
**Pulp — Estimation of dirt and shives —
Part 1:
Inspection of laboratory sheets**

*Pâtes — Estimation des impuretés et bûchettes —
Partie 1: Examen des feuilles de laboratoire*



Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 5350-1 was prepared by the European Committee for Standardization (CEN) in collaboration with ISO Technical Committee TC 6, *Paper, board and pulps*, Subcommittee SC 5, *Test methods and quality specifications for pulp*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 5350-1:1982), of which it constitutes a technical revision.

ISO 5350 consists of the following parts, under the general title *Pulp — Estimation of dirt and shives*:

- *Part 1: Inspection of laboratory sheets*
- *Part 2: Inspection of mill sheeted pulp*
- *Part 3: Inspection by reflected light*

Annexes A and C form an integral part of this part of ISO 5350. Annex B is for information only.

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Foreword

The text of EN ISO 5350-1:1998 has been prepared by Technical Committee CEN/TC 172 "Pulp, paper and board", the secretariat of which is held by DIN, in collaboration with Technical Committee ISO/TC 6 "Paper, board and pulps".

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 1999, and conflicting national standards shall be withdrawn at the latest by January 1999.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

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Introduction

This European Standard is based on visual inspection, and a normative Annex C is added where the inspection is performed using instrumental devices. This is justified by the present state of instrumental development. For the time being, the visual inspection is the main part of this European Standard and the instrumental procedure forms an Annex C. This will eventually be changed when more experience with instrumental devices is gained and it has been shown that such equipment can estimate dirt and shives to an acceptable level of precision at least equal to visual inspection.

Annex C is applicable to pulps with high dirt counts.

1 Scope

This Part of EN ISO 5350 specifies the method for the estimation by transmitted light of the visible dirt and shives in laboratory sheets prepared from pulp. It is applicable to all kinds of pulp, though it is mainly intended for pulp that is not manufactured in sheet form.

Part 2 of this European Standard deals with the estimation of dirt and shives in mill sheeted pulp.

This part can also be applied to mill sheeted pulp if the sheets have high grammage or are very opaque for other reasons, in which case Part 2 is not applicable.

This European Standard is not intended for recycled pulp.

For inspection of pulp with a high dirt count the procedure described in Annex C shall be applied.

NOTE: Shives in mechanical pulp are usually determined by means based on screening or optical analyses. Some grades of mechanical pulps can cause problems in sheet-making or inspection, which makes this European Standard impractical.

2 Normative References

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN ISO 5350-2

Pulp – Estimation of dirt and shives – Part 2: Inspection of mill sheeted pulp (ISO 5350-2 : 1998)

EN 20638

Pulps – Determination of dry matter content (ISO 638 : 1978)

EN 27213

Pulps – Sampling for testing (ISO 7213 : 1981)

EN ISO 5263

Pulp – Laboratory wet disintegration (ISO 5263 : 1995)

ISO 5269-1

Pulps – Preparation of laboratory sheets for physical testing – Part 1: Conventional sheet-former method (ISO 5269-1:1998)

ISO 5269-2

Pulps – Preparation of laboratory sheets for physical testing – Part 2: Rapid-Köthen method (ISO 5269-2:1998)

3 Definitions

For the purposes of this European Standard, the following definitions apply:

3.1 contrary (in pulp): any unwanted particle, of specified minimum size and having a contrasting opacity with respect to the surrounding area of the sheet, according to the comparison chart given in Annex A.

3.1.1 dirt: any non-fibrous contrary.

3.1.2 shive: sliver of wood, or fibre bundle.

4 Principle

Laboratory sheets, formed from disintegrated pulp, are inspected in transmitted light. The area of all contraries larger than a specified value and showing contrasting opacity with respect to the surrounding area of the sheet according to the comparison chart presented in Annex A are estimated. The estimated areas are added and the total area of dirt and shives is reported as square millimetre per kilogram of oven-dry pulp (mm²/kg).

NOTE: If required, the areas of dirt and shives in different size classes can also be reported.

5 Apparatus

5.1 Viewing table with an illumination device suitable for inspecting the laboratory sheets in transmitted artificial daylight. The luminance as measured at the surface of the viewing table, shall be 2500 cd/m² to 3000 cd/m². Daylight or direct light from any external source should be avoided.

NOTE: The luminance can be measured by a luminance meter.

5.2 Comparison chart: A film with a series of black and grey spots of different shapes, areas and contrasts. This shall be used for visual inspection or for calibration of an instrumental device. The chart is included in Annex A of this European Standard.

Do not use the illustration in Annex A, or any copy thereof in any inspection, because reproduction may change the size and the contrast of the spots.

5.3 Preparation of laboratory sheets

5.3.1 General

Care shall be taken to avoid contamination of the pulp during the test. It is necessary to ensure that the surface and the elements of the disintegrator and sheet-making equipment are clean and free from corrosion and deposits. Make sure that the water to be used is free from foreign particles; if necessary filter the water.

5.3.2 Disintegrator as specified in EN ISO 5263.

5.3.3 Sheet-making equipment as specified in ISO 5269-1 or ISO 5269-2.

5.3.4 Blotters of a size corresponding to the sheet-making apparatus.

6 Preparation of sample

6.1 Sampling

If the dirt count is to represent the dirt in a lot of pulp, the number of sheets to be inspected and the method of taking them shall be in accordance with EN 27213.

The total mass of a sample shall be at least 180 g as oven-dry.

As 100 g of pulp is required for the inspection, two batches of 60 g each shall be prepared (see EN ISO 5263). A sample of 180 g provides the possibility to make a preliminary test as described in 6.2.

6.2 Pretreatment of the sample

The sample shall be soaked in accordance with the procedure stated in EN ISO 5263.

Prepare two batches of disintegrated pulp according to the procedure given below:

Add water until the consistency is 60 g of oven-dry pulp per 2700 ml of water. Disintegrate the sample in the disintegrator. Choose the number of revolutions so that extensive disintegration is avoided, but all lumps of fibres have disappeared. It is advisable to make some preliminary tests to establish the number of revolutions needed. Table 1 gives an indication of the number of revolutions found appropriate for some grades of dry pulp.

Combine the two batches.

Table 1: Recommended values for the number of revolutions, the grammage (as oven-dry) and minimum number of laboratory sheets

pulp qualities	number of revolutions	grammage g/m ²	number of sheets	
			conventional sheet-former	Rapid Köthen sheet-former
flash dried bleached chemical pulp	10000	≈ 700	6	5
mechanical pulp, dry	6000 ¹⁾	≈ 150	25	22
unbleached, kraft pulp, dry	8000	≈ 80	47	40

¹⁾ For some grades as much as 12000 revolutions is needed for complete disintegration.

It is very time consuming to examine pulp with a very high dirt count, so if it is found by a preliminary test that the number of contraries exceeds 300 per kilogram of oven-dry pulp, the amount to be inspected can be reduced to 50 g of oven-dry pulp. This shall be reported with the result.

6.3 Sheet making

Prepare a number of sheets in the sheet-making apparatus. The number of sheets and their grammage shall correspond to at least 100 g of oven-dry pulp. Table 1 gives the recommended grammages and the minimum number of sheets to be inspected for some pulp qualities. Mark the top sides of the sheets. Press the sheets at about 400 kPa. A final dry matter content of about 30 % is recommended. However, dry sheets may be used if they are transparent enough to ensure that all contraries are visible, but the use of dry sheets shall be reported together with the result.

NOTE 1: The sheets can dry out if inspection is not made immediately after sheet-making. This can be avoided by covering the sheets with a sheet of plastic until used. If the sheets become too dry, they may be rewetted by the use of a hand spray or an atomizer.

NOTE 2: It is recommended to ensure that all contraries are visible by marking a small spot at the surface of the sheet, and checking the visibility of this spot when viewing the sheet from the other side.

7 Procedure

7.1 Examination

Examine the laboratory sheets visually using the viewing table. Examine half of the sheets produced from the topside, and the other half from the wire side. Use the comparison chart in Annex A as an aid. Only contraries having an area of $\geq 0,04 \text{ mm}^2$ shall be noted. Size class 5 can be deleted, if agreed upon.

Classify the contraries according to their area. Distinguish between dirt and shives if required.

7.2 Determination of dry matter

Carry out the determination of the amount of dry matter of the inspected sheets by drying the sheets in accordance with EN 20638.

8 Expression of results

8.1 Calculation

For all contraries (or separately for dirt and shives) calculate the total area, or the area in each size class according to the formula:

$$X = \sum \frac{c_i \cdot n_i}{b} \quad (1)$$

where

- X is the total area of contraries (or of the contraries in each class), expressed in square millimetre per kilogram (mm^2/kg) of oven-dry pulp;
- c_i is the logarithmic mean area of each class, indicated in table 2, expressed in square millimetre (mm^2);
- n_i is the number of contraries in the class;
- b is the oven-dry mass of the test pieces, expressed in kilogram (kg).

The logarithmic mean areas are given in table 2.

For contraries exceeding 5 mm^2 $c_i \cdot n_i$ is replaced by the contraries' true areas, which shall be evaluated separately for each contrary and stated in the report.

NOTE: The logarithmic mean area of a class is justified, as there is a tendency towards enrichment of contraries towards the lower limit of the class.

EXAMPLE

If 8 contraries are counted within the size class 0,15 to 0,39, their area $c_i \cdot n_i$ is calculated as follows:

$$8 \times 0,242 \text{ mm}^2 \approx 1,9 \text{ mm}^2$$

8.2 Results

Report the total area of contraries to the nearest integer. Results below 5 mm²/kg shall be reported to one decimal place.

NOTE: On request, the result can be expressed separately for each size class, or separately for dirt and shives. However, if the count is reported by categories, the categories containing few contraries will be subject to much higher sampling uncertainty.

8.3 Precision

Exact figures for repeatability and reproducibility of this European Standard cannot be stated. The results from some investigations are presented in Annex B.

9 Test report

The test report shall refer to this European Standard and state:

- a) all information necessary for complete identification of the sample or lot;
- b) the result expressed in square millimetre of contraries per kilogram of oven-dry pulp. On request, the result can be divided into classes according to size or nature, i.e. dirt or shives;
- c) information whether the result is based on visual inspection or instrumental procedure;
- d) the number of revolution used in the disintegration and the grammage of the laboratory sheets;
- e) the mass of pulp inspected in grams;
- f) the sheet making procedure used;
- g) any departure from this European Standard, or any circumstances regarded as optional that may have affected the result.

10 Classification of contraries

It is usual to report only the total area, though when required the contrary area in each class can be reported. In this case the classification given in table 2 shall be used. Size class 5 can be deleted if agreed upon, but this shall be stated in the test report.

Table 2: Recommended classification of contraries according to area

size class	area mm ²	logarithmic mean area mm ²
1	above 5	-
2	1,00 to 4,99	2,234
3	0,40 to 0,99	0,629
4	0,15 to 0,39	0,242
5	0,04 to 0,14	0,075

Dirt and shives may be reported separately by agreement.

Annex A (normative)

Comparison chart

Use the chart here enclosed.

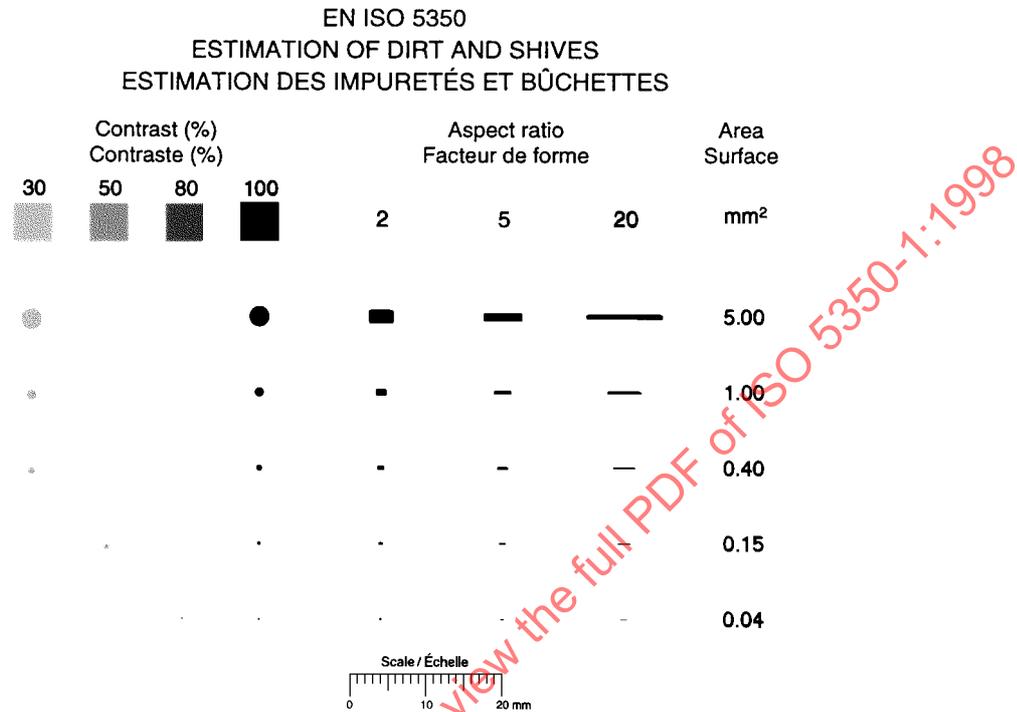


Figure A.1: EN ISO 5350 Pulp – Estimation of dirt and shives, Comparison chart

NOTE: In the official three language versions of this European Standard this chart will be in the form of a positive film and will be enclosed in an envelope attached to this page.

The left part of the chart is intended for calibration of an instrumental device and as an aid for visual inspection. The spots having the minimum contrast to be considered in each size class are indicated, i. e. 30 %, 50 % and 80 % minimum contrast for contraries equal to or larger than respectively 0,40 mm², 0,15 mm² and 0,04 mm².

The spots on the right hand indicate contraries of different aspect ratios. The contrast ratio is 100 %. This part of the chart is to be used as an aid for size classification.

Copies of this part of ISO 5350 printed by ISO include a comparison chart reproduced on transparent film (see 5.2). Users having only an electronic copy, or a printed copy reproduced from an electronic copy, may obtain an original transparent film comparison chart from the ISO Central Secretariat (price code: A).

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Annex B (informative)

Precision

No exact figures concerning the precision can be given. The precision varies from case to case for reasons depending on the observer and on the sample. However, the following results provide some information about the precision of the method.

B.1 Visual inspection

B.1.1 In one laboratory 5 analysts investigated one sample of bleached hardwood kraft pulp. The mean value found was 49 mm²/kg of pulp. The coefficient of variation was 82 %.

In another laboratory 5 batches of another sample were tested by one analyst. The mean value found was 64 mm²/kg of pulp and the coefficient of variation was 36 %.

B.1.2 In a study on CTMP from softwood 15 laboratory sheets of about 350 g/m² were inspected by one person. The mean value found was 60 mm²/kg and the coefficient of variation was 29 %.

B.1.3 In a study on groundwood pulp from hardwood 5 parallel tests, each consisting of 25 laboratory sheets of 150 g/m², were made by one person. The results are given in table B.1.

Table B.1: Mean values and coefficient of variation for the contraries of various size classes

classes of contraries	mean value mm ² /kg	coefficient of variation %
above 5 mm ² , shives	0	-
above 5 mm ² , dirt	0	-
1 to 4,99 mm ² , shives	12	91
1 to 4,99 mm ² , dirt	31	96
0,4 to 0,99 mm ² , shives	7	108
0,4 to 0,99 mm ² , dirt	10	100
0,15 to 0,39 mm ² , shives	17	37
0,15 to 0,39 mm ² , dirt	41	33
0,04 to 0,15 mm ² , shives	14	51
0,04 to 0,15 mm ² , dirt	80	23
total mm ² , shives	49	15
total mm ² , dirt	162	31
total mm ² , dirt and shives	211	23

B.2 Repeatability tests by instrumental inspection

B.2.1 5 batches, comprising 22 sheets each, of a sample of CTMP from softwood were investigated using an instrumental device. The mean value found was 4595 mm²/kg and the coefficient of variation was 8,1 %.

B.2.2 In a test performed with another instrumental device on bleached softwood pulp 5 batches comprising 6 sheets each of the same sample were inspected. The mean value found was 16 mm²/kg pulp and the coefficient of variation was 46 %.

B.3 Interlaboratory tests, visual inspection

B.3.1 Four laboratories using one analyst, on a sample of bleached chemical pulp, found a mean value of 16 mm²/kg oven-dry pulp with a standard deviation of 13 mm²/kg and a coefficient of variation of 79 %.