, such as screening time and the load on the screening trays (11.1). This should be considered when abnormal chip samples are to be analysed.

2 References

SCAN-CM 39 Wood chips for pulp production – Dry matter content
SCAN-CM 41 Wood chips for pulp production – Sampling

3 Definitions

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

3.1 *Size distribution* – The content of chips in different classes, grouped according to size and shape.

3.2 *Size classification* – A procedure for separating, by means of a series of screens, a sample of wood chips into classes according to size or shape.

3.3 *Chip classifier* – Apparatus for chip size classification.

3.4 *Oversize chips (45 mm hole)* – Chips that do not pass the first screen of the classifier (*Figure 1*), when chip size classification is performed as specified in this Method.

3.5 *Overthick chips (8 mm slot)* – Chips that pass the first screen of the classifier (*Figure 1*) but are retained on the second screen, when chip size classification is performed as specified in this Method.

3.6 *Large accept chips (13 mm hole)* – Chips that pass the top two screens of the classifier (*Figure 1*) but are retained on the third screen, when chip size classification is performed as specified in this Method.

3.7 *Small accept chips (7 mm hole)* – Chips that pass the top three screens of the classifier (*Figure 1*) but are retained on the fourth screen, when chip size classification is performed as specified in this Method.

3.8 *Pin chips (3 mm hole)* – Chips that pass the top four screens of the classifier (*Figure 1*) but are retained on the fifth screen, when chip size classification is performed as specified in this Method.

3.9 *Fines* – Particles that pass all five screens of the classifier (*Figure 1*), when chip size classification is performed as specified in this Method.

> *Note* – For practical reasons, we have chosen to name the classes that retain on the third screen (13 mm holes) and the fourth screen (7 mm holes) for *large accept chips* and *small accept chips* respectively. This means, however, that accept chips not always are "acceptable" for its purpose or that the other classes not always are "not-acceptable".

4 Principle

A sample of wood chips is placed on the top screen of a stack of five screen trays and a fines tray. The screens have holes or slots of specified dimensions and the stack is kept in a reciprocating motion. After a specified time, the screening is stopped and the six classes obtained are weighed separately. The size of each class is its mass, expressed as a percentage of the total mass of all six classes.

5 Apparatus

5.1 *Chip classifier,* having 5 screen trays and a fines tray, *Figure 1*. The classifier should be firmly mounted on a solid horizontal bed.

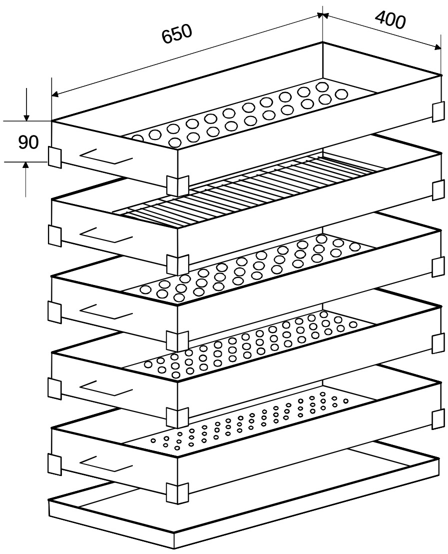

Figure 1. The five screens and the fines tray in the chip classifier (dimensions in millimetres).

The bottom of each screen tray shall be a screen 650 mm × 400 mm in size. The tray rims shall be 90 mm high. The fines tray has the same dimensions as the screen trays. The five trays shall be constructed so that they can be mounted on top of the fines tray to form a stack.

> *Note 1* – In some classifiers the fines tray is larger than specified above and mounted in a fixed position under the shaking frame. Such a classifier is considered as complying with this Method, provided that measures are taken to avoid loss of sample by dusting and when emptying the tray before weighing the fines.

The five screens, in numerical order from the top, meet the following specifications (maximum and minimum values):

First screen tray: Made of between 2 mm and 4 mm thick untreated aluminium or stainless steel, plane and having circular holes, (45,0 ± 0,1) mm in diameter, see *Figure 2.* The holes shall be placed in a triangular pattern and the distance between the centres of adjacent holes is (60,0 ±1,0) mm. All holes must be complete circles, parts of holes, e.g. at the edges of the screen, are not allowed.

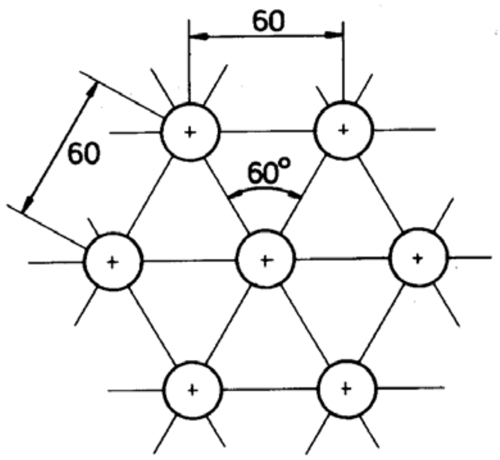

Figure 2. Arrangement of the holes in the hole screen trays. The distance 60 mm refers to the first screen.

Second screen tray: Parallel, cylindrical rods of stainless steel, 5 mm in diameter; the free distance between two adjacent rods shall not exceed 8,3 mm or fall short of 7,7 mm in any place, i.e. (8,0 ± 0,3) mm, see *Figure 3*. The mean free distance between adjacent rods shall be (8,0 ± 0,1) mm. Each second rod shall be in a lower level than the others. The vertical distance, *w*, between the two sets of rods shall be 6,25 mm (centre to centre). The rods shall be parallel to the short side of the screen and may be supported by a vertical plate, parallel to the longer rims of the screen. This plate shall not protrude more than 5 mm over the top rods. The maximum thickness of this plate is 4 mm.

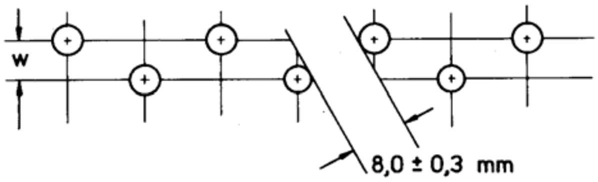

Figure 3. Arrangement of the rods in the second screen. w = 6,25 (dimensions in millimetres).

Third screen tray: Similar to the first screen, hole diameter (13,0 ± 0,1) mm, distance between the centres of adjacent holes (18,0 ± 0,5) mm.

Fourth screen tray: Similar to the first screen, hole diameter (7,0 ± 0,1) mm, distance between the centres of adjacent holes (8,5 ± 0,3) mm.

Fifth screen tray: Similar to the first screen, hole diameter (3,0 ± 0,1) mm, distance between the centres of adjacent holes (8,0 ± 0,3) mm.

The other parts of the trays may be made of aluminium, stainless steel or other similar material.

The stack, with the fines tray, should be firmly fastened on a shaking frame, horizontally mounted on a solid foundation. The frame shall have a mechanism which gives it a reciprocating motion along a line, parallel to the longer side of the trays. The frame must be guided so that it cannot move in the direction parallel to the shorter side of the trays. The motion in the vertical direction must not exceed 5 mm.

The stroke (the movement in the direction parallel to the longer side of the trays) shall be (120 ± 2) mm and the frequency (160 ± 10) cycles per minute.

> *Note 2* – The dimensions of the screens influence the result. Thus, it is important that they are checked regularly. Deposits of sticky material (resin etc.) shall be removed with the aid of a suitable solvent, such as acetone or alcohol.

5.2 *Balance*, accurate and readable to 0,1 g.

6 Sampling and preparation of sample

The sampling procedure is not covered by this Method. Make sure that sampling has been carried out in a manner that ensures representative samples. A suitable sampling procedure is described in SCAN-CM 41.

The dry matter content of the sample should be within the range 40 % to 70 %. If the sample is wet and has a dry matter content of less than 40 %, dry it to a dry matter content within that range in air at room temperature. The method for determination of dry matter content is described in SCAN-CM 39.

The test portion for each classification should be between 8 litres and 10 litres. If the sample has to be subdivided to obtain test portions of that size, take precautions to avoid any fractionation of the material. A suitable procedure for subdividing a sample is described in SCAN-CM 41.

7 Procedure

Arrange the screen trays in the order given in Section 5 to form a stack. Mount the stack on the shaking frame. Distribute the test portion, between 8 litres and 10 litres of wood chips, on the top tray. Start the shaking mechanism and shake the stack for 10 min ± 10 s. Immediately remove the six classes obtained and weigh them separately to the nearest 0,1 g.

> *Warning* – The shaking time influences the separation of chips. To get reproducible results, it is important that the shaking time is within the tolerance level.

Weigh the classes as quickly as possible on a balance placed near the chip classifier.

> *Note* – No determination of the dry matter content is required, but it is essential for the accuracy of the result that the material does not gain or lose moisture after the classification.

8 Calculation

Name the classes in the screen trays as follows:

First tray:	oversize chips
Second tray:	overthick chips
Third tray:	large accept chips
Fourth tray:	small accept chips
Fifth tray:	pin chips
Fines tray:	fines

Calculate the total mass of all six classes and then the mass of each class as a percentage of the whole, with one decimal.

9 Report

The test report shall include reference to this SCAN-test Method and the following particulars:

(a) date and place of testing;
(b) identification mark of the sample tested;
(c) the results;
(d) any departure from the standard procedure and any other circumstances that may have affected the results.

10 Precision

10.1 Repeatability

Six laboratories each analysed one sample ten times. The repeatability, calculated as the coefficient of variation, is given in *Table 1*.

Table 1. Repeatability for six different laboratories. The samples were analysed ten times.

	Lab 1		Lab 2		Lab 3		Lab 4		Lab 5		Lab 6	
	$\bar{x}$	CV, %	$\bar{x}$	CV, %	$\bar{x}$	CV, %	$\bar{x}$	CV, %	$\bar{x}$	CV, %	$\bar{x}$	CV, %
Oversize chips	3,8	8,3	0,4	61,3	0,7	47,7	2,8	27,0	3,0	7,7	3,3	7,2
Overthick chips	11,6	2,4	6,3	6,3	7,9	3,5	14,2	3,9	9,1	4,8	7,2	4,7
Large accept chips	76,5	0,9	67,7	1,7	60,0	1,7	71,2	1,0	70,7	0,9	82,8	0,5
Small accept chips	6,6	3,7	21,7	2,2	23,4	1,6	10,0	3,4	15,1	1,6	5,5	5,5
Pin chips	1,2	5,8	3,6	11,4	7,8	6,4	1,5	4,1	2,0	4,5	0,7	14,1
Fines	0,4	0,0	0,2	24,0	0,2	26,0	0,2	23,0	0,1	8,1	0,3	16,0

$\bar{x}$ = *arithmetic mean, as a percentage*
CV = *coefficient of variation*

10.2 Reproducibility

Seven laboratories tested the same four samples from different wood chips grades. The reproducibility, calculated as the coefficient of variation, is given in *Table 2.*

Table 2. The reproducibility between seven laboratories.

Size class	CV, %
Oversize chips	21,1
Overthick chips	3,1
Large accept chips	2,1
Small accept chips	11,7
Pin chips	14,6
Fines	20,8

CV = coefficient of variation between laboratories.

11 Literature

11.1 Edberg, U., Eskilsson, S.: Analysis of pin chips. Svensk Papperstidning 75; p. 467-472 (1972)

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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