SCAN-CM 6:05
Revised 2005

SCANDINAVIAN PULP, PAPER AND BOARD
TESTING COMMITTEE

Mechanical and chemical pulps

Fibre fractionation

in the McNett classifier

0 Introduction

This SCAN-test Method replaces SCAN-M 6:69 from which it differs in the following ways:
– the method is now also applicable to chemical pulps;
– precision data have been inserted.

The McNett classifier described in this Method is essentially the same as that in TAPPI T 233 cm-95 (10.1) but the water flow and the testing time differ and the two methods therefore do not give equivalent results.

1 Scope

This SCAN-test Method describes a fibre-fractionation procedure, defined as the grouping of fibres in a pulp suspension into fractions of different average fibre size.

The method is applicable to suspensions of mechanical and chemical pulps.

2 References

ISO 5263-1	Pulps – Laboratory wet disintegration – Part 1: Disintegration of chemical pulps
ISO 5263-2	Pulps – Laboratory wet disintegration – Part 2: Disintegration of mechanical pulps at 20 °C
ISO 5263-3	Pulps – Laboratory wet disintegration – Part 3: Disintegration of mechanical pulps at > 85 °C
ISO 4119	Pulps – Determination of stock concentration

Note – SCAN-test has withdrawn a number of test methods and refers instead to the corresponding ISO and/or EN Standards.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 *Chemical pulp* – Pulp in which the fibres have been principally separated by chemical means.

3.2 *Mechanical pulp* – Pulp in which the fibres have been principally separated by mechanical means.

3.3 *Long-fibred pulp* – Softwood chemitermomechanical pulps (CTMP) and softwood chemical pulps.

3.4 *Medium-fibered pulp* – Termomechanical pulps (TMP).

3.5 *Short-fibered pulp* – Hardwood chemical pulps, hardwood chemitermomechanical pulps (CTMP), ground wood (GW) and pressurized ground wood (PGW).

4 Principle

An agitated pulp suspension is fractionated by means of a screening process employing vertical screens with

increasing wire sieve cloth numbers. The screens are mounted in tanks arranged in cascade.

The mass of the fibres retained by each screen and of those passing all the screens is determined and expressed as a percentage of the oven-dry mass of the original sample.

5 Apparatus

5.1 *McNett classifier* consisting of two or more units mounted in cascade, *Figure 1*. Each unit comprises, see *Figure 2*:

5.1.1 *A tank* having the dimensions shown in *Figure 2*. One of the flat sides of the tank has a rectangular aperture sealed by a detachable frame which is clamped against a gasket. The frame is fitted with a slit plate and a wire sieve cloth, 335 cm^2 (165 mm × 203 mm) in area and the lower edge of the frame is 50 mm above the bottom of the tank. The slit plate, which equalizes the flow through the wire sieve cloth, can be removed from the frame. It has three vertical slots measuring 2 mm × 190 mm and set 41 mm apart; the middle slot is located centrally with respect to the screen. The guide plate in the tank is mounted 14 mm inside the screen and parallel and symmetrical with it.

The outlet tube located above the screen permits the suspension to flow to the next tank. The drain in the bottom of the tank is connected to an inverted cup covered by a filter cloth for collecting the fibre fraction. The drain is furnished with a plug.

5.1.2 *A motor-driven cylindrical agitator* having the dimensions shown in *Figure 2* and equipped with four symmetrically placed paddles, each of them 10 mm wide. The agitator is mounted vertically in the centre of one of the semicircular sections of the tank, with its mid-point in level with the centre of the screen. The agitator is rotated at 580 rpm ± 25 rpm in the direction indicated in *Figure 2*.

5.1.3 *Wire sieve cloths* made of metal (phosphor bronze or stainless steel) according to the following specifications:

Wire sieve cloth mesh no	Wire diameter mm	Sieve opening mm
12	0,810 ± 0,081	1,68 ± 0,008
16	0,650 ± 0,065	1,19 ± 0,006
30	0,390 ± 0,039	0,595 ± 0,030
50	0,215 ± 0,022	0,297 ± 0,015
100	0,110 ± 0,011	0,149 ± 0,009
200	0,053 ± 0,008	0,074 ± 0,005

These wire sieve cloths conform to the specifications in ASTM E 11-01 (10.2).

The screens shall be carefully cleaned after usage and stored dry or stored in alcohol.

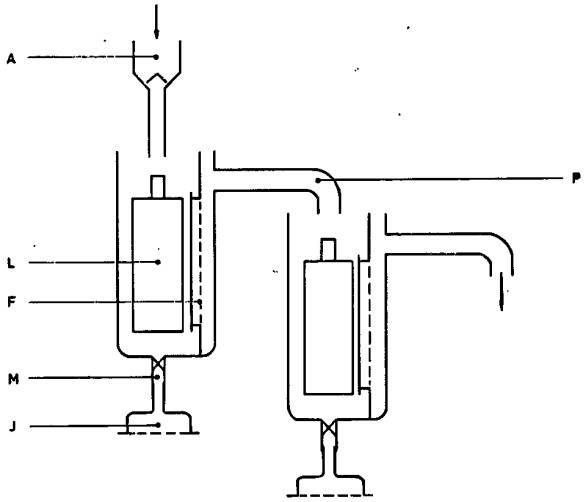

Figure 1. Principle of the classifier
A. Funnel
F. Screen
J. Cup with filter cloth
L. Agitator
M. Drain
P. Overflow

Note – The corresponding wire sieve cloths in the Tyler series have the numbers 10, 14, 28, 48, 100 and 200 in that order. The critical measure for the fibre fractionation is the mean length of the two diagonals of the sieve openings.

To avoid alterations in the dimensions of the sieve openings, the wire sieve cloth should be mounted by soldering on the frame in such a way that it is neither too slack nor too tightly stretched.

Note – The wire sieves can be inspected using a microscope. It is recommended to change wire sieve cloth when deposits in the sieve openings can be noticed.

5.1.4 *A funnel* with a spreader cone and a nozzle discharge arranged to give a constant water flow of 10,0 l/min ± 0,2 l/min. The funnel has an overflow orifice and the discharge is diffused by a screen plate at the outlet so as to avoid channelling in the tank. The funnel is placed above the first tank.

The equipment should be made of non-corrosive material.

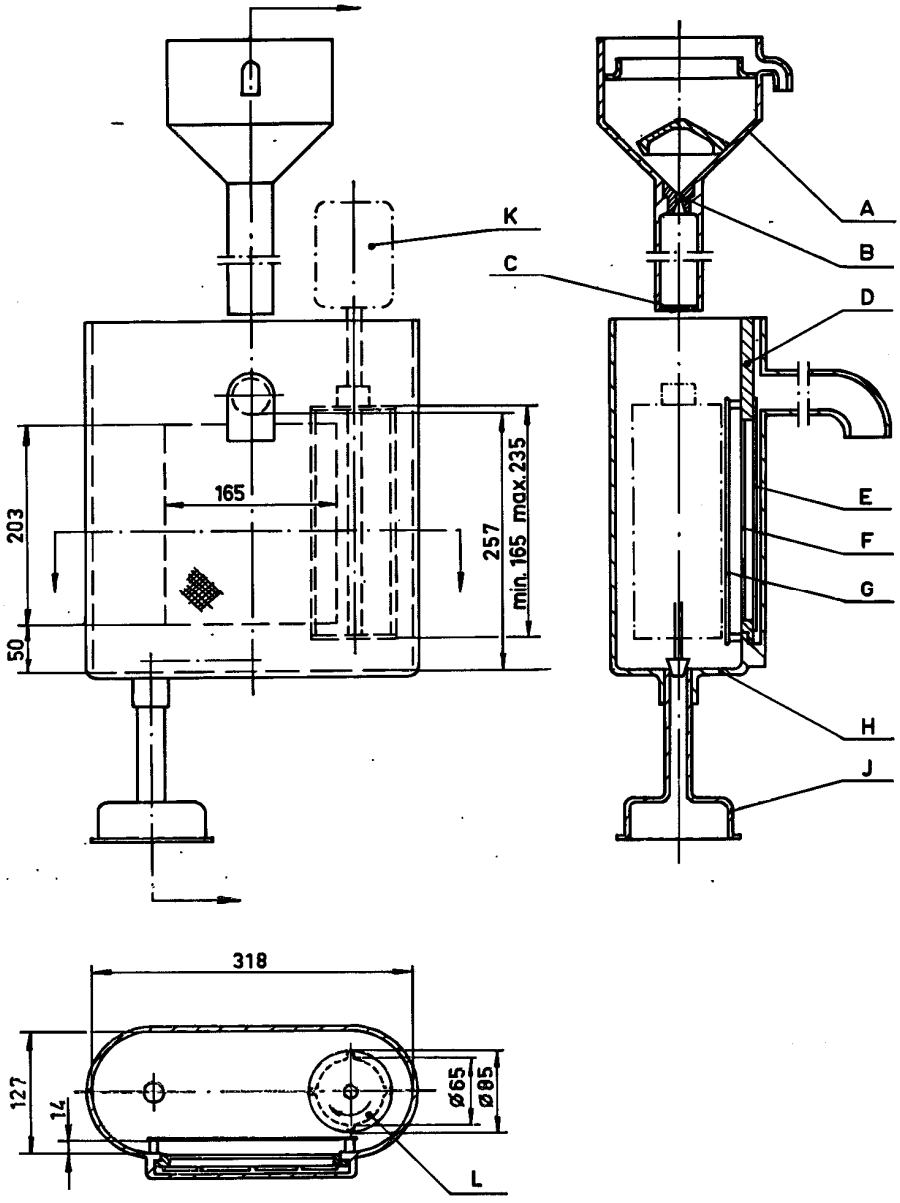

Figure 2 McNett classifier.

A. Funnel
B. Nozzle discharge
C. Screen Plate
D. Frame
E Slit frame
F. Wire sieve cloth
G. Guide plate
H. Tank
J. Cup with filter cloth
K. Motor
L Agitator

6 Preparation of sample

Disintegrate the pulp as described in the relevant part of ISO 5263 and dilute the suspension so obtained to a concentration between 3 g/1 and 4 g/1. Determine the stock concentration as described in ISO 4119.

7 Procedure

Place the screens plates in the tanks. The fractionation should be performed in 2−5 steps with screens in size order, the coarsest screen first and the finest screen last. To avoid build up on the screens, the screens should if possible be chosen, so that the fraction retained on each screen do not exceed 30 %. Recommended screens are:

Pulp	**Wire sieve cloths no**.
Long-fibered pulps	12, 16, 30, 200
Medium-fibered pulps	16, 30, 50, 200
Short-fibered pulps	30, 50,100, 200

Place the plugs in the drains and admit water to the funnel at a rate slightly above 10 l/min giving a moderate overflow. When all the tanks are full, start the agitators. Over a period of 15 s, pour into the first tank a volume of the pulp suspension corresponding to 10,00 g ± 0,05 g of oven-dry pulp. Then start a stop watch. After 15 min ± 3 s stop the flow of water. When no more water flows from the last tank (after about 30 s) stop the agitators. Remove the drain plugs and allow the contents to drain into the cups. Rinse the tanks carefully so that no pulp remains on the screens (see 5.1.3). Dry and weigh the fibre fractions collected on the filter cloths to the nearest 0,005 g; the drying being performed as described in ISO 4119.

8 Calculation and report

Calculate, on an oven-dry basis, the mass of the fibre fractions as a percentage of the mass of the pulp added. The fraction passing through the screen with the wire sieve cloth no. 200 is calculated by subtraction.

Report the results to the nearest 0,1 % for example as $F_{>30}$, $F_{30\text{-}50}$, $F_{100\text{-}200}$ and $F_{<200}$, according to the screens used.

9 Precision

9.1 Repeatability

In an interlaboratory comparison test, one laboratory tested three pulp samples repeated times (n=5). The following results were achieved:

TMP, CSF 48 ml	Fraction retained, %	CV, %
$F_{>16}$	14,7	0,7
$F_{16\text{-}30}$	24,2	0,5
$F_{30\text{-}50}$	15,7	0,8
$F_{50\text{-}200}$	17,0	0,3
$F_{<200}$	28,6	0,3

Bl. hardwood kraft, 40 SR	Fraction retained, %	CV, %
$F_{>30}$	4,1	1,4
$F_{30\text{-}50}$	50,1	0,7
$F_{50\text{-}100}$	30,2	1,4
$F_{100\text{-}200}$	7,6	11,4
$F_{<200}$	8,0	9,4

Bl. softwood kraft, 30 SR	Fraction retained, %	CV, %
$F_{>16}$	46,9	1,8
$F_{16\text{-}30}$	26,7	1,1
$F_{30\text{-}50}$	12,1	0,8
$F_{50\text{-}200}$	6,5	3,1
$F_{<200}$	7,8	8,8

9.2 Reproducibility

In an interlaboratory comparison test, five laboratories tested three pulp samples repeated times (n=4). The following results were achieved:

TMP, CSF 48 ml	Fraction retained, %	CV, %
$F_{>16}$	11,1	42,1
$F_{16\text{-}30}$	21,8	13,0
$F_{30\text{-}50}$	20,8	11,9
$F_{50\text{-}200}$	18,7	19,2
$F_{<200}$	27,6	7,4

Bl. Hardwood kraft, 40 SR	Fraction retained, %	CV, %
$F_{>30}$	5,1	37,9
$F_{30\text{-}50}$	65,3	16,2
$F_{50\text{-}100}$	18,0	46,0
$F_{100\text{-}200}$	4,1	45,9
$F_{<200}$	7,6	7,8

Bl. Softwood kraft, 30 SR	Fraction retained, %	CV, %
$F_{>16}$	54,6	15,7
$F_{16\text{-}30}$	18,8	35,0
$F_{30\text{-}50}$	10,9	18,5
$F_{50\text{-}200}$	6,6	16,8
$F_{<200}$	9,3	7,9

Warning – Since the coefficient of variation (CV) between laboratories is very large, it is not recommended to directly compare results from different laboratories.
One possible reason for the large coefficient of variations is that the wires have been delivered from different suppliers. One way to avoid this can be to buy at one time a large lot of wires from the same supplier and to use that supply within the whole company or within all laboratories that want to compare results.

10 Bibliography

10.1 TAPPI T 233 cm-95 Fiber length of pulp by classification.

10.2 ASTM E 11-01 Standard Specification for Wire Cloth and Sieves for Testing Purposes.

Annex -
Checking the classifier

1. Check that the water flow is 10,0 l/min ± 0,2 l/min.

2. Check that the agitators rotate at 580 rpm ± 25 rpm in water.

3. Check that the wire sieve cloths conform to the specifications.

4. Check that the frames of the screens are tight against the gaskets as follows: Cover the screen carefully with a sheet of plastic and fasten it with water-resistant adhesive tape. If, on filling the tank with water, it leaks between the frame and the gasket, clean and check the sealing surfaces.

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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