

JIS

JAPANESE INDUSTRIAL STANDARD

Methods of test for pigments

JIS K 5101—1991

Translated and Published

by

Japanese Standards Association

Printed in Japan

In the event of any doubt arising,
the original Standard in Japanese is to be final authority.

Contents	Page
1. Scope	1
2. General	1
3. Standard pigments	2
4. Sampling method	2
5. Dispersion methods	4
5.1 Hoover muller method	4
5.2 Paint conditioning machine method	6
6. Color	10
6.1 Method A	10
6.2 Method B	11
7. Tinting strength	13
7.1 Hoover muller method	13
7.2 Paint conditioning machine method	15
8. Hiding power	16
8.1 Checkerboard method	16
8.2 Criptometer method	17
9. Base of dispersion	19
9.1 Hoover muller method	19
9.2 Paint conditioning machine method	21
10. Rheological properties	22
10.1 Spreadmeter method	22
10.2 Rotational viscometer method	25
11. Comparison of pig	30
12. Resistance to fountain solution	30
13. Resistance to oil	31
14. Resistance to water	33
15. Resistance to solvent bleeding	34
16. Resistance to chemicals	35

K 5101-1991

	Page
17. Fastness to light	37
18. Heat resistance	43
18.1 Powder method	43
18.2 Coating film method	44
19. Density	46
20. Apparent density or apparent specific volume	49
20.1 Loose pack method	49
20.2 Tap method	51
21. Oil absorption	53
22. Residue on sieve	54
23. Loss on drying	56
24. Ignition residue	57
25. Matter soluble in water	58
25.1 Hot extraction method	58
25.2 Cold extraction method	60
26. pH value	61
26. (3) (3.1) Boiling method	61
26. (3) (3.2) Normal temperature method	62
Attached Table 1 Applicable standards	63
Attached Table 2 Corresponding International Standards	65
Reference standards	66
Informative Reference Measures for safety and hygiene, disaster prevention environmental conservation, and pollution control	67

JAPANESE INDUSTRIAL STANDARD

J I S

Methods of test for pigments

K 5101-1991

1. Scope

This Japanese Industrial Standard specifies the methods of test for pigments.

Remarks 1. Applicable standards in this Standard are given in Attached Table 1.

2. Corresponding International Standards to this Standard are given in Attached Table 2.

2. General

Items common to all tests shall be as given in JIS K 0050 but otherwise, be as follows.

- (1) Terms The terms shall be as given in JIS K 5500.
- (2) Glass apparatus Glass apparatus specified in JIS R 3503 and R 3505 shall be used. However, where special apparatus are required, an explanation or a descriptive drawing is indicated for each item.
- (3) Rounding off numerical values Rounding off numerical values of measured and calculated values shall be in accordance with JIS Z 8401.
- (4) Conditions of test place A test is performed under normal conditions of temperature and humidity ⁽¹⁾ specified in JIS Z 8703 without direct sunlight. The place shall be free from gaseous chemicals, vapors, dust, etc. which adversely influence the test, and also be free from vibration and air currents.

Note ⁽¹⁾ Relative humidity may be lower than normal humidity.

Remarks: The normal temperature herein means a temperature range of 5 to 35°C. The normal humidity herein means a humidity range of 45 to 85 %.
- (5) Color comparison by visual observation The method for comparing surface color by visual observation shall be in accordance with JIS Z 8723.
- (6) Drying conditions of a sample Where a sample initially dried for testing, drying conditions shall be a temperature of $105 \pm 2^{\circ}\text{C}$ for 2 h.
- (7) Test report For test report, the following items shall be indicated.
 - (a) Symbols expressing the name, type, lot number, etc. of a pigment to be tested
 - (b) Symbols expressing the name, type, lot number, etc. of a standard pigment to be used

- (c) The class of test method of Japanese Industrial Standard and a test method where that method does not apply
- (d) Test results
- (e) Data of the test
- (f) Test personnel

Items required to be recorded in the test results based on particular conditions of the test items shall be specified for each item.

3. Standard pigments

Standard pigments shall be pigments to be used for evaluation of quality, which shall be predetermined upon the agreement with the parties concerned or otherwise, shall be predetermined for the purpose of quality control of the product by the manufacturer. Symbols expressing the name of the pigment, type, lot number, etc. shall be stated.

4. Sampling method

In order to obtain a proper pigment sample for testing, the formation of a lot, the sampling equipment, the sampling operation, sampling reduction and preservation shall be specified.

- (1) Formation of lot A lot means the sample manufactured under the same conditions, which shall be formed by a specified quantity of a pigment considered to be the same quality.
- (2) Equipment The equipment shall be as follows:
 - (a) Sampling equipment for a small container Appropriate to container size. An example is as given in Fig. 1.
 - (b) Sampling equipment for a large container Appropriate to container size. An example is shown in Fig. 2.
 - (c) Sample reduction equipment Appropriate to sample size. An example is shown in Fig. 3.
 - (d) Sample container An appropriately sized sample container impervious to light and humidity that can be hermetically sealed.
- (3) Operation The operation shall be carried as follows.
 - (a) For small containers (paper bag, corrugated fiber board box, oilcan, fiber drum, etc.) Select at random two containers ⁽²⁾ for each lot, sample a fixed quantity of at least two times the quantity required for the test of the product from near the center of each container by using a sampling equipment for a small container; the composite sample shall be well mixed.

Note ⁽²⁾ The number of containers sampled can be separately determined upon agreement of the parties concerned.

- (b) For large containers (flexible containers) Select at random two containers (2) for each lot, sample a fixed quantity of at least two times the quantity required for the test of the product from the upper, middle and lower parts of each container by using a sampling equipment for a large container and mix the composite sample well.
- (4) Reduction Reduce the mixed sample to two times the quantity required for the test of the product with a sample reduction equipment by an incremental reduction method as needed by the particular test.
- (5) Preservation Put a sample into a sample container, hermetically seal it, and record the data such as the sample name, sampling date, lot number and other information.

Fig. 1. Example of a sampling equipment for a small container

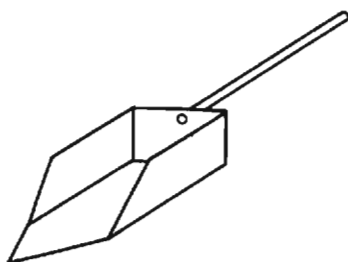


Fig. 2. Example of sampling equipment for large containers

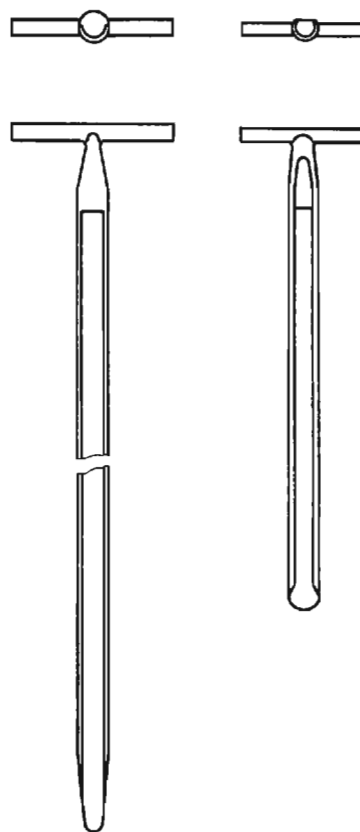
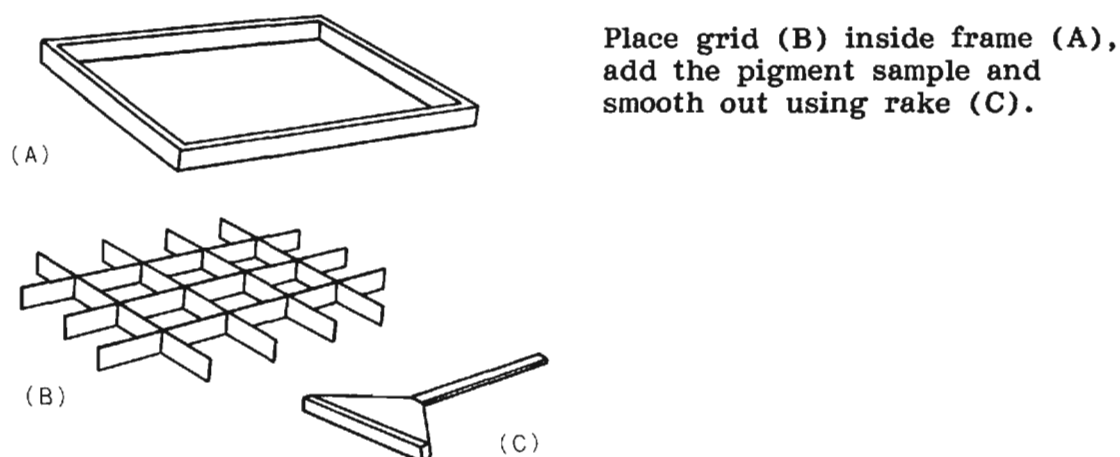


Fig. 3. Example of sample reduction equipment



5. Dispersion methods

There are Hoover muller and paint conditioning machine methods for the dispersion of pigment. In this Standard, the paste-like pigment dispersion prepared by the Hoover muller method is taken as pigment paste, and the liquid pigment dispersion prepared by the paint conditioning machine method is taken as the liquid dispersion.

5.1 Hoover muller method A sample and a standard pigment are respectively dispersed in a vehicle by using a Hoover muller, and the resulting color or other properties. This method is widely used and is simple to perform.

(1) Apparatus The apparatus shall be as follows:

(a) Hoover muller The Hoover muller consists of a grinding device made up of two 180 to 200 mm diameter ground glass plates which can be aligned vertically, and an apparatus which rotates the lower grinding plate. The rotary speed of the lower grinding plate is approximately 100 r.p.m. The Hoover muller has an automatic cut off device capable of being set at 100 rotations in multiples of 25 rotations. A load of three 22.68 kg counterweights can be added to the upper grinding plate in order to regulate the grinding pressure. An example is given in Fig. 4.

(b) Chemical balance A chemical balance capable of weighing to the nearest 1 mg.

(c) Pallet knife A knife or straight edge formed from steel.

(2) Vehicle ⁽³⁾ For the vehicle, any one of the following materials can be used.

(a) Linseed oil No. 4 lithographic varnish Linseed oil No. 4 lithographic varnish of 2.2 to 2.8 Pa · s viscosity.

- (b) Boiled linseed oil Boiled linseed oil specified in JIS K 5421.
- (c) Resin containing varnish Resin modified phenolic resin varnish for lithographic ink.

Note (3) Other vehicles can be used as agreed upon by the parties concerned.

(3) Operation The operation shall be as follows:

- (a) Weigh out a sample to the nearest 1 mg and a vehicle to the nearest 10 mg (4), transfer onto the lower grinding plate of a Hoover muller, mix with a pallet knife, and spread in a long narrow strip on the grinding plate (5).
- (b) Place the upper grinding plate in alignment with the lower grinding plate, add a counterweight, set to a specified number of rotations (6), and turn on.
- (c) After the rotation has stopped, lift the upper grinding plate, collect the paste-like sample on the grinding plate with the pallet knife, and spread in a long narrow strip on the grinding plate (5).
- (d) Repeat the operation of (b) and (c) the specified number of times, to prepare the pigment paste (7).
- (e) Perform the operation of (a) to (d) also for a standard pigment.

Notes (4) The quantity of the pigment and vehicle is the quantity needed to form a paste that spreads near to the edge of the grinding plate.

(5) The pigment paste is distributed to the band between the center and edge of the grinding plate to form an approximately 50 mm wide ring as shown in Fig. 5. A sheet of a paper is placed under the grinding plate or the position is marked at the rear of the grinding plate, to indicate the location of the band.

(6) The number of rotations is generally specified to be 50 or 100 rotations.

(7) Precautions should be taken to prevent overheating the grinding plate.

Remarks: The quantity of a sample, the class and quantity of a vehicle, the number of counterweights, number of rotations and number of repetitions shall be as given in the product standard.

Fig. 4. Example of Hoover muller

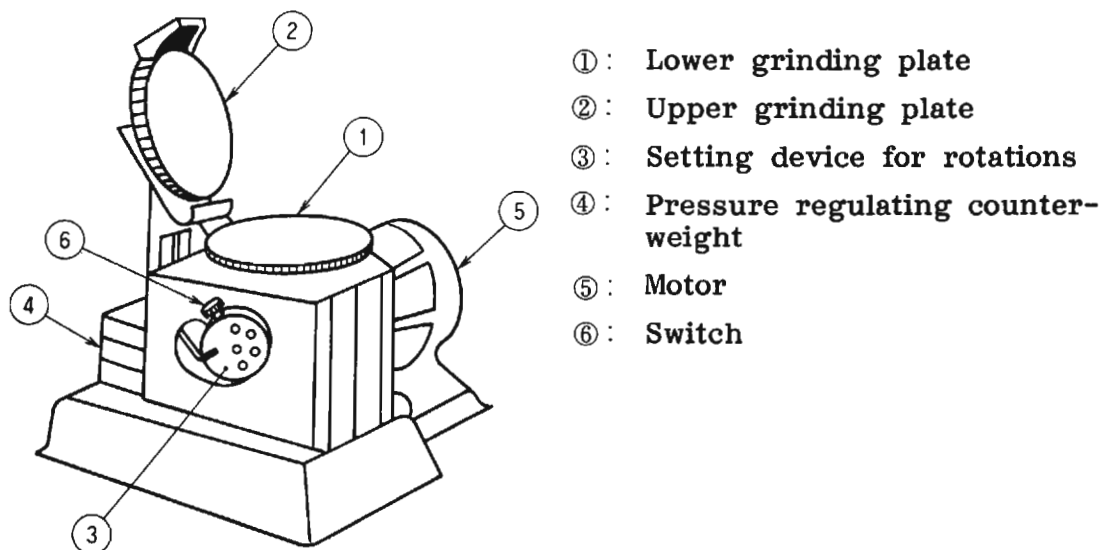
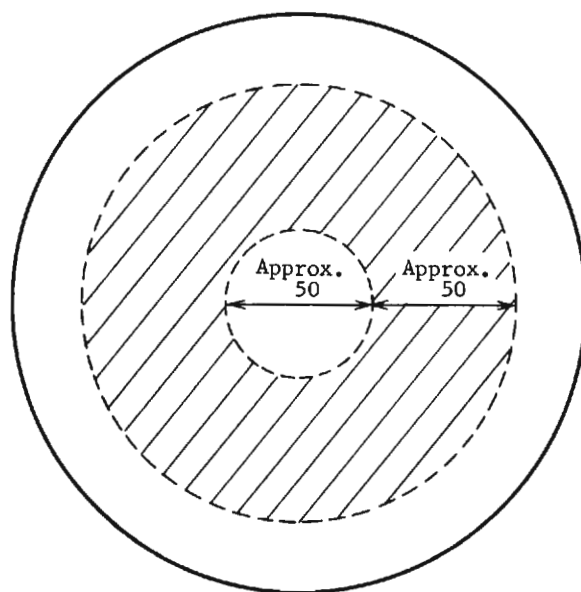


Fig. 5. Placement of the paste on the Hoover muller grinding plate

Unit: mm



5.2 Paint conditioning machine method A sample and a standard pigment are respectively dispersed into a vehicle by using a paint conditioning machine and the resulting dispersion is used in the tests of color or other properties. This method is suitable for testing the quality characteristics of pigments to be used in coatings or similar applications.

(1) Apparatus The apparatus shall be as follows:

(1.1) Paint conditioning machine

- (a) Machine body A paint conditioning machine vibrates a glass bottle fitted to a holder by a reciprocating motion of approximately 16 mm and an approximately 25° to 30° angle of oscillation at approximately 650 to 750 r.p.m. The holder is set so that the central axis of the oscillatory action becomes vertical. An example is given in Fig. 6.

Informative

Reference: There are paint conditioners and paint shakers illustrative of this kind of apparatus.

- (b) sample holder attachment A pair of wooden blocks for attaching several glass bottles to the paint conditioning machine. As an example, the holder attachment in which four bottles are set is shown in Fig. 7. The glass bottles are fixed in place on the top and bottom between two holder attachments. In order to vibrate both left and right glass bottles uniformly, cavities for placing the glass bottles are located from the center line AB, and the holder attachment on which the glass bottles are placed is located so that the center line AB is aligned on the center line of the drive shaft.
- (c) Glass bottle A wide mouthed glass bottles of approximately 140 ml capacity and approximately 90 mm in height, with an outside screw cap and a plastic inner liner.

Further, where a greater quantity of dispersion is required, a larger bottle of appropriate size is used.

- (d) Bead Glass beads of 3 ± 0.5 mm diameter ⁽⁸⁾.

Note ⁽⁸⁾ Different media can be used as agreed upon by the parties concerned.

- (1.2) Spatula A stainless steel spatula of approximately 180 to 240 mm in length.
- (1.3) Chemical balance A chemical balance capable of weighing to the nearest 0.01 g.
- (2) Materials Vehicle ⁽⁹⁾ Aminoalkyd resin varnish prepared by mixing coconut oil modified alkyd resin as given in Table 1 and butylated melamine resin as given in Table 2 at a 75 to 25 ratio by weight. The diluent solvent is prepared by mixing xylene and butanol at an 80 to 20 ratio by weight.

Table 1. Coconut oil modified alkyd resin

Items	Quality
Nonvolatile content	60 ± 1 %
Oil length	32 to 35 %
Viscosity (Gardner)	V to Z
Acid value	7 max.
Phthalic anhydride	40 to 45 %
Solvent	Xylene

Fig. 6. Example paint conditioning machine

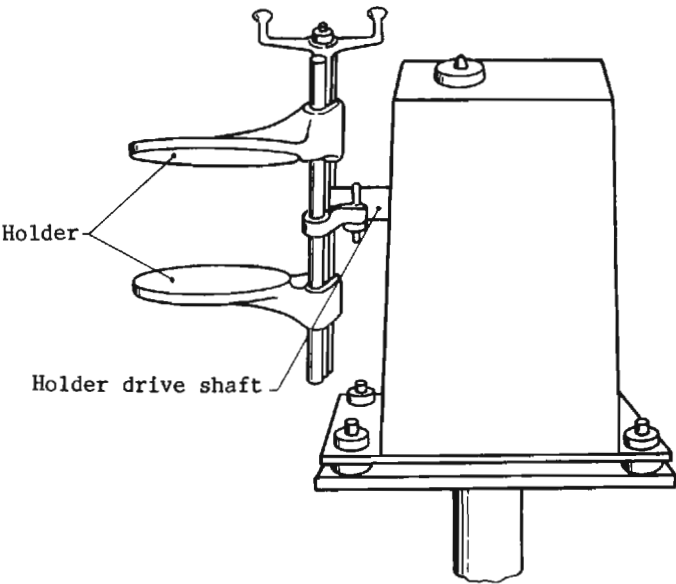


Fig. 7. Example holder attachment
Unit: mm

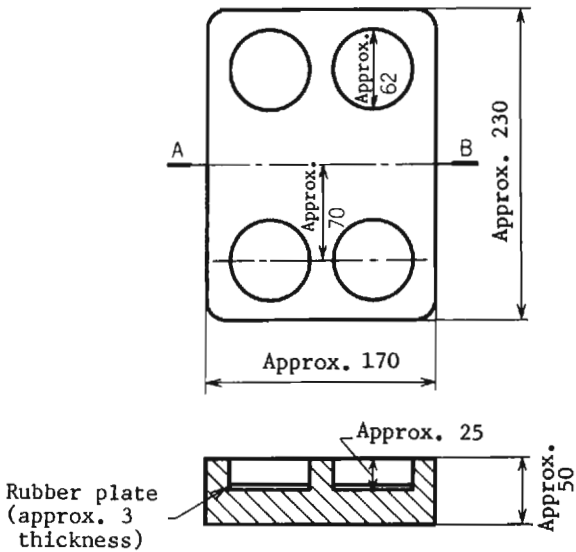


Table 2. Butylated melamine resin

Items	Quality
Nonvolatile content	$60 \pm 2 \%$
Viscosity (Gardner)	A to H
Solvent	Xylene + butanol

Note (9) Other varnishes for coatings or fluid inks, etc. can be used as vehicles as agreed upon by the parties concerned.

(3) Operation The operation shall be carried out as follows:

- (a) Weigh out 90 g of beads (¹⁰), varnish, and diluent solvent (see Table 3) to the nearest 0.1 g and lightly shake to wet the beads.
- (b) Weigh out a sample to the nearest 0.01 g, transfer to the glass bottle, stir with a spatula to wet the sample. Transfer any material adhering to the spatula to the glass bottle, and cap it.
- (c) Repeat operations (a) and (b) for a standard pigment.
- (d) Attach the glass bottles containing the sample and standard pigment to a paint conditioning machine, and shake for the specified time.
- (e) After shaking for the specified period, weigh out vehicle into each glass bottle to the nearest 0.1 g, add it and attach to the paint conditioning machine, shake for 5 min to prepare the dispersions of the sample and the standard pigment.

Note (¹⁰) Where media other than glass beads are used, the apparent volume shall be taken to be one half of the capacity of the glass bottle but not more than this quantity.

Remarks: The quantities of a vehicle, diluent solvent and a sample, and the shaking time shall be specified in the product standard.

Informative

Reference: For typical pigments, examples of dispersion conditions in the aminoalkyl resin varnish are given in Table 3.

Table 3. Example of conditions in which typical pigments are dispersed in aminoalkyd resin varnish

Pigment			g	Aminoalkyd resin varnish g	Diluent solvent g	Shaking time min	Additional aminoalkyd resin varnish g
Example 1	Titanium oxide		20.0	15.0	5.0	30	40.0
Example 2	Chrome yellow and molybdate orange		15.0	10.0	5.0	30	50.0
Example 3	Iron oxide red and iron oxide yellow		10.0	16.0	6.0	45	50.0
Example 4	Iron blue and ultramarine blue		4.0	16.0	10.0	60	50.0
Example 5	Organic pigments		4.0	16.0	10.0	60	50.0
Example 6	Carbon black	Less than 100 % oil absorption	3.0	16.0	10.0	60	50.0
Example 7		100 % min. oil absorption	2.0	16.0	10.0	90	50.0

6. Color

There are two methods, A and B, for testing colors.

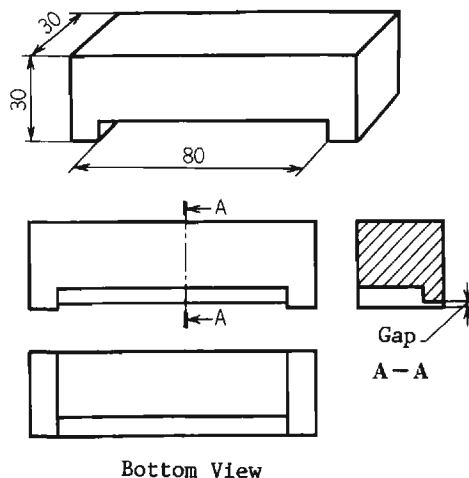
6.1 Method A After drawing down the Hoover muller pastes of a sample and standard pigments on white paper or similar substrates, compare the color visually.

(1) **Equipment** The equipment shall be as follows:

- (a) **Pallet knife** A straight edge formed steel pallet knife.
- (b) **Film applicator** A 0.15 mm or over gap film applicator. An example is given in Fig. 8.

Fig. 8. Example of a film applicator

Unit: mm



(2) Substrate ⁽¹¹⁾ For the substrate, either of the following may be used.

(a) White paper Printing paper A as specified in JIS P 3101 or JIS P 3105.

(b) Glass plate A glass plate as specified in 4.5 of JIS K 5410.

Note ⁽¹¹⁾ Other substrate can be used as agreed upon by the parties concerned.

(3) Pigment paste of a sample and a standard pigment Hoover muller paste of a sample and a standard pigment as prepared in 5.1 (3).

(4) Operation The operation shall be carried out in either of the following ways.

(a) Mount the pigment pastes of a sample and a standard pigment side by side on a sheet of white paper, draw down with a pallet knife so that both come in contact with each other, and prepare an extremely thin layer and a thick layer that is not influenced by the paper color.

(b) Mount the pigment pastes of a sample and a standard pigment side by side on a substrate, and draw down both with a film applicator so that both come in contact with each other.

Remarks: The gap of a film applicator and the type of substrate shall be as specified in the product standard.

(5) Evaluation The evaluation shall be carried out by either of the following ways.

(a) For the print tone of the thin layer and the mass-tone of the thick layer which were drawn down in (4) (a), compare the sample with the standard pigment visually, and examine the degree of difference between them.

(b) For the front or rear surface color which is drawn down in (4) (b), compare the sample with the standard pigment visually, and examine the degree of a difference between them.

6.2 Method B The dispersions of a sample and standard pigment which are obtained by using a paint conditioning machine are drawn down on coated paper or similar substrate, and are visually compared to each other.

(1) Apparatus The apparatus shall be as follows.

(1.1) Hot air circulating oven A hot air circulating oven with a precision of $\pm 1^{\circ}\text{C}$, a temperature range of 100 to 200°C and a $\pm 2.5^{\circ}\text{C}$ temperature distribution range.

(1.2) Draw down equipment Either of the following type of draw down equipment shall be used.

(a) Film applicator As specified in 6.1 (1) (b).

- (b) Wire wound rod A draw down device in which a 0.07 to 1.90 mm diameter stainless steel wire is wound tightly on a special steel rod approximately 6.35 mm in diameter and approximately 400 mm in length. The length of the windings is approximately 300 mm. An example is given in Fig. 9.
- (1.3) Substrate base A base is used under the substrate for color draw downs, either of the following substrate base shall be used.
- (a) Glass plate A flat glass plate with no flaws on the surface, that is larger than the substrate.
- (b) Suction type base A base which holds coated paper or polyester film by suction. An example is given in Fig. 10.

Fig. 9. Example of a wire wound rod

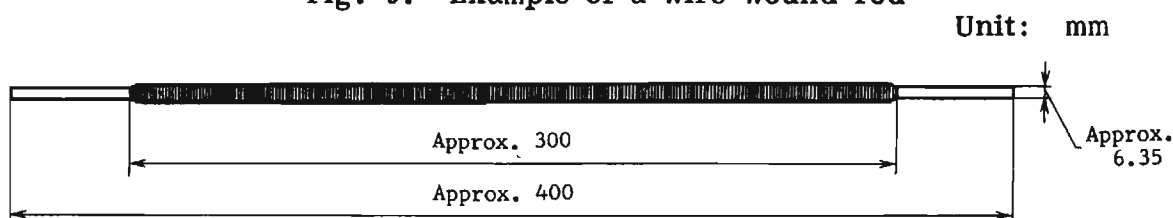
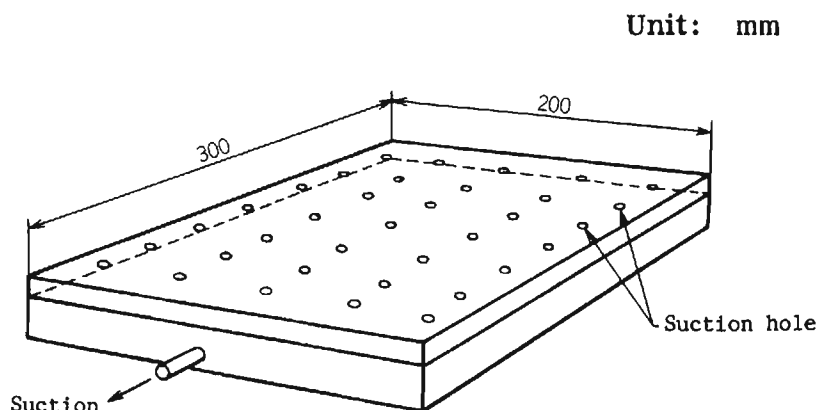


Fig. 10. Example of a suction type substrate base



- (2) Substrate ⁽¹²⁾ Either of the following substrates shall be used.
- (a) Coated paper A coated paper is prepared by smoothly applying a solvent resistant transparent coating on the paper.
- (b) Polyester film A 30 to 100 μm thick colorless transparent polyester film.

Note ⁽¹²⁾ Other substrates can be used as agreed upon by the concerned parties.

- (3) Liquid dispersions of sample and standard pigment Those prepared as specified in 5.2 (3).

(4) Operation The operation shall be carried out as follows:

- (a) Place the substrate on a horizontal base, mount a small quantity of the dispersions of sample and standard pigment on the substrate side by side, and make draw down both so they meet by using a draw down equipment.
- (b) After making the drawn down on the substrate place on a horizontal surface in a dust-free location at normal temperature for 20 to 30 min. Place in an oven at 120°C, for 30 min to dry, and allow to stand at room temperature for 1 h to be taken as the drawn down exhibit ⁽¹³⁾.

Note ⁽¹³⁾ When the vehicle is not an aminoalkyd resin varnish, the draw down shall be dried under conditions appropriate for the vehicle used.

Remarks: The gap of the film applicator, the diameter of the wire wound stainless steel rod, and the substrate shall be specified in a product standard.

- (5) Evaluation For evaluation, compare a sample with the standard pigment visually for the print tone of the draw down coated paper is used and for reflected and transmitted color of the draw down on a polyester film. Examine the degree of difference.

7. Tinting strength

There are Hoover muller and paint conditioning machine methods for testing tinting strength.

7.1 Hoover muller method Draw down a tint in which a sample and a standard pigment are joined by an auxiliary pigment to be dispersed in a vehicle on the Hoover muller, or a tint in which the pigment pastes of the sample and standard pigment obtained in 5.1 are mixed with the pigment paste of an auxiliary pigment on white paper or a similar substrate, and compare the depth of said color visually. The mixed paste applies only to colored pigments.

(1) Apparatus The apparatus shall be as follows:

- (a) Hoover muller As specified in 5.1 (1) (a).
- (b) Pallet knife As specified in 5.1 (1) (c).
- (c) Film applicator As specified in 6. (1) (b).
- (d) Chemical balance A chemical balance capable of weighing to the nearest 1 mg.

(2) Materials The materials shall be as follows:

- (a) Vehicle As specified in 5.1 (2).
- (b) Substrate As specified in 6.1 (2).

- (3) Auxiliary pigments Titanium dioxide (pigment) ⁽¹⁴⁾ as specified in JIS K 5116 is used for colored pigments, and carbon black (pigment) as specified in JIS K 5107 is used for white pigments.

Note ⁽¹⁴⁾ Zinc oxide can be used instead of titanium dioxide as agreed upon by the concerned parties.

- (4) Auxiliary pigment paste The auxiliary pigment paste is prepared by mixing titanium dioxide (pigment) ⁽¹⁴⁾ as specified in JIS K 5116 with a vehicle at a specified mass ratio and grinding on a 3-roll mill to maximum 7.5 μm particle size with a grind meter.
- (5) Hoover muller paste of a sample and standard pigment Hoover muller pastes of a sample and standard pigment are prepared as given in 5.1 (3).
- (6) Operation The operation shall be carried out as follows:

- (6.1) For colored pigments For colored pigments, the operation shall be carried out in either of the following ways:

- (a) Weigh out the sample to the nearest 1 mg, weigh out respectively the auxiliary pigment and vehicle to the nearest 10 mg, add, and grind together in accordance with 5.1 (3) (a) to (d) using a Hoover muller. Repeat the operation for the standard pigment.

Draw down the pigment pastes of the sample and the standard pigment in accordance with 6.1 (4) (a) or (b).

- (b) Weigh out respectively pigment pastes to the nearest 1 mg so that the specified mass ratio of sample and auxiliary pigments is obtained, and mix in accordance with 5.1 (3) (a) to (d) by using a Hoover muller. Run 25×4 rotations, and use one counter weight (22.68 kg mass). Repeat the operation for a standard pigment.
- (c) Draw down the pigment pastes of sample and standard pigment in accordance with 6.1 (4) (a) or (b).

- (6.2) For white pigments For white pigments, the operation shall be carried out as follows:

- (a) Weigh out the sample to the nearest 10 mg. Weigh out the auxiliary pigment to the nearest 1 mg, and a vehicle to the nearest 10 mg, add, and mix together in accordance with 5.1 (3) (a) to (d) using a Hoover muller. Repeat the operation for the standard pigment.
- (b) Draw down the pigment pastes of the sample and the standard pigment in accordance with 6.1 (4) (a) or (b).

Remarks: The quantity of sample, auxiliary pigment, the type and quantity of vehicle, and the ratio of sample to auxiliary pigment shall be specified in the product standard.

- (7) Evaluation For evaluation, compare visually the color depth of the sample with that of the standard pigment, and evaluate the degree of difference. Take less intense color as being lower in tinting strength for colored pigments. Take high brightness as being higher tinting strength for white pigments.

7.2 Paint conditioning machine method Draw down the substance obtained by mixing the liquid dispersions of a sample and a standard pigment from the paint conditioning machine with the dispersion of auxiliary pigment, and compare their color depths.

- (1) Apparatus The apparatus shall be as follows:
- (a) Hot air conditioning oven As given in 6.2 (1.1).
 - (b) Chemical balance A chemical balance capable of weighing to the nearest 0.01 g.
 - (c) Film applicator As given in 6.1 (1) (b).
 - (d) Wire wound rod As given in 6.2 (1.2) (b).
 - (e) Coating board As given in 6.2 (1.3).
- (2) Materials Coated paper As given in 6.2 (2) (a).
- (3) Auxiliary pigment dispersion
- (a) Titanium dioxide dispersion A dispersion which is prepared in accordance with 5.2 (3) by using titanium dioxide (pigment) as specified in JIS K 5116 and the same vehicle used for the sample dispersion, or a titanium dioxide dispersion for which a similar type of vehicle is used. It is used in a test for colored pigments.
 - (b) Carbon black dispersion A dispersion which is prepared in accordance with 5.2 (3) by using carbon black (pigment) as specified in JIS K 5107 and the same vehicle as for the sample dispersion or a carbon black dispersion for which a similar type of vehicle is used. It is used in a test for white pigments.
- (4) Dispersion of a sample and standard pigment Those prepared as given in 5.2 (3).
- (5) Operation The operation shall be carried out as follows:
- (5.1) For colored pigments
 - (a) Weigh out respectively a liquid dispersion of the sample and titanium dioxide into a suitable container to the nearest 0.01 g such that the mass ratio of the sample and the titanium dioxide is 1 to 10 ⁽¹⁵⁾ and the total mass of both dispersions is 30 g or more, and mix until uniform.

- (b) Repeat the operation of (a) for a standard pigment.
- (c) Using the resulting mixture of the sample and standard pigments, draw down in accordance with 6.2 (4), and dry ⁽¹⁶⁾.

(5.2) For white pigments

- (a) Weigh out respectively liquid dispersions of the sample and carbon black into a suitable container to the nearest 0.01 g so that the mass ratio of the sample and carbon black is 100 to 1 and total mass of both dispersions is 30 g or more, and mix until uniform.
- (b) Repeat the operation of (a) for a standard pigment.
- (c) Using the resulting mixture of the sample and standard pigment, draw down in accordance with 6.2 (4), and dry ⁽¹⁶⁾.

Notes ⁽¹⁵⁾ For high tinting strength pigments or low tinting strength pigments, the mass ratio can be varied to 1 to 20 or 1 to 5.

⁽¹⁶⁾ Where the sample or auxiliary pigments flocculate or flood during drying after drawing down, tinting strength can not be accurately compared. The presence of flocculation or flooding is judged by lightly rubbing a part of the draw down paint film with a finger when the draw down surface of the paint film is viscous. Compare the color of the rubbed part with the back ground color. When the color depths are different, due to flocculation or flooding, this shall be recorded in the test results.

- (6) Evaluation Compare visually the color depth of a sample with that of a standard pigment, and evaluate by examining the degree of difference. Take less intense color as being lower in tinting strength for colored pigments. Take high brightness as being higher tinting strength for white pigments.

8. Hiding power

There are a checkerboard method and a criptometer method for testing hiding power.

8.1 Checkerboard method Coat the pigment paste or liquid dispersions of a sample and standard pigment on a checkerboard substrate so that both come in contact with each other, and compare the hiding power visually.

- (1) Equipment The equipment shall be as follows:

- (a) Film applicator As given in 6.1 (1) (b).
- (b) Wire wound rod As given in 6.2 (1.2) (b).
- (c) Coating board As given in 6.2 (1.3).

- (2) Materials Checkerboard paper The approximately 174 × 144 mm art paper having alternating a white and a black surfaces which is coated with a solvent resistant transparent coating, and 45 degrees and zero degree diffuse reflectance which is $80 \pm 1 \%$ for the white surface and 2 % max. for the black surface.
- (3) Pigment paste or liquid dispersion of a sample and standard pigment These are prepared in accordance with 5.1 (3) or 5.2 (3).
- (4) Operation The operation shall be carried out as follows:
- (a) Place a checkerboard on a horizontal substrate base.
 - (b) Mount side by side small quantities of the pigment pastes or liquid dispersions of a sample and standard pigment on the sheet and draw down both so that they contact each other using a film applicator or wire wound rod.
 - (c) Where the pigment paste of 5.1 (3) is used, evaluate just after drawing down.
 - (d) Where the dispersion of 5.2 (3) is used, place the draw down checkerboard horizontally, and evaluate after drying under the same conditions as in 6.2 (4) (b).

Remarks: The gap of a film applicator or the diameter of a wire wound stainless steel rod are specified in the product standard.

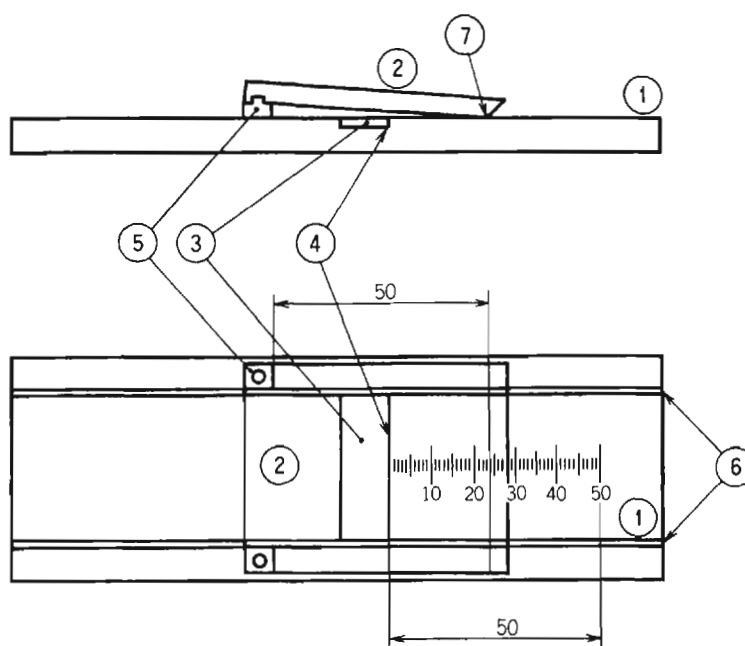
- (5) Evaluation For evaluation, compare visually the brightness over a white surface of the sample and over the black surface with that of a standard pigment. Compare the degree of difference. Take a small brightness difference between the white surface and the black surface as large hiding power.

8.2 Criptometer method Measure hiding power by using a criptometer for the pigment paste of the sample, and compare with the measured value for the pigment paste of a standard pigment which is run simultaneously. This method is a simple method in the case where only hiding power is independently measured.

- (1) Equipment Criptometer A criptometer is composed of two plates ① and ②. The plate ①, the upper surface of which is an optical flat surface, is a black or white glass plate approximately 140 × 70 × 7 mm with a lengthwise groove ③ 5 mm deep and 10 mm wide, two lateral grooves 2 mm deep and 3 mm wide, and scale divisions marked at 1 mm intervals. The black plate ① is used for white pigments and the white plate ① is used for color pigments. The plate ②, whose upper and lower surfaces are optical flat surface, is approximately 70 × 70 × 6 mm transparent glass, and is equipped with steel sheet legs ⑤, set at a distance from the edge ⑦ of 50 mm. There are two types of legs ⑤ for the plate ②, with thickness of 1 mm or 0.5 mm which are chosen dependent on the hiding power of the pigment. An example is given in Fig. 11.

Fig. 11. Example of a criptometer

Unit: mm



- ①: Black or white glass plate
- ②: Transparent glass plate
- ③: Longitudinal groove
- ④: Edge of longitudinal groove
- ⑤: Leg made of steel sheet
- ⑥: Lateral groove
- ⑦: Edge of the transparent glass plate

(2) Pigment paste of a sample and a standard pigment The Hoover muller paste prepared as given in 5.1 (3).

(3) Operation The operation shall be carried out as follows:

- (a) Put the Hoover muller paste of the sample in the lengthwise groove ③ of the criptometer until a meniscus forms.
- (b) Carefully lower the transparent glass plate ② so that its edge ⑦ is slightly to the right of the 50 graduation of plate ① and is placed on the pigment paste. At that time, the pigment paste between the plate ① and the plate ② forms a wedge-shape.
- (c) Slowly move plate ② to the left on plate ①, and read the graduation at which the line ④ of the border can be seen with the edge ⑦ of the plate ②. Then, slowly move the plate ② to the right, read the graduation of the edge ⑦ at which the line ④ of the border disappears, and obtain the median of both.
- (d) Perform the operation (a) to (c) for the pigment paste of a standard pigment.