

JIS

JAPANESE INDUSTRIAL STANDARD

Testing Method for Dissolving Pulp

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JAPANESE INDUSTRIAL STANDARD

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Testing Method for Dissolving Pulp

P 8101-1976
(Reaffirmed: 1984)1. General

1.1 This Japanese Industrial Standard specifies the testing method for dissolving pulp made from needle-leaved and broad-leaved trees.

1.2 The items specified in this standard are as follows:

1.2.1 General Test Weight and average moisture of pulp bales

1.2.2 Physical Test Dimensions, weight, thickness, bulk density, dirt, shives and specks and brightness.

1.2.3 Chemical Test Ash, total quantity of calcium oxide and magnesium oxide, pitch component, α -cellulose, β -cellulose, copper number, 1 % sodium hydroxide solubility, 10 % sodium hydroxide solubility, 10 % potassium hydroxide solubility, pentosan and relative viscosity.

1.2.4 Alkali Steeping Test Swelling volume, absorptiveness and absorption rate.

- Remarks 1. Chemicals for use in test The chemicals for use in the test shall be the reagents specified in Japanese Industrial Standards. It shall be clearly noted when industrial chemicals are used.
2. The units and numerical values given in { } in this standard are in accordance with the International System of Units (SI), and are appended for reference.

Applicable Standards:

JIS K 8006-Fundamental Articles on Volumetric Determinations.

JIS P 3801-Filter Paper (for Chemical Analysis)

JIS R 3503-Glass Apparatus for Chemical Analysis

JIS Z 9031-Random Sampling Methods

2. Sampling and Preparation of Samples

2.1 Sampling Six bales shall be sampled from a group of up to 1000 bales in accordance with JIS Z 9031. For a group of more than 1000 bales, the number of sample bales S shall be determined by the following formula and the objective bales shall be random-sampled.

$$S = 6 \times \sqrt[3]{\frac{N}{1000}} \text{ (up to the first integer)}$$

where N : number of bales

The height of each bale shall be divided into the same number of divisions as the number of sample bales as shown in Fig. 1 and four sheets of samples shall be random-sampled from each division.

4 sheets of samples random-sampled from the first division of the first bale

4 sheets of samples random-sampled from the second division of the second bale

4 sheets of samples random-sampled from the third division of the third bale

4 sheets of samples random-sampled from the fourth division of the fourth bale

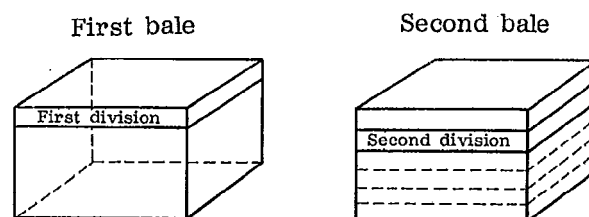
4 sheets of samples random-sampled from the fifth division of the fifth bale

4 sheets of samples random-sampled from the sixth division of the sixth bale

4 sheets of samples random-sampled from the seventh and eighth divisions of the seventh and eighth bales, respectively according to the above.

Total: 24 sheets of samples (or 28 sheets, 32 sheets, ...)

Fig. 1. Sampling Method



The third bale and following bales shall accord to the above.

Twelve sheets (or fourteen, sixteen, ...) in total, i.e. 2 sheets each from six bales, of samples shall be used for measurement of the dimensions and weights.

Other twelve sheets (or fourteen, sixteen, ...) shall cut in order in various sizes of small samples as shown in Fig. 2 by setting the sampling format on the samples and used for various tests as described below.

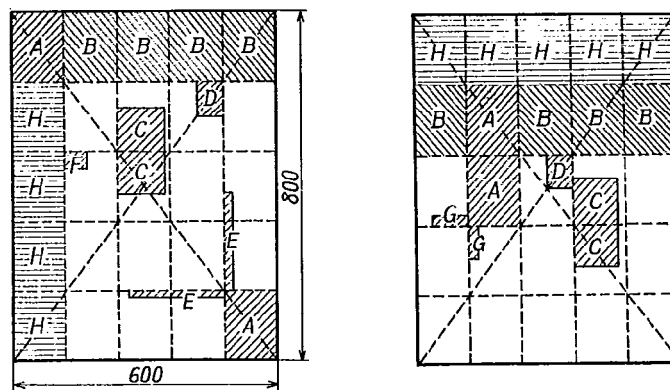
Fig. 2. Sampling Method of Sample Pieces

First division

First sheet of sample

Second sheet of sample

Unit: mm



The second division and the following divisions shall accord to the above procedure.

The thickness of sample A (120 mm x 160 mm) shall be measured, then the halves of cut sheets of samples shall be collected, and specified cut sample pieces shall be prepared from these halves for use as the test specimens for the tests of pitch component, α -cellulose, β -cellulose, 10 % sodium hydroxide solubility and pentosan.

Disintegrated cotton type samples, hereinafter referred to as the cotton type sample shall be prepared from the remaining parts for use as the test specimens for measurement of copper number, 1 % sodium hydroxide solubility, 10 % potassium hydroxide solubility and relative viscosity.

Sample B (120 mm x 160 mm) shall be cut in small pieces of 10 mm x 80 mm and mixed thoroughly for use as the test specimen for measurement of ash and the total quantity of calcium oxide and magnesium oxide.

Sample C (100 mm x 100 mm) shall be used as the test specimen for measurement of dirt, shives and specks.

Sample D (60 mm x 80 mm) shall be used as the test specimen for measurement of swelling volume and absorptiveness.

Sample E (15 mm x 220 mm) shall be used as the test specimen for measurement of the absorption rate.

Sample F (40 mm x 50 mm) shall be used as the test specimen for measurement of the bulk density.

Samples G (20 mm x 80 mm) and H (120 mm x 160 mm) shall be used as the test specimen necessary for other tests.

2.2 Preparation of Samples The cotton type sample and a sample of 10 mm x 10 mm shall be kept at the room temperature for more than 24 h in a desiccator containing 40.0 ± 0.5 % sulfuric acid to balance the moisture of the samples. Samples D and E shall be put in the same desiccator to balance the moisture.

3. General Tests

3.1 Bale Weight Ten bales shall be the number of samples for a group of up to 1000 bales and random-sampled in accordance with JIS Z 9031. For a group of more than 1000 bales, the number of sample bales S shall be determined by the following formula and the objective bales shall be random-sampled.

$$S = 10 \times \sqrt[3]{\frac{N}{1000}} \quad (\text{up to the first integer})$$

where N : number of bales

The total weight of each bale shall be weighed by every 0.5 kg and all measured values shall be averaged as A (kg). Then the packing materials of each bale shall be weighed by every 0.5 kg and all measured values shall be averaged as B (kg).

The bale weight W (kg) shall be calculated from the following formula and the value to the first digit below the decimal point shall be reported.

$$W = (A - B) \frac{100 - W_1}{100 - 10} + B$$

where W_1 : bale moisture (%)

The overall weight of bales shall be denoted by multiplying the bale weight by the number of bales. If the bale weights are not constant, the overall weight of bales shall be obtained by using the above formula taking the total of measured weights of the bales as A (kg) and the total of measured weights of packing materials of the bales as B (kg).

3.2 Sampling for Bale Moisture Each half sheet (approx. 400 mm x 600 mm) of sample shall be random-sampled from the remaining parts excluding 20 mm each from the upper and lower surfaces of the bales extracted in 3.1 and shall be immediately put in a PVC bag.

3.3 Measurement of Bale Moisture

3.3.1 Sample Sample sampled in 3.2.

3.3.2 Apparatus The apparatus shall be as follows:

(1) Infrared ray dryer (see Fig. 3)

(a) Dimensions of the box: 700 mm x 500 mm x 580 mm

- (b) Style: Steel framework with aluminium walls with aluminium reflection plate and sample shelf
 - (c) Used infrared ray bulb: 12 bulbs of 100 V 250 W Interval between bulbs: 160 mm
 - (d) Irradiation distance: 170 mm (From the upper surface of the sample shelf to the reflection plate: 170 mm Distance from the filament to pulp: approx. 200 mm)
 - (e) Voltage: 60 ± 3 V
- (2) Upper plate balance: Capacity: 500 g Reciprocal sensibility: 0.5 g

3.3.3 Measuring Method The measuring method shall be as follows:

- (1) Take out a sample from the PVC bag and immediately weigh it with the upper plate balance.
- (2) Dry the samples in the infrared ray dryer one by one.
- (3) Irradiation time: 10 min.
- (4) Measure the absolute dry weight with the upper plate balance within 40 to 60 sec. after completion of irradiation.

3.3.4 Report The bale moisture $M(\%)$ shall be calculated by the following formula to obtain the mean value of all measured values and the value to the second digit below the decimal point shall be reported.

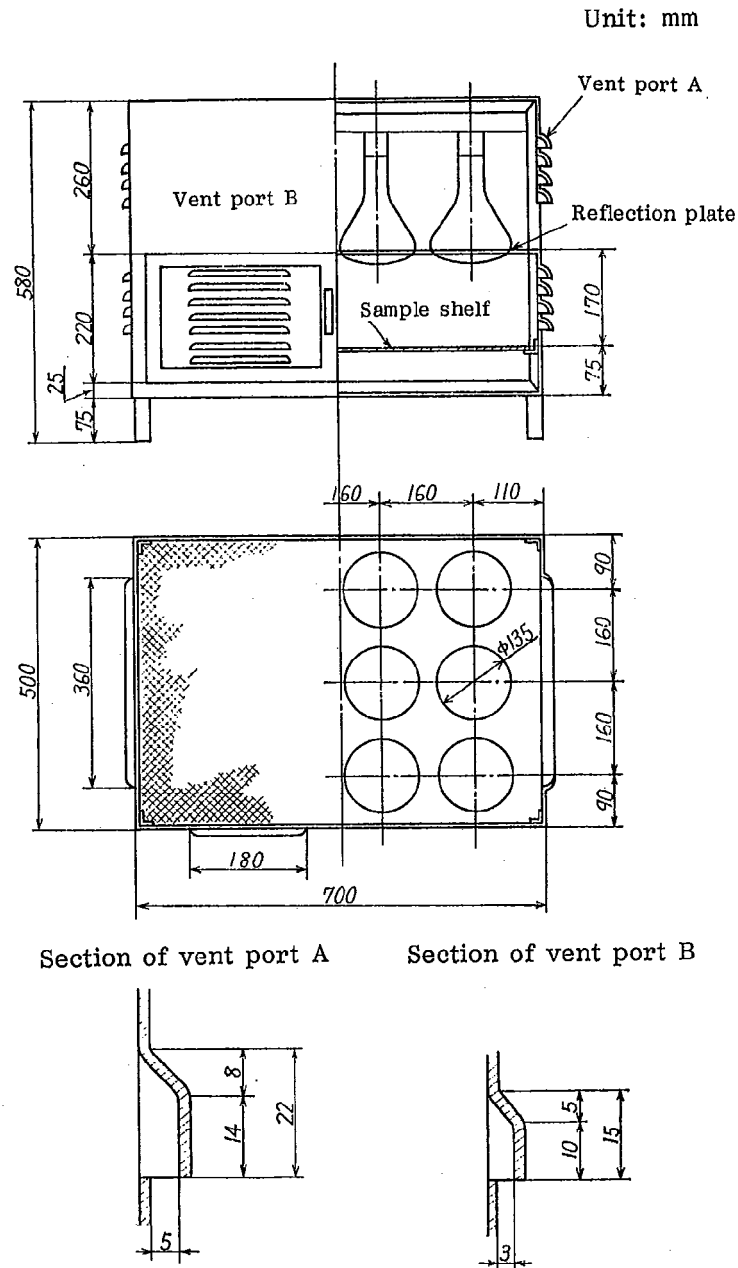
$$M = \frac{A - B}{A} \times 100$$

where

A: original weight of pulp (g)

B: absolute dry weight of pulp (g)

Fig. 3. Infrared Ray Dryer



4. Physical Test

4.1 Dimensions

4.1.1 Sample 12 (or 14, 16, ...) sheets of samples described in 2.1

4.1.2 Apparatus 1 m length gauge with 1 mm graduations

4.1.3 Measuring Method The length and width of the central part of each sheet of sample shall be measured in the unit of mm.

4.1.4 Report The mean values of length and width to the first integral digit shall be reported in the unit of mm.

4.2 Basis Weight (Weight per unit of area)

4.2.1 Sample 12 (or 14, 16, ...) sheets of samples described in 2.1 as same as used in the dimensional test in 4.1.

4.2.2 Apparatus The apparatus shall be as follows:

(1) Infrared ray dryer (see Fig. 3)

(a) Dimensions of box: 700 mm x 500 mm x 580 mm

(b) Style: Steel framework with aluminium walls with aluminium reflection plate and sample shelf

(c) Used infrared ray bulb: 12 bulbs of 100 V 250 W, Interval between bulbs: 160 mm

(d) Irradiation distance: 170 mm (From the upper surface of the sample shelf to the reflection plate: 170 mm Distance from the filament to pulp: approx. 200 mm)

(e) Voltage: 60 ± 3 V

(2) Upper plate balance: Capacity; 500 g Reciprocal sensibility: 0.5 g

4.2.3 Measuring Method The measuring method shall be as follows:

(1) Cut each sheet of sample into half and dry each half sheet of sample in the infrared ray dryer one by one.

(2) Irradiation time: 10 min

(3) Weigh the absolute dry weight of the sample with the upper plate balance within 40 to 60 sec. after completion of irradiation.

4.2.4 Report The report shall be as follows:

(1) The absolute dry weights of two half sheets obtained from the same sheet of sample shall be totalled to obtain the absolute dry weight of each sheet of sample and converted to the basis weight W (g/m^2) by the following formula when the percentage of water content is determined at 7.0 % and the mean value of the basis weight of each sheet shall be reported as a value to the first integer.

$$W = \frac{W_1}{0.93 \times L_1 \times L_2}$$

where W_1 : absolute dry weight (g)
 L_1 : length (m)
 L_2 : width (m)

Remark: The length and width are the values of each sheet of sample measured in 4.1.

- (2) The coefficient of variation of basis weight S (%) shall be calculated by the following formula to the first digit below the decimal point.

$$S = \frac{\sigma}{M} \times 100$$

where σ : standard deviation (g)
 M : average weight (g)

However, the standard deviation σ shall be calculated by the following formula.

$$\sigma = \sqrt{\frac{1}{N-1} \sum_{i=1}^N (X_i - \bar{X})^2}$$

where $\bar{X}$: mean value of measured values (g)
 N : total number of measured sheets
 X_i : measured value of each sheet (g)

4.3 Thickness

4.3.1 Sample 12 (or 14, 16, ...) sheets of sample A described in 2.1.

4.3.2 Apparatus The apparatus shall be as follows:

- (1) Schopper micrometer: Provided that sample holding area; 160 mm² (14.3 mm in diameter) Load charged on the sample; 0.55 ± 0.05 kgf/cm² {5.4 ± 0.49 N} Graduation: 0.01 mm

4.3.3 Measuring Method The thickness of each sheet of sample shall be read at five positions to the nearest 0.01 mm.

4.3.4 Report The report shall be as follows:

- (1) The mean value of five measured values of each sheet shall be the thickness of each sheet of sample and the mean value of the thickness of each sheet shall be reported in the unit of 0.05 mm.

- (2) The coefficient of variation of the thickness S (%) shall be calculated by the following formula.

$$S = \frac{\sigma}{M} \times 100$$

where σ : standard deviation (mm)
 M : average thickness (mm)

However, the standard deviation σ shall be calculated by the following formula.

$$\sigma = \sqrt{\frac{1}{N-1} \sum_{i=1}^N (X_i - \bar{X})^2}$$

where $\bar{X}$: mean value of thickness of all sheets (mm)
 N : total number of measured sheets
 X_i : mean value of measured values of each sheet (mm)

4.4 Bulk Density

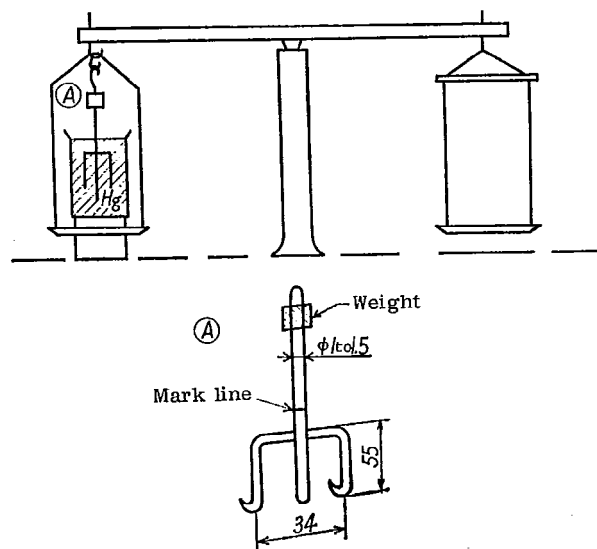
4.4.1 Sample 5 sheets of sample F described in 2.1.

4.4.2 Apparatus The apparatus shall be as follows:

- (1) Balance: Capacity; 100 to 200 g, Reciprocal sensibility; 0.01 g
- (2) Measuring apparatus (see Fig. 4)

Fig. 4. Bulk Density Measuring Apparatus

Unit: mm



4.4.3 Measuring Method The weight of each sheet shall be measured as A (g). Besides, attach a stay and a weight (A) to the left side hook of the balance, immerse it into mercury up to the mark line and place lead balls on the right side plate to balance the plates. Leaving lead balls on the plate as they are, attach a sample to the stay, immerse it into mercury, place a weight on the left side plate to balance the plates to determine the weight B (g).

4.4.4 Report The bulk density T (g/cm³) shall be calculated by the following formula and reported as a value to the second digit below the decimal point.

$$T = \frac{A \times 13.6}{A + B}$$

Remarks 1. The bulk density is a value obtained by dividing the weight per unit area by the thickness.

When the area of pulp (cm²) assumes S and the thickness (cm) d , the buoyancy in this measurement is:

$$\text{buoyancy} = A + B = S \times d \times 13.6$$

$$\text{thus, bulk density (g/cm}^3\text{)} = \frac{A/S}{S \times d} = \frac{A}{S \times d} = \frac{A \times 13.6}{A + B}$$

2. The following method is recommended to maintain the sample pulp in mercury vertically.

- a. Fix the stay to the balance and lift the mercury container.
- b. Add a weight to the stay.

4.5 Dirt, Shives and Specks

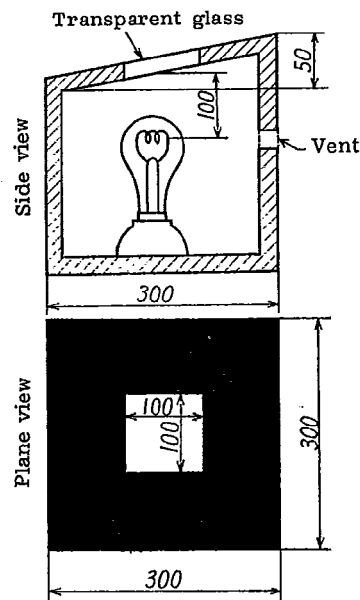
4.5.1 Sample 12 (or 14, 16, ...) sheets of sample C described in 2.1.

4.5.2 Apparatus The apparatus shall be as follows:

- (1) Dirt, shives and specks measuring diagram
- (2) Dirt, shives and specks measuring apparatus (see Fig. 5)

Fig. 5. Dirt, Shives and Specks Measuring Apparatus

Unit: mm



The interior of the box shall be painted in white. The box shall be shielded by leaving a part of 100 mm square at the center of the transparent glass of 300 mm square.

4.5.3 Measuring Method Immerse each sheet of sample in fresh water, apply it on a glass plate and measure the number of dirts, shives and specks having actual areas larger than 0.05 mm^2 which may be observed on both surfaces of the sheet of sample, using the dirt, shives and specks measuring diagram in accordance with the sizes while irradiating from the rear side of the glass plate with a 100 W delustered lamp.

Remark: In measurement, dirt, shives and specks of intermediate sizes shall be treated by the rounding-off method.

4.5.4 Report The dirt, shives and specks $M (\text{mm}^2/\text{m}^2)$ shall be calculated by the following formula and reported as a value to the first integer.

$$M = \frac{\sum(a_i \times m_i)}{n} \times 100$$

where

a_i : indicating area of the measuring diagram (mm^2)

m_i : number of dirt, shives and specks of all samples according to the indicating area

n : number of sheets of sample

4.6 Brightness by Hunter and by Pulfrich

4.6.1 Brightness by Hunter The brightness by Hunter is a specific reflection factor of a sample which is irradiated by a light of blue and violet zones of a spectrum, using the Hunter multi-purpose reflect meter.

- (1) Sample Three sheets of samples shall be cut as the test specimen in a size of 80 mm x 100 mm from the sample H described in 2.1.

(2) Apparatus

- (a) Hunter multi-purpose reflect meter

The main unit of this apparatus consists of a light source for illumination, blue monochrome filter, photocell and galvanometer. In this case, the light source for illumination which provides the color temperature of approx. 3100°K and the monochrome filter which shows the maximum value which appears suddenly at approx. 457 nm of the spectral transmission factor shall be used and for the photocell, selenium photocell shall be used.

- (b) Standard plate: The plate to be used shall have the value approx. 83.3 of the reflection factor for a single blue light when the reflection factor of the standard white plate of magnesium oxide which is plated by evaporation with magnesium oxide in a thickness of 1 mm or over is assumed 100. The standard plate shall be checked periodically with the standard white plate of magnesium oxide.

- (3) Measuring Method Three sheets of test specimens shall be measured respectively on the top and back sides in vertical and horizontal directions. Irradiate the standard plate so that the scale plate indicates a value of reflection factor of the standard plate. Then set the pointer of the galvanometer to the zero point through the mirror. Next, replace the standard plate and the sample and read the scale at the time when the pointer of the galvanometer which has moved is adjusted again to the zero point.

- (4) Report The mean value of twelve readings shall be reported as a value up to the first integer.

4.6.2 Brightness by Pulfrich The brightness by Pulfrich shall be as follows:

- (1) Sample: 3 sheets of sample H described in 2.1.

(2) Apparatus

- (a) Pulfrich photometer

- (b) Standard white plate of magnesium oxide

How to make the standard white plate of magnesium oxide:
Gradually burn magnesium and collect produced smoke to deposit on a flat plate in a thickness of 0.5 mm or over.

- (3) Measuring Method Place the standard white plate of magnesium oxide on the sample rest of the reflection illuminating device of the Pulfrich photometer and measure the reflection factor R_1 of the standard white plate of magnesium oxide through a filter K 6 (main wavelength of the filter: 470 to 480 nm). Then replace the standard white plate of magnesium oxide and the sample, measure the overall reflection factor of both surfaces of the sample and determine the average reflection factor as R_2 .
- (4) Report The brightness W (%) shall be calculated by the following formula and reported up to the first integer.

$$W = R_2 \times \frac{R_1}{100}$$

where

R_1 : reflection factor of the standard white plate of magnesium oxide

R_2 : mean value of reflection factors of both surfaces of the sample

5. Chemical Test

5.1 Absolute Dryness Ratio This test shall be conducted to calculate the absolute dry weight of the test specimens in the chemical tests described in 5.2 and the following. The chemical tests common to the test specimens may be carried out in common or separately according to the case.

5.1.1 Apparatus The apparatus shall be as follows:

- (1) 100 to 105°C thermostatic dryer
- (2) Weighing bottle $\phi 50$ mm x 50 mm
- (3) Chemical balance Capacity; 100 to 200 g
Reciprocal sensibility; 1 mg
- (4) Desiccator

5.1.2 Measuring Method The measuring method shall be as follows:

- (1) Precisely weigh approx. 5 g of an air-dried sample as the absolute dry weight in the weighing bottle.
- (2) Dry the sample in the dryer of 100 to 105°C for four hours.
- (3) Weigh the sample after cooling naturally in the desiccator for a suitable period of time.