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JAPANESE
INDUSTRIAL
STANDARD

Translated and Published by
Japanese Standards Association

JIS L 1903 : 1998

Testing methods for feathers

ICS 59.060.10

Descriptors : feathers, textile products, testing

Reference number : JIS L 1903 : 1998 (E)

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of International Trade and Industry through deliberations at Japanese Industrial Standards Committee in accordance with the Industrial Standardization Law. Consequently JIS L 1903:1990 is replaced with JIS L 1903:1998.

Date of Establishment: 1990-11-01

Date of Revision: 1998-09-20

Date of Public Notice in Official Gazette: 1998-09-21

Investigated by: Japanese Industrial Standards Committee
Divisional Council on Consumer Life

JIS L 1903:1998, First English edition published in 1999-05

Translated and published by: Japanese Standards Association
4-1-24, Akasaka, Minato-ku, Tokyo, 107-8440 JAPAN

In the event of any doubts arising as to the contents,
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Printed in Japan



Testing methods for feathers

1 Scope This Japanese Industrial Standard specifies the testing methods for filler feathers to be used for feather products.

Remarks : The units and numerical values shown in { } in this Standard are based on the traditional units, and appended for informative reference.

2 Normative references The following standards contain provisions which, through reference in this Standard, constitute provisions of this Standard. The most recent editions of the standards indicated below shall be applied.

JIS K 0102 *Testing methods for industrial wastewater*

JIS K 8103 *Diethyl ether*

JIS K 8247 *Potassium permanganate*

JIS K 8951 *Sulfuric acid*

JIS L 0216 *Glossary of terms used in feathers*

JIS R 3503 *Glass apparatus for chemical analysis*

JIS Z 8401 *Rules for rounding off of numerical values*

JIS Z 8703 *Standard atmospheric conditions for testing*

JIS Z 8806 *Humidity—Measurement methods*

3 Definitions For the purposes of this Standard, the definitions in JIS L 0216 apply, and the rest of the terms are as follows.

- a) **sample** Feathers taken according to the sampling plan designed rationally and mixed uniformly.
- b) **test sample** A definite amount of feathers taken at random from the sample to be used directly for test.
- c) **standard condition of test room** The condition where the temperature, humidity and their tolerances of test room are $20^{\circ}\text{C} \pm 2^{\circ}\text{C}$ in temperature, and $(65 \pm 2)\%$ in relative humidity specified in JIS Z 8703.

Remarks : Measurement of temperature and humidity shall be carried out according to the Meteorological Agency type or Assmann's aspiration psychrometer of JIS Z 8806.

- d) **standard condition of sample** When the sample is left at least for 24 hours in a test room kept under standard condition and then its mass is measured at 15 minutes or more interval, the condition that the discrepancy of two successive measurements is not more than 0.1 % of later measured mass.
- e) **absolute dry condition and absolute dry mass of sample** When standing the sample in a drier at $105^{\circ}\text{C} \pm 2^{\circ}\text{C}$ of temperature and then its mass is measured at 15 minutes or more interval, the condition that the discrepancy of two successive measurements is not

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more than 0.1 % of later measured mass, and the mass obtained thereat.

4 Test items Test items shall be as follows.

- a) Composition mixing rate
- b) Specific volume
- c) Oil and fat content
- d) Moisture percentage
- e) Cleanness
- f) Oxygen count

5 Test conditions Test shall be carried out in a laboratory kept at standard condition. When the laboratory cannot be kept at standard condition, carry out it at the site of which condition is set as close as possible to the standard condition, and append the temperature and humidity for test in test results.

6 Preparation of test Place the test sample in the metal net container for adjustment (1) which is moderately covered to make air pass through and to make feather not disperse, and then allow it to become standard condition. This procedure shall be omitted for measurement of moisture percentage.

Note (1) This is the cage made of metal net with mesh opening of 2.0 mm × 2.0 mm.

7 Test methods Test methods shall be as follows. The rounding off of numerical values, however, shall follow JIS Z 8401.

7.1 Composition mixing rate

7.1.1 Apparatus Apparatus shall be as follows.

- a) **Cabinet for composition selection** As shown in Fig. 1, it shall be structured so as to prevent the test sample from scattering.

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Unit : mm

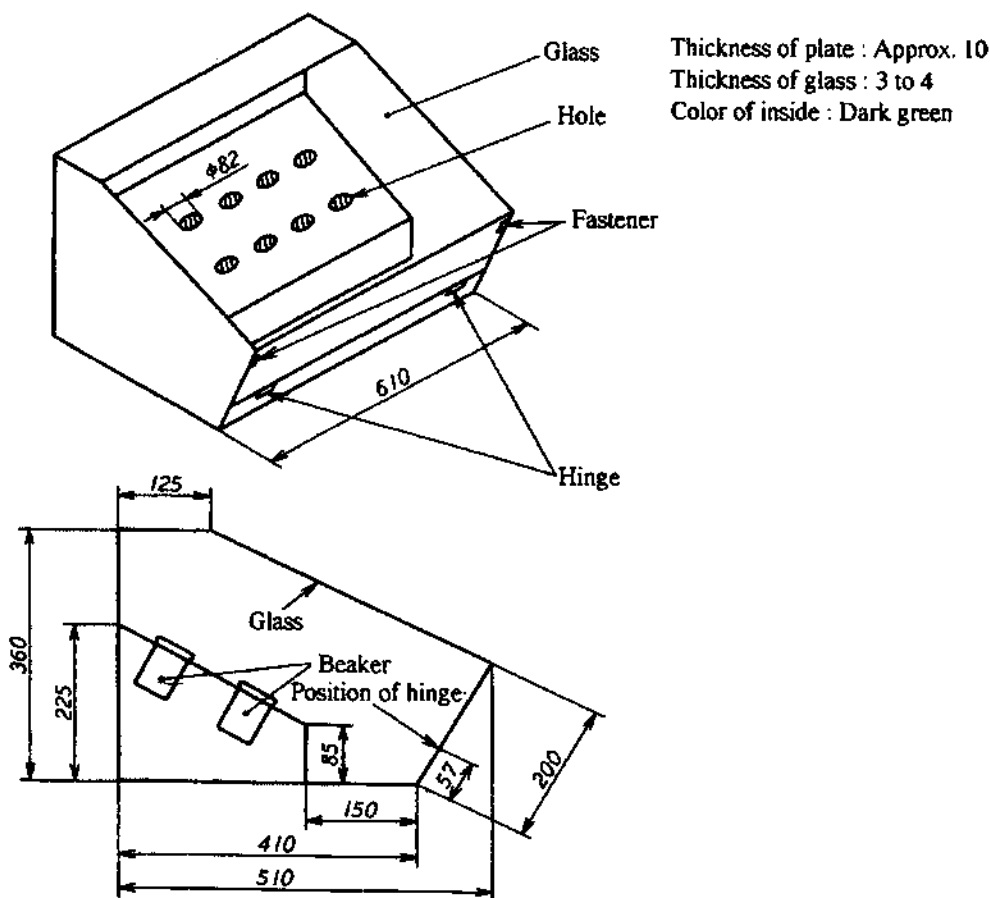


Fig.1 Example of cabinet for composition selection

b) **Chemical balance** Capable of weighing to the nearest 0.1 mg.

7.1.2 Classification of composition components The composition components shall be classified into the following 8 classes (see Informative reference).

- a) Down
- b) Small feather
- c) Large feather
- d) Damaged feather of waterfowl
- e) Landfowl feather
- f) Down fiber
- g) Feather fiber
- h) Admixtures

7.1.3 Operation As the first selection, take two test samples weighing each about 3-g from the sample shown in 6, carry out the following procedures on respective test samples.

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Hold the stem of a feather at its root with pincettes, brush it lightly with a thumb and a forefinger, take off down and fiber, classify them into small feather, large feather, damaged feather, and landfowl feather, and put respectively them into beakers. Then, take out down and fiber ⁽²⁾ from remaining test sample with pincettes, and put them into other beakers. Place the last remaining admixture into another beaker, and weigh each mass in the beakers to the nearest 0.1 mg.

W_a : mass of small feather after the first selection (mg)

W_b : mass of large feather after the first selection (mg)

W_c : mass of damaged feather after the first selection (mg)

W_d : mass of landfowl feather after the first selection (mg)

W_m : mass of down and fiber after the first selection (mg)

W_n : mass of admixture after the first selection (mg)

Then, mix uniformly the down and fiber, which has been first selected, and take at random the second selected test samples weighing each about 0.2 g from the upper, intermediate, and lower layers of the mixed ⁽³⁾. Pinch the down from this test sample one by one with pincettes, whisk it four or five times to let fiber fall down, pick up carefully one by one the feather fiber that has stuck or been entangled in the down, and put them respectively into the beakers. If there is admixture, however, put it into another beaker, and weigh their masses (mg) respectively.

W_x : mass of down after the second selection (mg)

W_{y1} : mass of down fiber after the second selection (mg)

W_{y2} : mass of feather fiber after the second selection (mg)

W_z : mass of admixture after the second selection (mg)

Making use the following formulae, obtain the composition mixing rate (%), and represent it with the average of two test samples (to the first decimal place). If there is a discrepancy of 3 % or more between two measurements on down mixing rate, carry out two more measurements, and obtain the average of four measurements.

Notes ⁽²⁾ When admixture is hardly separated owing to strong sticking to the down and fiber, there is no need to separate forcibly at the first selection.

⁽³⁾ When the mixture of down and fiber is less than 0.2 g, take all of them as the test sample for the second selection.

$$X_a = \frac{W_a}{W_a + W_b + W_c + W_d + W_m + W_n} \times 100$$

$$X_b = \frac{W_b}{W_a + W_b + W_c + W_d + W_m + W_n} \times 100$$

$$X_c = \frac{W_c}{W_a + W_b + W_c + W_d + W_m + W_n} \times 100$$

$$X_d = \frac{W_d}{W_a + W_b + W_c + W_d + W_m + W_n} \times 100$$

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$$X_{e1} = \frac{W_m}{W_a + W_b + W_c + W_d + W_m + W_n} \times \frac{W_{y1}}{W_x + W_{y1} + W_{y2} + W_z} \times 100$$

$$X_{e2} = \frac{W_m}{W_a + W_b + W_c + W_d + W_m + W_n} \times \frac{W_{y2}}{W_x + W_{y1} + W_{y2} + W_z} \times 100$$

$$X_g = \frac{W_m}{W_a + W_b + W_c + W_d + W_m + W_n} \times \frac{W_z}{W_x + W_{y1} + W_{y2} + W_z} \times 100$$

$$+ \frac{W_n}{W_a + W_b + W_c + W_d + W_m + W_n} \times 100$$

$$X_f = 100 - (X_a + X_b + X_c + X_d + X_{e1} + X_{e2} + X_g)$$

Where, X_a : mixing rate of small feather (%)

X_b : mixing rate of large feather (%)

X_c : mixing rate of damaged feather (%)

X_d : mixing rate of landfowl feather (%)

X_{e1} : mixing rate of down fiber (%)

X_{e2} : mixing rate of feather fiber (%)

X_f : mixing rate of down (%)

X_g : mixing rate of admixture (%)

7.2 Specific volume

7.2.1 Apparatus As shown in Fig. 2, the apparatus is composed of a cylindrical part, a disk part for loading, and an injector.

- Cylindrical part** This part is composed of a cylinder and its stand, and the transparent cylinder, measuring $290 \text{ mm} \pm 1 \text{ mm}$ in inside diameter and $500 \text{ mm} \pm 10 \text{ mm}$ in height, has 3 scales respectively with 2 mm graduation on its side and is finished smoothly at the inside of wall. The stand has a cylindrical convex base measuring about 10 mm in height and the same inside diameter as that the cylinder, and is horizontally adjustable.
- Disk part for loading** This part is composed of a disk for loading and a cord for suspending it and its bobbin. The disk for loading, made of aluminum, measuring $285 \text{ mm} \pm 1 \text{ mm}$ in diameter and 45° taper finish at its margin, has the outside margin and frame with about 30 mm width and 3 empty sectors covered with nylon cloth (*). It weighs totally $120 \text{ g} \pm 0.5 \text{ g}$, and has 3 indexes at the outside margin by which the scale of the cylinder can be pointed. The bobbin is capable of making up and down the disk for loading and stopping it.

Note (*) This is nylon taffeta cloth, fineness of 12 tex {110 D}, with density of 110 longitudinal threads and 75 transverse threads in 2.54 cm.

- Injector for sample** The injector has an opening for sample injection, measuring 160

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mm inside diameter, and has a cover capable of opening and closing.

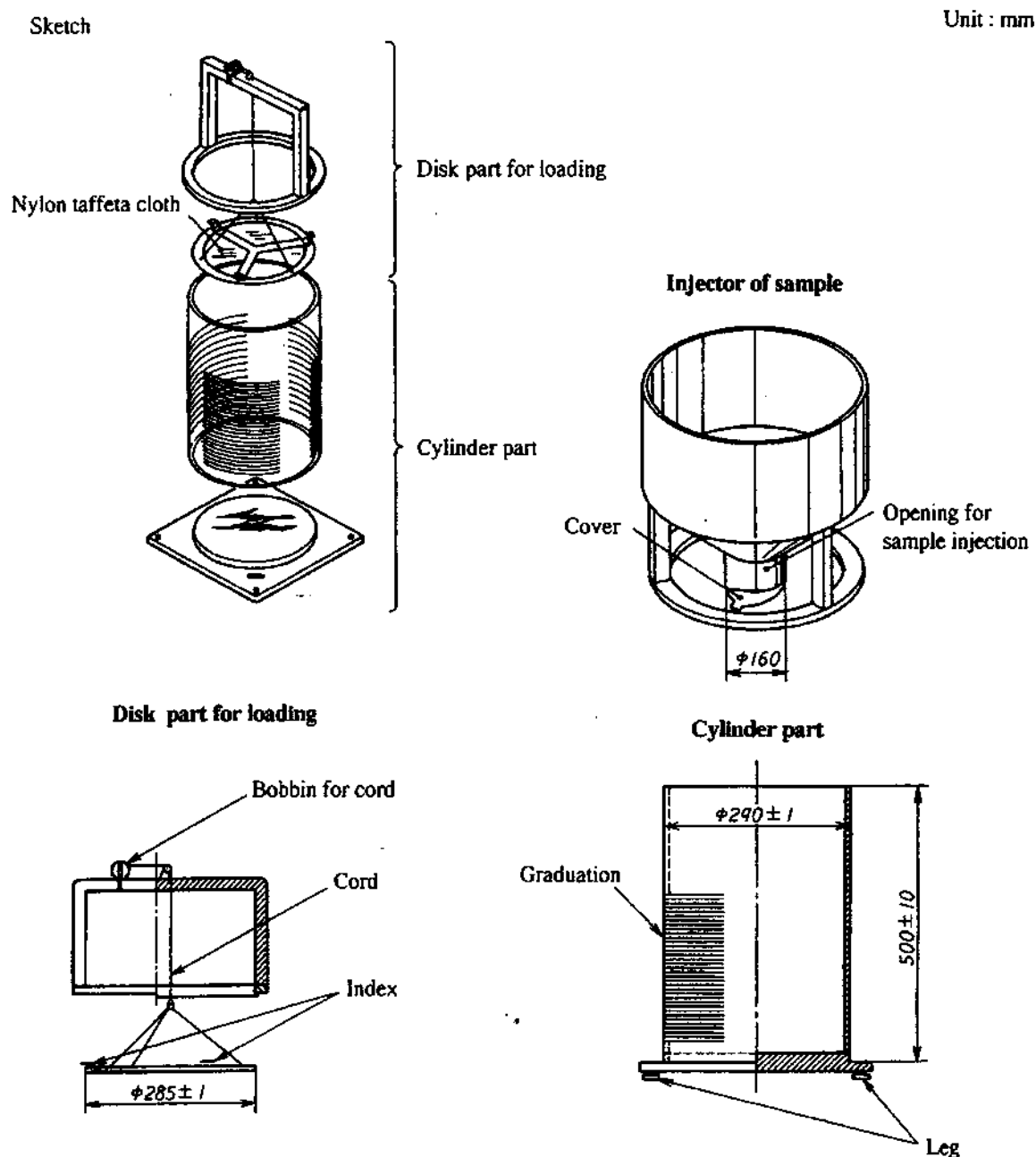


Fig. 2 Measuring apparatus of specific volume

7.2.2 Operation Out of the sample prepared at 6, take one test sample of $30 \text{ g} \pm 0.1 \text{ g}$. Put it into a sample injector, open its cover, and make the sample fall quietly into the cylinder. Then, remove the sample injector, drop slowly the disk for loading in the cylinder, let time elapse for 2 minutes after the cord, suspending the disk for loading, gets slackened, measure the height of the disk for loading using 3 scales graduated inside, to the nearest 1 mm, and calculate their average (mm).

Carry out 3 times the measurements of specific volume, and express it with the average (mm) (with whole number).

7.3 Oil and fat content

7.3.1 Apparatus and materials Apparatus and materials shall be as follows.

- a) **Soxhlet extractor** Specified in JIS R 3503.
- b) **Chemical balance** Follow 7.1.1 b).
- c) **Diethyl ether** Guaranteed reagent specified in JIS K 8103 ⁽⁵⁾.

7.3.2 Operation Out of the sample prepared at 6, take one test sample weighing about 3 g, weigh its absolute dry mass (mg)⁽⁶⁾, place it into an extraction thimble or glass filter, and insert it in a Soxhlet extractor. Employ 150 ml of diethyl ether, control the temperature of a water bath so as to make diethyl ether circulation 7 to 8 times per hour, and extract it for 4 hours. After extraction, condense the diethyl ether in the flask to get 10 ml to 15 ml and transfer it into a weighing bottle. Next, evaporate completely the diethyl ether in the weighing bottle, and obtain absolute dry mass of its residue (mg).

Calculate the oil and fat content (%) according to the following formula (to one decimal place).

$$f = \frac{e}{w} \times 100$$

where, f : oil and fat content (%)

e : absolute dry mass of extract (mg)

w : absolute dry mass of test sample (mg)

Notes ⁽⁵⁾ Because of large volatility of diethyl ether, it ignites easily and its mixture with air gives explosion, so that the evaporation of diethyl ether shall be done at the site free from any fire to dry naturally, and then absolute dry mass shall be obtained.

When handling it, the following shall be observed.

- ① Local ventilation devices shall be installed where it is handled.
- ② Its spilling shall be avoided when it is poured out from or put into a bottle.
- ③ Avoid contact with skin when handling it, and if necessary, a gas mask or protecting gloves shall be put on.
- ④ After handling it, wash hands sufficiently.
- ⑤ Store it at the place beforehand determined.

⁽⁶⁾ When a test sample is dried, it is recommended to cover the opening of a weighing bottle with a rough cloth in order not to let disperse the test sample.

7.4 Moisture percentage

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7.4.1 Apparatus Follow that shown in 7.1.1 b).

7.4.2 Operation Out of the sample prepared at 6, take 2 test samples weighing respectively about 2 g, weigh its mass before drying (mg) and its absolute dry mass (mg), calculate its moisture percentage (%) according to the following formula, and express it by the average of two samples (to one decimal place).

$$W_r(\%) = \frac{W - W'}{W'} \times 100$$

where,

W_r : moisture percentage (%)

W : mass of test sample (mg)

W' : absolute dry mass of test sample (mg)

7.5 Cleanness

7.5.1 Apparatus Apparatus shall be as follows.

- Shaker** With 40 mm of shaking width, and capable of controlling the shakings to be (150 ± 10) times per minutes.
- Transparency meter** Specified in JIS K 0102. Capable of measuring to 500 mm.
- Glass filter** G-1 specified in JIS R 3503.
- Erlenmeyer flask with a ground stopper** 500 ml.

7.5.2 Operation Out of the sample prepared at 6, take 4 test samples weighing respectively $3.0 \text{ g} \pm 0.1 \text{ g}$. Transfer respectively them into Erlenmeyer flasks with ground stoppers, add 100 ml of distilled water into them, and agitate them until test samples get sufficiently moistened. Then, add 200 ml of distilled water to soak them sufficiently, and then shake them for 45 minutes with a shaker. After shaking, filtrate the suspension through a glass filter, make two suspensions in two Erlenmeyer flasks with ground stoppers together, and fill it into a transparency meter. While observing the meter from its top to its bottom, discharge the suspension. When the double cross mark on a recognition plate is clearly recognized, stop discharge of the suspension, and measure height of the suspension making use of scale (mm) of the transparency meter.

Adopt the reading (mm) of transparency meter as cleanness, and express it with the average (mm) of two samples (with whole number).

7.6 Oxygen count

7.6.1 Apparatus and materials Apparatus and materials shall be as follows.

- Shaker** Follow 7.5.1 a).
- Microburet** With scale of 0.02 ml.
- Glass filter** Follow 7.5.1.c).
- Erlenmeyer flask with a ground stopper** Follow 7.5.1 d).

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- e) **Transfer pipette** 100 ml.
- f) **Sulfuric acid** Specified in **JIS K 8951**.
- g) **Potassium permanganate** Specified in **JIS K 8247**.

7.6.2 Operation Out of the sample prepared at 6, take 2 test samples weighing respectively $3.0 \text{ g} \pm 0.1 \text{ g}$. Transfer respectively them into Erlenmeyer flasks with ground stoppers, add 100 ml of distilled water at $20^\circ\text{C} \pm 2^\circ\text{C}$, and agitate them until the test samples get sufficiently moistened. Then, add 200 ml of distilled water kept at the same temperature, agitate to soak them sufficiently, and shake them for 45 minutes with a shaker. After shaking filtrate the suspension through a glass filter, take 100 ml of filtrate into a tall beaker or an Erlenmeyer flask ⁽⁷⁾ using a transfer pipette, add 1 ml to 2 ml of 3 mol/l {6 N} sulfuric acid, titrate it with 0.02 mol/l $\{\frac{1}{10} \text{ N}\}$ potassium permanganate solution using a microburet while adding about 0.02 ml per one drop, and continue the titration until red color of the solution lasts for at least 60 seconds.

Separately, instead of the suspension after extraction, take 100 ml of distilled water in which 1 ml to 2 ml of 3 mol/l {6 N} of sulfuric acid has been added, carry out a blank test on the solution, calculate the oxygen count (mg) according to the following formula, and express it with the average of two samples (to one decimal place).

$$O = 80(a - b) \times f$$

where, O : oxygen count (mg)

a : volume of (0.02 mol/l $\{\frac{1}{10} \text{ N}\}$) potassium permanganate solution needed for sample test (ml)

b : volume of (0.02 mol/l $\{\frac{1}{10} \text{ N}\}$) potassium permanganate solution needed for blank test (ml)

f : factor of (0.02 mol/l $\{\frac{1}{10} \text{ N}\}$) potassium permanganate solution

Note ⁽⁷⁾ Instead of a tall beaker or an Erlenmeyer flask, a white porcelain dish can be used.

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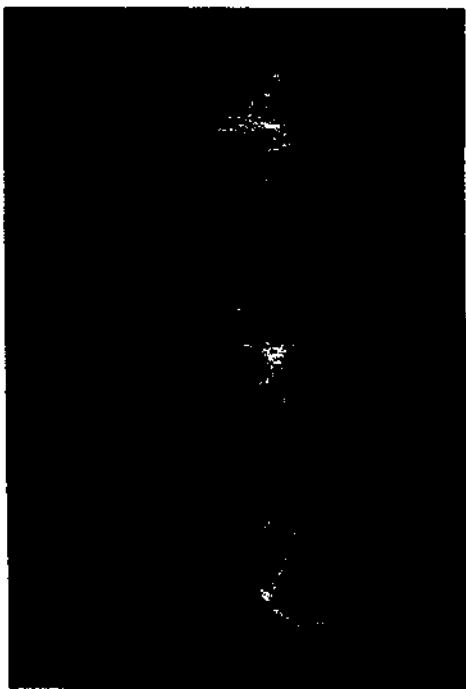
This Informative reference describes supplementary matters related to the text, and does not constitute a part of this Standard.

Classification of composition components It is recommended that the classification of composition components, specified in this text, be carried out collating with below mentioned Informative reference Table 1 and Informative reference Figure.

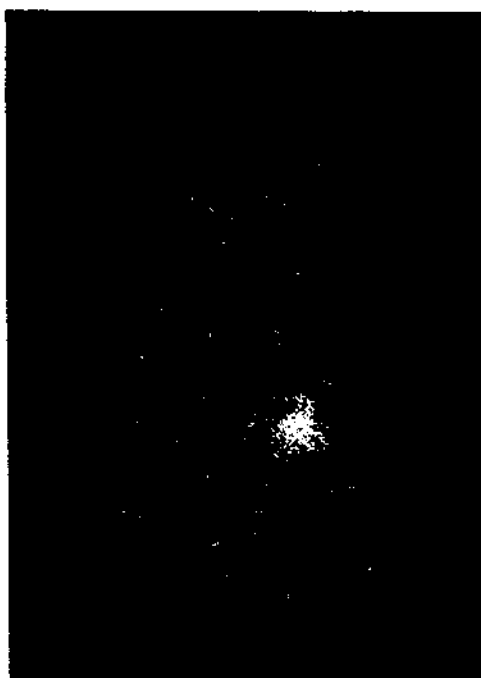
Informative reference Table 1 Classification of composition components

	Examples of matter contained in each composition component	Informative reference Figure
Down	Down	See Informative reference Figs. 1 to 4.
	Immature down	See Informative reference Fig. 5.
Small feather	Feather less than 6.5 cm length	See Informative reference Fig. 6.
	Immature feather	See Informative reference Fig. 7.
	Feather with plane type barb	See Informative reference Fig. 8.
	Yarn type feather	See Informative reference Fig. 9.
Large feather	Feather of 6.5 cm or longer length	See Informative reference Fig. 10.
Damaged feather	Damaged feather of waterfowl	See Informative reference Fig. 11.
Landfowl feather	Chicken feather	See Informative reference Fig. 12.
Down fiber	Down fiber	See Informative reference Fig. 13.
	Chicken fiber	See Informative reference Fig. 15.
Feather fiber	Feather fiber	See Informative reference Fig. 14.
Admixture	Impurity or others	See Informative reference Fig. 16.

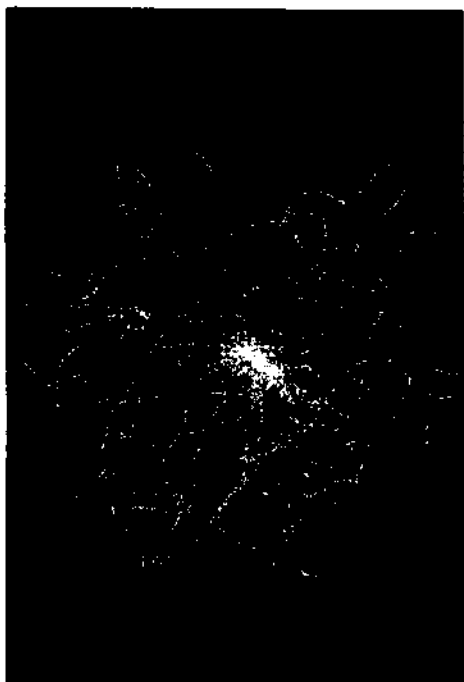
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Informative reference Fig. 2 Small down



Informative reference Fig. 4 Down with obscure quill shaft



Informative reference Fig. 1 Down

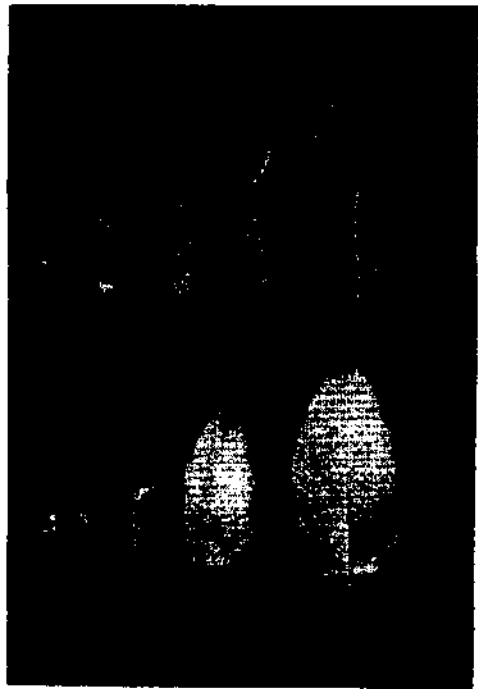


Informative reference Fig. 3 Down with 2 or more barbs

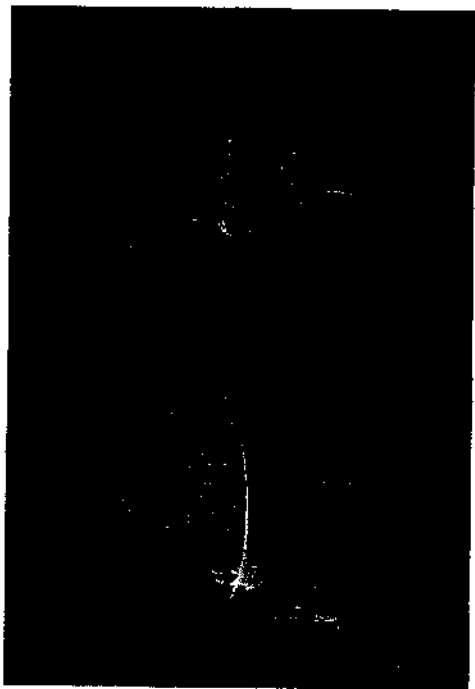
Informative reference Figure Examples of matter contained in each composition component

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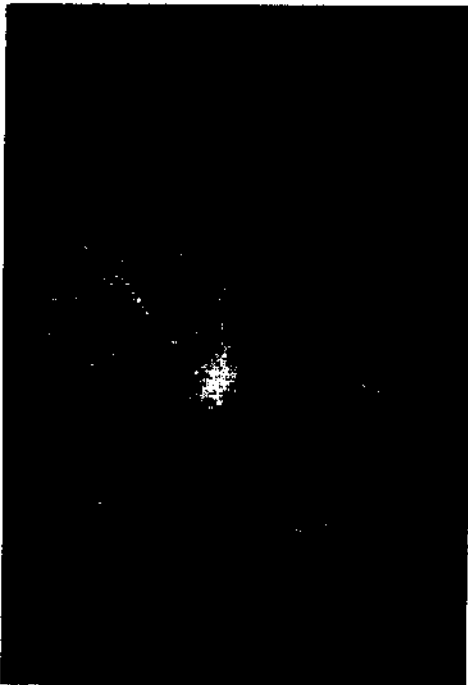
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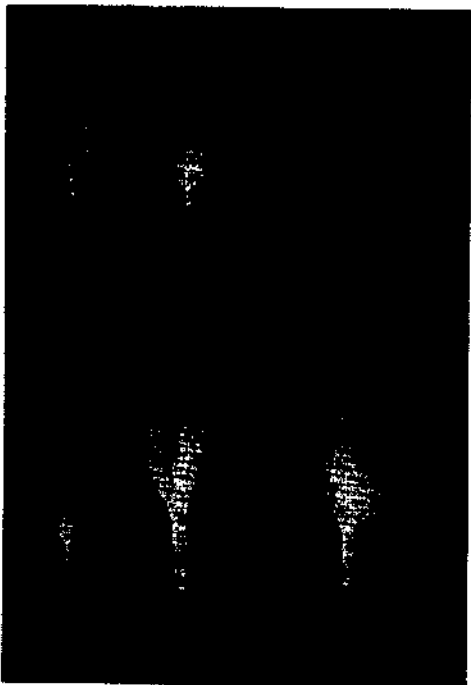
Informative reference Fig. 6 Feather less than 6.5 cm



Informative reference Fig. 8 Feather with plane type barb



Informative reference Fig. 5 Immature down



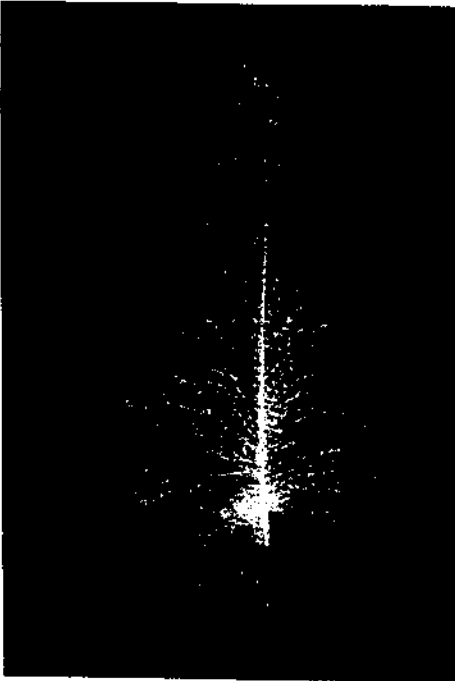
Informative reference Fig. 7 Immature feather

Informative reference Figure Examples of matter contained in each composition component (continued)

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Informative reference Fig. 10 Large feather



Informative reference Fig. 12 Landfowl feather (chicken feather)



Informative reference Fig. 9 Yarn type feather



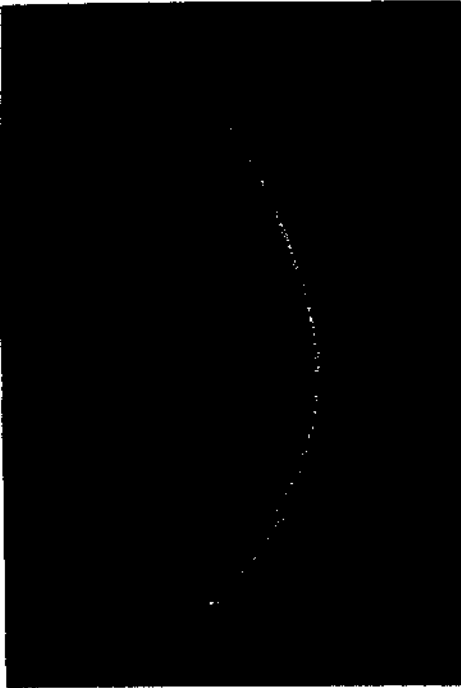
Informative reference Fig. 11 Damaged feather of waterfowl

Informative reference Figure Examples of matter contained in each composition component (continued)

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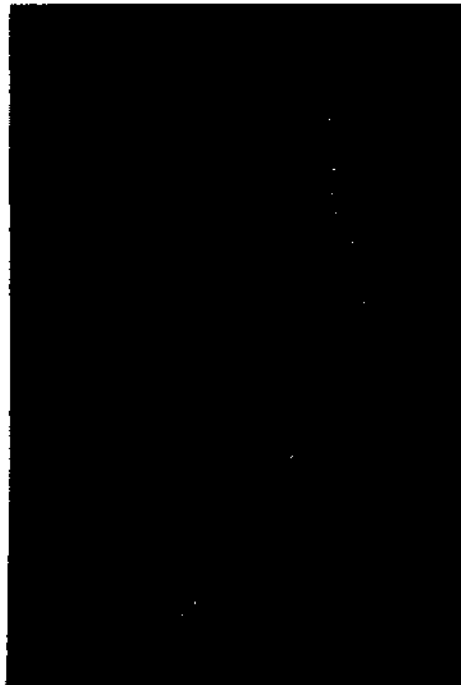
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Informative reference Fig. 14 Feather fiber



Informative reference Fig. 16 Admixture



Informative reference Fig. 13 Down fiber



Informative reference Fig. 15 Chicken fiber

Informative reference Figure Examples of matter contained in each composition component (concluded)