

JIS

JAPANESE INDUSTRIAL STANDARD

Testing methods for paints

JIS K 5400—1990

Translated and Published

by

Japanese Standards Association

Printed in Japan



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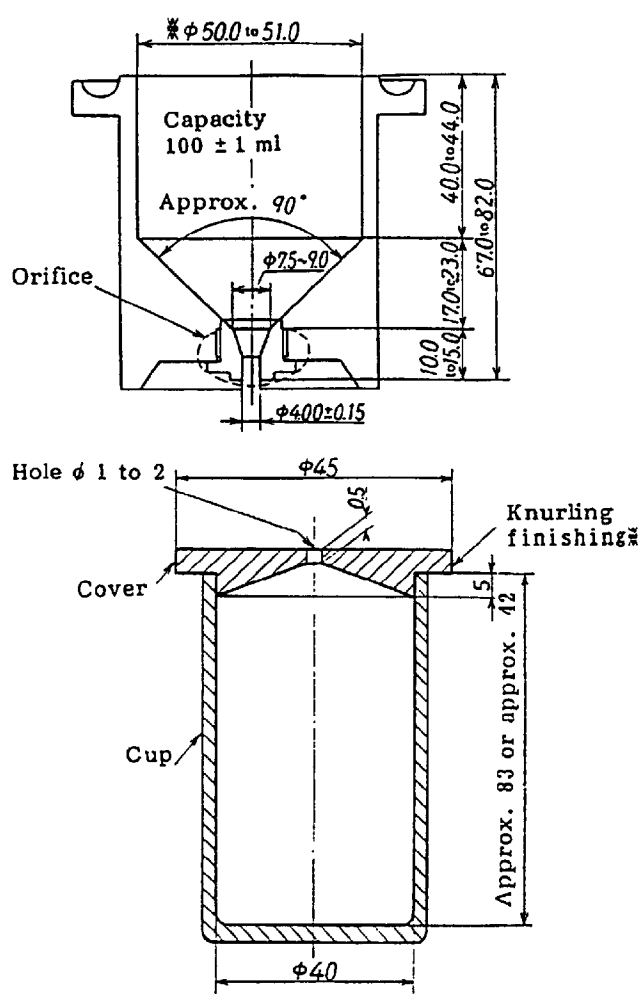
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ERRATA

1994. 8.

Page	Position	Wrong	Correct
51	Fig. 25	"※" denotes the position to be corrected.	
53	Fig. 26	 Fig. 25 dimensions: Top diameter $\phi 50.0 \pm 0.1$, Capacity 100 ± 1 ml, Approx. 90°, Orifice, $\phi 25 \sim 30$, $\phi 40.0 \pm 0.15$, $\phi 15.0$, $\phi 17.0 \pm 0.3$, $\phi 40.0 \pm 0.15$, $\phi 67.0 \pm 0.2$, $\phi 44.0$, $\phi 10.0$. Fig. 26 dimensions: Blow out Hole $\phi 1$ to 2, $\phi 45$, $\phi 0.5$, Knurling finishing, Cover, Cup, $\phi 40$, $\phi 42$, Approx. 83 or approx. 42.	
105	Condition of flaw, Evaluation point number 8 in Table 18	area of loss partds...	area of loss part...
105	Note (1)	Insert the following: The black part in Fig. 52 shows the area of loss part.	
174	Operating conditions, Discharge current in Table 28	58 to 62 V	58 to 62 A

Remarks: This errata is for correcting the sixth edition of this Standard.

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ERRATA

Page	Position	Wrong	Correct
41	Stokes, Symbol Y, Table 8	17.9	17.6
139	line 3, (5.1), 8.17	$W.V = \frac{200 \times M}{T \times S}$	$W.V = \frac{240 \times M}{T \times S}$
141	line 3, (5.1), 8.18	$CI = \frac{V \times M \times 10^2}{A \times 30}$	$CI = \frac{V \times M \times 10}{A \times 30}$

Remarks: This errata is for correcting the sixth edition of this Standard.

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

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ERRATA

Page	Position	Wrong	Correct
116	8.9 (1) line 1	taper type abraser	Taber type abraser
116	8.9 (2.2)(a),(b)	Taper Type	Taber Type

Remarks: This errata is for correcting the first to sixth edition of this Standard.

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Testing Methods for Paints

K 5400-1990

1. Scope

This Japanese Industrial Standard specifies testing methods for quality and performance of paints and paint films.

Remark: In this Standard the units and numerical values shown in { } are in accordance with traditional units and are Standard values.

2. Sampling

- (1) Summary For obtaining the sample to be used for test of paint, a suitable sampling method for each paint is required, and for the sampling method, the formation of batch, sampling number of pieces, sampling amount and sampling operation are determined.
- (2) Forming of Batch The batch means the quantity unit of paint products entered in the container for manufacture in the final process of paint manufacturing and divided from the paint products entered in other container for manufacture. Even in other processes of manufacture products are divided into several processes, the products entered in one container at the final process and mixed are one batch, even the products applied with one apparatus at the initial process, but at the final process treated with dividing into several containers shall be taken as separated batches for respective containers.

Further, out of batches of products made by mixing in a certain container, the batch mixed by adding newly other batch shall be taken as other batch different from the primary batch and the division shall be in accordance with No. The term of lot may be used in broad meaning, and therefore it shall not be used instead of batch.
- (3) Sampling Number of Pieces The sampling number of pieces shall be as follows.
 - (a) Divide the paints to be tested into each batch of manufacture, take one container at random from respective batches and take it as the representative container of the batch.
 - (b) In case where the amount of content in one container is less than the amount⁽¹⁾ required for test specified in product Standard, increase the number of containers to be selected from each batch so as the total amount of contents to become not less than the required amount, take it as one set and allow the set to be the representative container of the batch.
 - (c) Relating to the paints entered in a large type container such as tank lorry, handle the content of one container as one batch.

Applicable Standards, Japanese Agricultural Standards and Corresponding International Standards: See Pages 187 to 191.



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- (d) In the case where components of paint are divided into several parts, entered into separate containers to be one set and the paint is made so as to be mixed just before using, handle the one set of container group as one container.

Note (¹) In the case where the required amount for test is described in product Standard, it shall be followed, in cases where it is not described not less than 300 ml, and where test item of storage stability is specified in the product Standard, not less than 600 ml, shall be taken as the representative sample the batch. However, in the case where the paint is pasty or powdery, not less than 1 kg, be taken.

(4) Devices Devices shall be as follows:

- (a) Container for Sample The container for sample shall be a metallic container or the like having a sufficient capacity to fill the amount(¹) required for test and, be capable of closing tightly. As to the sample to which the metallic container can not be used, a glass bottle or the like shall be used. The container for sample shall be cleaned and dried.

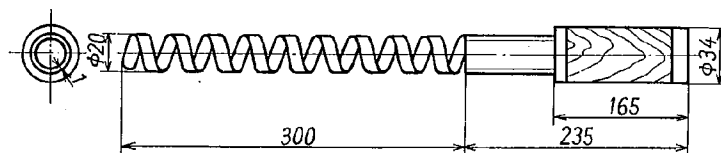
In the case where components are divided into several parts and entered in respectively individual containers to be a set of the paint, such containers for sample that the components to be taken as the sample becomes respectively approximately full in size shall be used.

- (b) Sampling Device According to the condition of paint, a glass bar, glass tube, scoop, spatula, thread cutting device, etc. shall be used for sampling device.

Further, an example of thread cutting device is shown in Fig. 1.

Fig. 1. An Example of Sampling Device of Pasty Paint

Unit: mm



(5) Sampling Amount The sampling amount shall be as follows:

- (a) According to the size of container out of representative containers drawn out from the objective batch for test, take not less than required amount(¹) for test according to either one of (b) to (e), and transfer quickly to test place. Provided that the method for mixing the contents of container before sampling shall be in accordance with either one of (6) (a) to (f) corresponding to the condition of paint.
- (b) In the case where the amount of content of drawn-out representative container is equal to or more than the required amount for test specified in product Standard, take the paint entered in the representative container as it is as the sample representing the batch.

- (c) In case where the amount of contents of drawn out representative container is extremely larger than the required amount⁽¹⁾ for test specified in product Standard, mix the contents thoroughly to make uniform take out the required amount or more from it, make the container for sample approximately full to close tightly, and take this as the sample representing the batch.
- (d) In the case where the content amount of one container is less than the required amount⁽¹⁾ for test described in product Standard and by increasing the number of containers to be drawn out according to (3) (b) to be one set, after mixing the contents of drawn out container, transfer in total to a large type container prepared separately, mix by rigid spatula or bar by stirring to make homogeneous, take out the not less than required amount⁽¹⁾ for test out of it so as to fill approximately full in the container for sample, the close tightly and take this as the sample to represent the batch.
- (e) In the case of paint made one set by dividing into a certain components, take the container for sample specified in product Standard according to either of (b) to (d) at the mixing ratio marked on each container. Make the amount of one set not less than the required amount⁽¹⁾ for test specified in product Standard. Note the mixing ratio of one set marked on the product container and take it as the sample representative to the batch.
- (6) Sampling Operation The sample operation shall be carried out as follows:
- (a) In the Case of Paints with a Large Flowability Having Comparatively Uniform Components In the case of paints with a large flowability having comparatively uniform components such as varnish, clear lacquer, thinner, etc., mix the contents of container by stirring or shaking as far as thoroughly, after stopping of flow of contents, take the sample by using a clean and dried glass tube, glass bar, scoop, etc.
Transfer the taken sample to a separately prepared container. Repeat it so as to make the transferred total amount to not less than the required amount⁽¹⁾ for test and mix by shaking to be homogeneous.
- (b) In the Case of Liquid Paint of which Component Has Tendency to Precipitation In the case of liquid paint of which component has tendency to partially precipitation such as ready-mixed paint, synthetic resin enamel, lacquer enamel, primer, etc., open the opening of container, if skin exists in contents, remove it, mix the content sufficiently to make homogeneous and take out the required amount⁽¹⁾ for test from it by using a glass bar, scoop, spatula, etc.
- (c) In the Case of Pasty Paints (Putty or the Like) Open the opening of container, if skin exists in contents remove it, mix the content by kneading to make uniform, and take out not less than required amount⁽¹⁾ from it by means of a spatula, thread cutting device, etc.

- (d) In the Case of Paint of Which Solid Contents Has Tendency to Separate Open the opening of container, and if skin exists on the surface, remove it. Then, mix the contents by stirring to make uniform by using a rigid spatula, or glass bar, and take out not less than required amount⁽¹⁾ for test from it by means of a spatula.
- (e) In Cases of Paint Difficult to Mixing In cases where the container is large and the content amount is large, the content is excessively viscous and therefore mixing by stirring and mixing by kneading are difficult, take the sample from several portions by using a thread cutting device with taking into consideration the property of content, and sampling portion and ratio so as to represent the content as far as possible, mix and put into a sample container.
- At this time, screw-in the top end of thread cutting device with it down, thereafter gently draw up, scrape off the paint adhered on the thread cutting device into a separately prepared container, after repeating this operation, mix the scraped-off paint thoroughly and it may be put into a container for sample.
- (f) In the Case of Powdery Paint After mixing the content to make uniform according to a suitable method, take not less than the required amount⁽¹⁾ for test. In case where it is impossible to mix the contents, by using a suitable sampling device respectively take small amounts from different portions, transfer to container for sample, and mix uniformly to take it as the sample.
- (7) Record Describe the name of sample, batch number, sampling date, post and name of sampling person, etc. and append it to the sample.
- Further, the special describing matters relating to the product are required to append to the sample according to the method by copy or the like.

3. General Test Conditions

General test conditions shall be as follows.

3.1 Place for Testing Conditions of place for testing shall be as follows:

- (1) Standard Conditions The place for test shall be at $20 \pm 1^\circ\text{C}$ in temperature, $65 \pm 5\%$ in relative humidity (hereinafter referred to as "humidity.") without receiving direct sunlight, free from gas, steam, dust to affect the test, less in ventilation and not less than 20 l per 100 cm² of paint film in volume.
- (2) General Conditions The place for test shall be inside of a room at ordinary temperature (5 to 35°C) without receiving direct sunlight and less in gas, steam, dust, etc. to affect the test.
- (3) Place for Spray Painting The place for spray painting shall be a place⁽¹⁾ at $20 \pm 5^\circ\text{C}$ in temperature, not more than 78 % in humidity, record those at each conduction of test and take them as the informative reference for the test thereafter.

Note ⁽¹⁾ It is preferable to paint in a spray booth ventilating at approximately 0.7 m/s in wind velocity.



- (4) Diffuse Daylight The diffuse daylight means the light from north window avoiding direct radiation of daylight from 3 h after sunrise until 3 h before sunset. However, the standard illuminant D₆₅ and standard illuminant C specified in JIS Z 8720 may be used as diffuse daylight.

Further, the sample, materials, etc. to be used for test shall be prepared at all places for test, and, made so as the interference on test due to difference of temperatures and humidities not to be caused. In the case where the place of test is not specified specially, the test shall, as a rule, be carried out under the standard conditions of (1).

3.2 General Matters General matters such as glass devices, materials, reagents, testing apparatus, etc. to be used for test and their control method, treating method of measured value, specified conditions in product Standard, etc. shall be as follows:

3.2.1 Apparatus, Materials and Reagents for Testing The apparatus, materials and reagents for testing shall be those specified respectively in the following Japanese Industrial Standards.

(a) Glass Devices

JIS R 3503

JIS R 3505

(b) Materials

JIS K 5410

JIS R 6251, JIS R 6252, JIS R 6253

JIS Z 1522

(c) Reagents Reagents of the uppermost grade specified in respective Japanese Industrial Standards shall be used.

Further, the deionized water of not more than 1 μ S/cm in electric conductivity shall be used.

3.2.2 Test Equipment and the Like and Their Control Methods
Because the selection and control method of test equipment (facilities, machine, devices) give the important influence on the results of test, sufficient cares shall be taken on the following points.

(a) Test Equipment and the Like As to the test equipment and the like, those specified in the following Japanese Industrial Standards shall, as a rule, be used:

JIS B 7410

JIS B 7502

JIS B 7525

JIS B 7601

JIS B 7751

JIS B 7753

JIS B 7754

JIS B 9809

JIS Z 2371 2. Salt spray testing apparatus

JIS Z 8722 4.2 Spectrophotometer and 5.2 photoelectric photometer

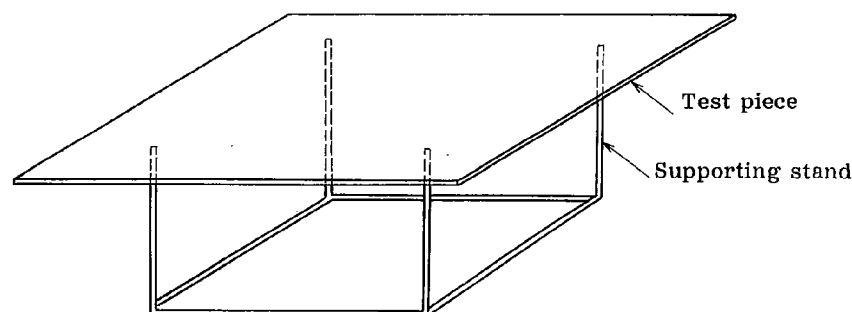
JIS Z 8741 4. Specular gloss measuring apparatus

- (b) Thermostatic Oven The thermostatic oven shall be an electric thermostatic oven capable of slowly ventilating and its volume, be not less than 20 l per 100 cm² in painting surface to be entered. The part for placing the test piece shall be for air kept at the temperature specified in product Standard of sample capable of circulating gently and uniformly, and, be capable of so adjusting that within 5 min since putting-in the test piece into the thermostatic oven it becomes at the specified temperature.

Cares shall be so taken that the heating or cooling of test piece does not become ununiform due to influence of transmission of heat from the stand supporting the test piece and the like according to heat generation or radiation of hot rays or cool air from the cooling part of thermostatic oven. A test piece is placed at a position apart from the heat generating or cooling part of thermostatic oven, and the thermostatic oven shall be such structure that the heated or cooled air circulates in the thermostatic oven.

The supporting stand for test piece shall be of shape of Fig. 2 made of wire and a test piece is placed on this to be put into the thermostatic oven.

Fig. 2. An Example of Supporting Stand for Test Piece



- (c) Control Method of Test Equipment and the Like The equipment and the like (facilities, machines, devices) used for test shall be controlled by providing the control reference specified with the respective check items, check method (calibration method), check reference (permissible range), check time (period), etc. in order to maintain and control adequately the function and accuracy.

Informative Reference: As the example of control reference of testing apparatus and the like, there is "control and handling reference of paint test facilities" specified by the juridical foundation Japan Paint Inspecting Association.

3.2.3 Presentation and Reduction of Data The presentation and reduction of data shall be in accordance with JIS Z 9041.

3.2.4 Test Conditions to Be Specified in Product Specification Out of test conditions required for respective tests, the test conditions different depending upon the product Standard, shall be itemized at the end of each test method as the "test conditions to be specified in product specification".

3.2.5 Notes and Remarks Notes and remarks shall be attached with a series number for each item.

3.3 Preparation of Test Pieces The preparation of test pieces shall be as follows.

- (1) **Summary** This item specifies the painting method to test panel when preparing the paint film from sample, and methods for drying, maintaining, etc. to carry out the test as the paint film.

The matter made by painting the sample on the test panel is called the test piece. At the time of preparing the test piece, fix or maintain the test plate, paint by the specified method to dry, further, in the case where conditioning is required, successively maintain for the time specified in product Standard of sample. In case where there is a fear to receive influence on the periphery and back surface of test piece at the time of test, paint these parts to wrap with specified paint or material.

- (2) **Pretreatment of Test Panel** Prior to using a test panel specified in 3.2.1 (b) following treatment (hereinafter referred to as the "pretreatment") shall be carried out and then, used. Conditions of the place to be carried out the pretreatment shall be general conditions specified in 3.1. However, when solvent vapour, dust, etc. due to polishing, it is preferable to carry out the pretreatment at a place where air is exhausted at a wind velocity of approximately 0.5 m/s or more.

(2.1) **Method of Pretreatment**

- (2.1.1) **Steel Panel** The pretreatment of steel panel shall be as follows:

- (2.1.1.1) As to the test panel to be used for test relating to the paint film formation function and for test relating to visual characteristics, carry out the following solvent washing.

In the case where the test panel is coated with rust preventive oils, after wiping off its most part, immerse in xylene specified in JIS K 8271 or petroleum system solvent, and wash sufficiently by using hard hair brush or the like. Further, wash other xylene or

petroleum solvent and dry it so as the dust not to adhere. After confirming that the washed and dried test panel is clean⁽¹⁾, put into a desiccator⁽²⁾ and use for the test within 24 h.

Notes ⁽¹⁾ Confirmation of Cleanness Take at random one sheet out of the washed and dried test panel, wipe strongly a part of surface of test panel by using a clean white cloth free from fluffs or facial tissues specified in JIS S 3104, and when stains are not confirmed on the white cloth or facial tissues, the test panel treated similarly at the same time shall be taken as to be clean. The test panel used for confirmation shall not be used for the test.

⁽²⁾ The desiccator shall be that containing silica gel for drying.

(2.1.1.2) The test panels to be used for the test relating to chemical and physical resistance of film and for the test relating to a long period endurance of paint film shall be carried out with the following polishing treatment.

In the case where the test panel is coated with rust preventive oils, after wiping off the most part, immerse into xylene or petroleum solvent, wash sufficiently with hard hair brush or the like, and polish carefully the surface to be painted with the sample by using the abrasive cloth, abrasive paper or waterproof abrasive paper No. 280 respectively specified in 3.2.1 until metallic gloss appears.

The procedures of polishing by hand work shall be as follows:

- (a) Polish linearly in parallel to one side.
- (b) Polish in the vertical direction to the primary direction until the primary polishing trace disappears.
- (c) While describing a circle so polish that each circle overlaps in spiral state.

After carrying out the above-mentioned treatment, use the test panel treated according to the operation of (2.1.1.1).

(2.1.2) Galvanized Steel Plate Carry out solvent washing according to (2.1.1.1). After confirming that the washed and dried test panel is clean⁽¹⁾, put into a desiccator⁽²⁾ and use for test within 48 h.

(2.1.3) Tin Plate Carry out the solvent washing. After confirming that the washed and dried test panel is clean⁽¹⁾, put into a desiccator⁽²⁾ and use for the test within 48 h.

- (2.1.4) Aluminium Panel Polish the peripheral part of test panel by using the abrasive cloth, abrasive paper or waterproof abrasive paper No. 280 respectively specified in 3.2.1, wash sufficiently with mixture of 2-propanol specified in JIS K 8839 and xylene specified in JIS K 8271 at volumetric ratio of 1:1, dry, and after confirming that it is clean⁽¹⁾, carry out the following treatment:

Put the solution mixed with phosphoric acid specified in JIS K 9005, 1-butanol specified in JIS K 8810, 2-propanol specified in JIS K 8839 and water at the volumetric ratio of 10:40:30:20 into a beaker, while keeping the temperature at approximately 80°C, immerse the test plate washed and dried there into for 10 min, take out, stand in a room to place for 2 h, rub lightly with a soft cotton cloth, after washing with water, place in a dryer kept at approximately 50°C so as the dust not to adhere for 1 h, take out, immediately put into a desiccator⁽²⁾ and use for the test within 48 h.

- (2.1.5) Glass Plate The pretreatment of glass plate shall be as follows:

- (a) Wash with aqueous solution of soap, surface active agent, alkali, etc., wash with water sufficiently to dry, further wash sufficiently with xylene or petroleum solvent and dry so as the dust not to adhere. After confirming that the washed and dried test panel is clean⁽¹⁾, put into a desiccator⁽²⁾ and preserve until using for test.
- (b) In the case of reuse, after peeling off the paint film so as the glass plate not to be flawed, carry out the treatment same as in (a).

Remark: As to the faces of float palte glass, there are top faces and bottom faces. For the chemical resistance test, it is preferable to use the top face. For discrimination of top face and bottom face, if a light of fluorescent lamp which generate may ultraviolet radiations near 253.7 nm and 366.0 nm is applied to the bottom face generate fluorescence because the bottom face has intension of tin. Examples of fluorescent lamps to be used for inspection are shown in Table 1.

Table 1. Fluorescent Lamps

Wavelength	Near 253.7 nm	Near 366.0 nm
Fluorescent lamp	The lamp specified in JIS C 7605, (abbreviation: sterilization lamp)	Fluorescent lamp for insect collector or black light

- (2.1.6) Asbestos Cement Panel Cut the periphery by a file to make flat, round the corners, after washing the whole surface with running water, then stand so as not to overlap mutually and dry for not less than 7 days. Wipe the dried test panel on the surface with a dried gauze and use for the test. At this time confirm that the index of water content on the surface is not more than 10 %⁽³⁾.

Note (3) Confirm the index of water content by using a mortar water-content meter.

- (2.1.7) Cement Mortar Panel Remove sufficiently ductile matters and powdery matters from the surface to be used for test by using number 150 of waterproof abrasive paper specified in JIS R 6253 and wipe with a soft and clean cloth. At this time, conform that the water-content index of the surface is not more than 10 %⁽³⁾.
- (2.1.8) Asbestos Cement Pearlite Panel The pretreatment of asbestos cement pearlite panel shall be as follows:
- (a) Cut the opening of test panel to make flat by using abrasive paper and round off the corners.
 - (b) Fall down powders and stains adhering on the whole surface of test plate by means of a soft brush. At this time, test plate having adhesives not to be removed do not take it the test panel. Thereafter stand the test panels so as not to overlap mutually, and after standing still for not less than 24 h, use for the test. At this time confirm that the index of water content of surface is not more than 15 %⁽³⁾.
- (2.1.9) Gypsum Board The pretreatment of gypsum board shall be as follows:
- (a) Cut the opening of test panel to make smooth by using abrasive paper or the like and round off the corners.
 - (c) Remove the powders and stains adhering on the whole surface of test panel by using a soft brush or the like. At this time, the test panel having adhesives impossible to be removed shall not be taken as the test panel. Thereafter, stand the test panel so as not to overlap mutually and after standing still for not less than 24 h, use for the test.
- (2.1.10) Wood Veneer The pretreatment of wood veneer shall be as follows:
- (a) Cut the opening of test panel by using abrasive paper or the like to make flat and round off the corners.
 - (b) Fall down fluffs and stains on the surface to be used for test by using number 280 of waterproof abrasive paper specified in JIS R 6253 and wipe lightly with ethanol (95) specified in JIS K 8102. After drying, confirm that the index of water content is not more than 12 %⁽⁴⁾ and use for the test.

Note (4) Measure the index of water content by using a wood-water content meter.

- (2.1.11) Wood Plywood The pretreatment of wood plywood shall be as follows:
- (a) Cut the opening of the test panel by using abrasive paper or the like to make flat and round off the corners.
 - (b) Fall down fluffs and stains on the surface to be used for test by using number 280 of waterproof abrasive paper specified in JIS R 6253, and wipe lightly with ethanol (95) specified in JIS K 8102. After drying, confirm that the index of water content is not more than 12 % (4) and use for the test.
- (2.1.12) Asphalt Block Remove stains adhering on the surface to be used for test by using a soft brush or the like. At this time the panel having adhering matters impossible to be removed shall not be taken as the test panel.
- (3) Preparation of Sample After mixing the sample thoroughly by stirring at each time of test to make uniform immediately use. When skinning exist in the sample, remove the skins. In the case of liquid paint where the skins are thin and difficult to be removed, or skins are mixed in the paint, at first mix the content by stirring to make uniform, and then filter by using a standard sieve of 500 μm specified in JIS Z 8801 and then use for the test.
- (4) Mixing of Sample In the case of samples made one set by dividing several components and by putting into separate containers, mix by the ratio and the method specified in product Standard of sample. The mixture shall be used in the range of pot life time specified in product Standard.
- (5) Thinning Method of Sample The sample shall be thinned exclusively to the sample specified in product Standard of sample. When thinning, while mixing the sample by stirring, add little by little the reducer or thinner to make uniform. Use the reducer or thinner specified in product Standard of sample and dilute so as to become the viscosity specified in product Standard of sample. Record the mass ratio of the sample obtained herein and the reducer or thinner.
- (6) Fixing of Test Panel when Painting The fixing of test panel when painting shall be carried out as follows:
- (a) When the test panel moves, fix by a suitable method with placing the test panel between or fix by adhering.

- (b) In cases where dimension of test piece is smaller than 200 mm x 150 mm and the panel is coated by hanging with hand or both surfaces of test panel are coated, fix the one short side by placing between fingers or fix by clamping with a device and remain the fixed side in coating of approximately 10 mm in width. In the case of coating the both surfaces, coat to wrap to the edge excepting the coating remaining one side.
- (7) Application Method The application method for giving a coating of sample to the test panel shall be in accordance with the procedure from brush coating of (7.1) to spatula coating of (7.7), and the selection of coating method, coating amount and thickness of paint film, clearance of film applicator, etc. shall be in accordance with the specifications of product Standard of the sample. The environmental conditions during application, the coating method and the fixing and supporting methods for test panel are specified in Table 2.

Table 2. Environmental Conditions, Application Method,
Fixing and Maintaining of Test Panel

Coating method	Brush coating		Spray coating and airless spraying		Film applicator coating	Bar coater coating	Roller brush coating	Knifing
	Test panel of not less than 0.1 m ²	Test panel less than 0.1 m ²	Test Panel of not less than 0.1 m ²	Test panel less than 0.1 m ²				
Con- ditions								
Fixing and maintaining method of test panel.	Make the long side horizontally and incline the short side by approximately 85 degrees relative to the horizontal plane.	Not specified specially.	Stand the long side horizontally and the short side approximately vertically.	Stand the long side vertically as far as possible.	Place horizontally	Place horizontally	Place horizontally	Place horizontally
Environmental conditions	Temperature 20 ± 1°C, humidity 65 ± 5 %		Temperature 20 ± 5°C, humidity not more than 78%, wind velocity not more than 0.7 m.	Temperature 20 ± 1°C, humidity 65 ± 5 %				
Coating method	At first time: parallelly to long side At second time: parallelly to short side At third time: parallelly to long side At each time, the coating overlap between lines shall be not larger than 10 mm.	In accordance with the left method as appropriate, take care so as the paint film to become uniform thickness.	1. Parallelly to long side 2. In cases where not less than twice the coating is overlapped, make at right angles with the before time coating direction. 3. Spray so as not less than 10 cm of outside of each side of plate to be coated uniformly. 4. Make overlapping of coating between lines at each time so as to be 1/3 of coating width.	In accordance with the left method as appropriate, take care so as the paint film to become uniform thickness.	1. Parallelly to long side 2. Draw a length of approximately 150 mm in approximately 1 s.	1. Parallelly to long side 2. Draw a length of approximately 80 mm in approximately 1 s	1. At first, travel the roller in W letter shape. 2. Next re-circulate the roller densely. 3. At last, move the roller in a definite direction.	At first time: Parallelly to short side At second time: Parallelly to long side

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Table 2 (Continued)

Coating method Con- ditions	Brush coating		Spray coating and airless spraying		Film applicator coating	Bar coater coating	Roller brush coating	Knifing
	Test panel of not less than 0.1 m ²	Test panel less than 0.1 m ²	Test panel of not less than 0.1 m ²	Test panel less than 0.1 m ²				
Maintaining of test piece after completion of coating	Stand the long side similarly to the time when the long side is coated horizontally.	1. Place horizontally. 2. Stand the test piece to be immersed in liquid with fixing the upper end downward at the time of immersing.	Place the long side horizontally and stand the short side at approximately 85 degrees to the horizontal plane.	1. Place horizontally. 2. Stand the test piece to be immersed in liquid with fixing the upper end downward at the time of immersing.	Place horizontally	Place horizontally	Place horizontally	Stand the long side at approximately 85 degrees to the horizontal place.

(7.1) Brush Coating The brush coating shall be carried out as follows:

(7.1.1) Devices Brushes shall be flat brushes or Sujikai brushes made of soft hairs and run in using until hairs become not to be drawn out, clean sufficiently⁽⁴⁾ and use the brushes suitable for the sample.

An example of material quality, length, width and thickness of brush end part are shown in Table 3.

Table 3. An Example of Material Quality and Dimensions of Brush End Part

Unit: mm

Area of test panel	Sample	Material quality of brush end part	Dimensions of brush end part		
			Length	Width	Thickness
Test panel of 0.1 m ² min.	Water borne paint	Goat hairs	Approx. 40	Approx. 45	Approx. 15
	Paints other than water borne paints	Horse hairs	Approx. 45	Approx. 45	Approx. 20
Test panel less than 0.1 m ²	All kinds	Horse hairs	Approx. 20	Approx. 40	Approx. 5

Note ⁽⁴⁾ Wash the brush after using with thinner and dry to preserve.

(7.1.2) Quantity for Application The quantity of application of sample shall be the quantity specified in product Standard of sample. In the case where the quantity of application is specified by volume, measure the density of sample according to the specific gravity cup method shown in 4.6.2, obtain the mass of paint to be coated to the test plate at a ratio of specified quantity per 100 cm², and confirm the quantity for application according to the following either one method.

(a) After weighing the mass of test panel⁽⁵⁾, then apply to the test panel and again weigh the mass so as the difference from the test panel to be the specified mass.

Note ⁽⁵⁾ For weighing the mass use a trip balance (reciprocal sensibility 10 mg).

(b) Weigh out the sample into a small container and weigh the mass of brush and small type container, and after applying to the test panel, make the difference of these masses to become the specified mass.

(7.1.3) Application Method The application method shall be carried out as follows:

(a) In the case where the area of test panel is not less than 0.1 m², stand the long side of test plate so as to maintain horizontal, and to maintain the short side at approximately 85 degrees

relative to the horizontal surface and allow the sample on the surface to contain in the brush end part specified in (7.1.1). At first move the brush in parallel to the long side to coat approximately uniformly, then move in parallel to the short side to make even, at last move in parallel to the long side to make even, and coat uniformly so as to be quantity of application specified in (7.1.2).

At this time, move the brush at the same velocity, transport from one side through until other side and make the overlapping between lines approximately 10 mm. After completion of coating, stand the long side horizontally.

- (b) In the case where the area of test panel is less than 0.1 m^2 , while supporting the test panel so as to be horizontal by hand, coat similarly to (a) so as the paint film to be uniform. After completion of coating, place the panel horizontally with the coated surface upward. However, relating to the test panel to be tested by immersing in liquid, stand with making the upper end when immersing, down.

(7.2) Spray Coating The spray coating shall be carried out as follows:

- (7.2.1) Apparatus Select the spray gun suitable to the sample from those specified in JIS B 9809.
- (7.2.2) Measurements of Thickness of Paint Film Measure the thickness of paint film according to 3.5.
- (7.2.3) Preparation of Sample Dilute the sample to the viscosity specified in product Standard, if required, filter by using a sieve, Yoshino paper (made of long filaments suitable for filtration of paints), etc., and put into a container.
- (7.2.4) Place to Carry Out Spraying The place to carry out the spraying shall be in accordance with 3.1 (3).
- (7.2.5) Type of Spray Gun and Spraying Conditions The type of spray gun, nozzle opening diameter, spray air pressure, distance between the test plate and the spray gun, etc. shall be suitable for the sample so as the painting operation to be carried out under the good condition.
- (7.2.6) Coating Method The coating method shall be carried out as follows:
 - (a) In the case where the area of test panel is not less than 0.1 m^2 , stand so as the long side of test panel to be horizontal and the short side to be vertical approximately, and spray the sample by using a spray gun to coat uniformly. For coating the sample to the test panel, direct the air cap to the surface of test panel, keep the distance with the test panel at a range of 20 to 25 cm, and move the spray gun in parallel to the long side of test panel at a uniform speed. During this, make the main direction of mist of paint coming out from the spray gun always at right angles with the surface of test panel.

Further, make the section of mist so as the ellipse pattern to come out, and while making the major diameter of ellipse pattern

at right angles with the direction to move the spray gun, move the spray gun so as to coat the parts of not less than 10 cm in respective width outsides from the periphery of test panel and further so as the overlapping of each line mutually to become $1/3$ of pattern opening.

In the case where the coating is carried out with overlapping a certain number of times by spray coating, make the direction to move spray gun at each time respectively always so as to be at right angles with the before direction. However, in the case of coating in parallel to the short side, adjust the air cap so as the vertical section of mist of paint to go out uniformly in ellipse shape laterally long.

* Yoshino paper: Paper made of long filament to suitable for filtration of paints.

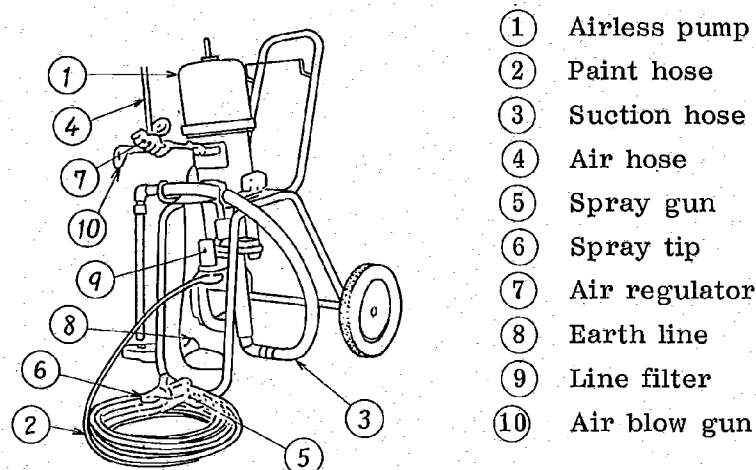
- (b) In the case of area of test panel less than 0.1 m^2 , the selection of spray gun, standing method of test panel, spray method, moving direction of spray gun, etc. may not be in accordance with this specification. For example, in some cases the long side of test plate is fixed vertically.

- (7.2.7) Conditioning of Test Piece Transfer the test piece completed with coating to a place kept at standard condition, stand the test piece of not less than 0.1 m^2 so as the long side to be horizontal and the short side to be approximately 85° degrees to the horizontal plane, and place test piece less than 0.1 m^2 horizontally with the coating surface upward. However, stand the test piece to be, immersed into liquid with its upper end at the time of immersion downward.

- (7.3) Airless Spraying The airless spraying shall be carried out as follows:

- (7.3.1) Apparatus The primary pressure, compression ratio, and nozzle tip of airless spray shall be selected according to the specification of product Standard of sample. An example of airless spray apparatus is shown in Fig. 3.

Fig. 3. An Example of Airless Spray Apparatus



- (7.3.2) Measurement of Thickness of Paint Layer or Paint Film The thickness of paint layer shall be measured according to 3.4 and the thickness of paint film, according to 3.5.
- (7.3.3) Preparation of Sample The sample, if required, shall be diluted with thinner and put into a container.
- (7.3.4) Environmental Conditions of Spray Booth The place where the spray is carried out shall be a place under the conditions of 3.1 (3).
- (7.3.5) Coating Method For coating of sample to a test plate, always keep the direction of spray gun at right angles with the test panel. Keep the distance with the test plate at a definite distance, and move the spray gun at a equal speed to the long side of panel. During this, make the main direction of mist of paint going out from the nozzle tip perpendicular to the panel surface.
Further, make the major diameter of pattern of mist section perpendicular to the direction to move the spray gun, and move the spray gun so as the whole test panel to be coated uniformly, so as the overlapping of each line mutually become $1/3$ of opening of pattern. In the case where overlapping coating is carried out by airless spray coating, make the moving direction of spray gun at each time perpendicular to the previous time direction respectively.
- (7.3.6) Conditioning of Test Piece Transfer the test piece completed with coating to a place kept at a standard condition, stand the test piece of not less than 0.1 m^2 so as the long side to be horizontal and the short side to be approximately 85 degrees to the horizontal plane, and place the test piece less than 0.1 m^2 horizontally with the coating surface upward. However, stand the test piece to be immersed in liquid with its upper end at the time of immersion downward.
- (7.4) Film Applicator Coating The film applicator coating shall be carried out as follows:
- (7.4.1) Device The film applicator shall be of shape shown in Fig. 4 and the one of dimensions of Table 4, used.

Fig. 4. An Example of Film Applicator

Unit: mm

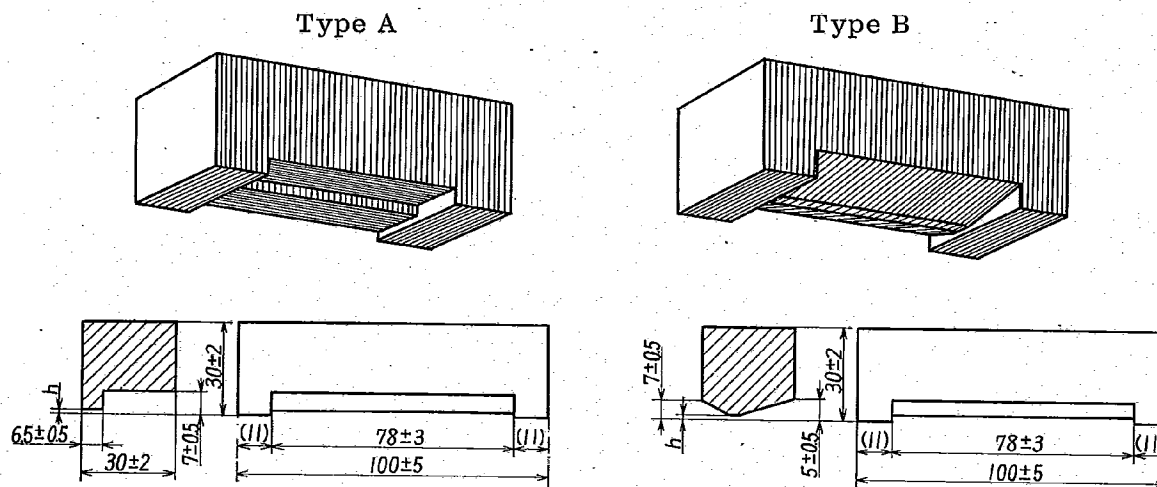


Table 4. Dimensions of Clearance (h) of Film Applicator

Unit: μm							
Clearance	75	100	125	150	200	250	500
Permissible deviation	± 2	± 3	± 3	± 4	± 4	± 5	± 5

(7.4.2) Measurement of Thickness of Paint Layer or Paint Film

The thickness of paint layer shall be measured according to 3.4 and the thickness of paint film, according to 3.5.

(7.4.3) Type of Film Applicator and Clearance For the type of film applicator and clearance (h), those specified in product Standard of the sample shall be used.(7.4.4) Coating Method Fix the test panel with the long side lengthwise and the short side laterally on a horizontal surface so as not to move.

Place a film applicator at a place near the short side forward the test panel in parallel to the short side, and spread the sample on the test plate just before it. With gripping the both ends of film applicator by fingers of both hands and while pressing the film applicator to the test panel, draw it to this side at once at a uniform speed. The drawing speed shall be such that that 150 mm is finished in drawing in approximately 1 s. After completion of coating, place horizontally with making the coated surface upward.

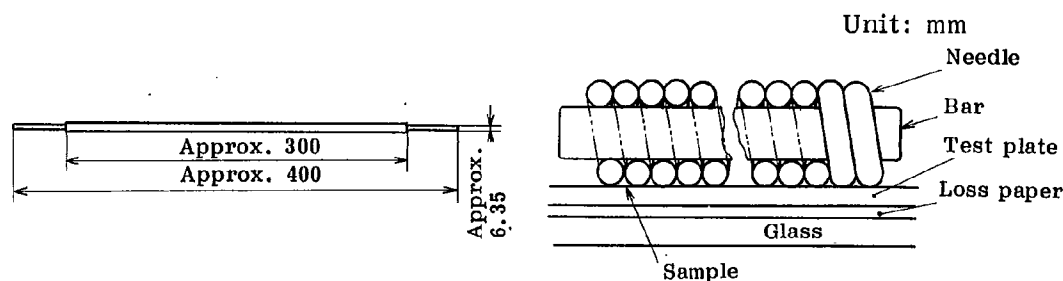
(7.5) Bar Coater Coating The bar coater coating shall be carried out as follows:

- (7.5.1) Device A bar coater of stainless steel bar of 6.35 mm approximately in diameter, and 400 mm approximately in length, wrapped without clearance with a wire of stainless steel shall be used. This is attached with a number⁽⁶⁾ according to the diameter of wire. For the types, there are 10, 12, 14, 16 48, 50, 56, 60, 70 numbers, etc. The condition of coating of bar coater is shown in Fig. 5.

Note ⁽⁶⁾ The number is expressed with diameter of wire by mill unit, and when using the one of large number, thick coating can be carried out.

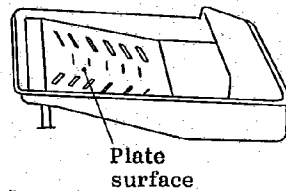
- (7.5.2) Measurement of Thickness of Paint Layer or Paint Film The thickness of paint layer shall be measured according to 3.4 and the thickness of paint film according to 3.5.
- (7.5.3) Type of Bar Coater The number of bar coater specified in the product Standard of sample shall be used.

Fig. 5. Condition of Caoting of Bar Coater



- (7.5.4) Coating Method Fix the test panel on a horizontal surface so as the long side to be lengthwise and the short side to be lateral and so as not to move. Place a bar coater at a position near the short side forward the test panel in parallel to the short side, and spread the sample just before the bar coater in band state in parallel. As to the moving method of bar coater, press the both ends by fingers of both hands so as the uniform force to be applied on the whole body of bar coater, and draw to this side at a uniform speed without rotating. The drawing speed shall be such as to finish 80 mm in approximately 1 s. After completion of coating, place horizontally with the coated surface upward.
- (7.6) Roller Brush Caoting The roller brush coating shall be carried out as follows:
- (7.6.1) Device
- (a) Roller Brush A roller brush specified in JIS Z 9024.
- (b) Tray An example of tray (dish state container) is shown in Fig. 6.

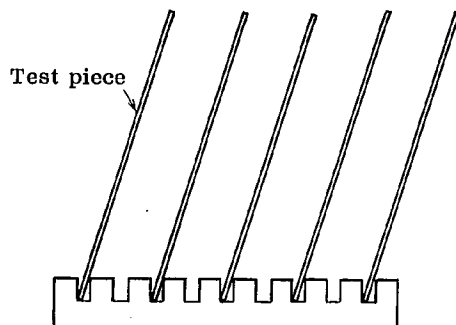
Fig. 6. An Example of Tray



- (7.6.2) Quantity for Application The calculation and confirmation of mass required for coating of sample shall be carried out according to (7.1.2).
- (7.6.3) Coating Method Put the sample into a tray, immerse a roller brush to about 1/2 in the sample, roll on the tray several times to permeate the sample into the roller brush. Further, roll the roller brush on the paper surface or veneer plate to become accustomed to the sample. Again attach the sample, roll on the tray to contain the sample uniformly and then coat. Place the test panel horizontally, move lightly the roller brush on the test panel in W letter shape to spread the sample on the test panel, reciprocate in small amounts the roller brush to spread by coating the sample and at last move the roller brush in a definite direction to arrange the coating surface. At first place the roller brush lightly on the test panel, and then use by applying gradually a force.
- (7.7) Knife Coating The knife coating shall be carried out as follows:
- (7.7.1) Device The spatula shall be made of Japanese cypress, metal or plastic, of which top is soft and approximately 60 mm in width, be used. Because a new spatula made of Japanese cypress absorbs the solvent, for test a spatula accustomed to use should preferably be used.
- (7.7.2) Method of Knifing Place a test panel horizontally, incline the spatula by approximately 45 degrees to the test panel, and while moving in parallel to the short side of plate, coat the sample to a uniform thickness. Then stand the spatula, while moving in parallel to the long side of panel, draw on the surface of sample to make flat and make accustomed to it. At this time move the spatula at the same speed, travel from one short side to another short side, and when becoming accustomed to the next line make the overlapping with the previous line approximately 10 mm.
- Stand the test piece completed with coating with the coating surface upward to keep the short side horizontal and keep the long side at approximately 85 degrees to the horizontal surface.
- (8) Drying Method The drying method shall be as follows:
- (a) In the Case of Natural Drying Dry under the standard condition according to 3.1. The drying time and conditioning time might be specified in product Standard.

- (b) In the Case of Baking Dry in a thermostatic oven according to 3.2. The baking temperature and baking time shall be in accordance with the specification of product Standard of sample.
- (9) Coating Wrapping and Holding of Periphery of Test Piece The coating wrapping and holding of periphery of test piece shall be as follows:
- (9.1) Coating Wrapping of Periphery In the case of coating the sample to the test panel to be tested with immersing in liquid, when the test panel is glass plate coat on the single side, when the test panel is other than glass panel coat the sample on the both side or coat the sample on the surface, and coat-wrapping the back surface with a paint or material having no influence on the test. As to the test piece coated on both sides of test panel, after the coating surfaces having dried coat-wrapping the periphery with the material specified product Standard of sample. When coating wrapping, the width of coating overlapping shall be approximately 5 mm.
- (9.2) Holding of Test Piece For holding by standing the test piece, stand on a test piece stand as shown in example of Fig. 7 or stand by clamping with fittings. For fixing horizontally the test piece coated on both surfaces, the side remaining uncoated shall be clamped with fittings.

Fig. 7. Example of Test Piece Stand



3.4 Measurement of Wet Film Thickness

- (1) Summary The thickness of coated paint layer is measured by using a wet film thickness gauge of rotary type or comb type.
- (2) Devices The devices, depending upon the thickness of object paint layer, select the type and measuring range suitable for the purpose to use.
- (a) Wet Film Thickness Gauge of Rotary Type At both sides supporting rings of 50 mm in diameter, at the middle part an eccentric ring, at both ends of rotary shaft of supporting centre, grips for holding shall be provided, and the eccentric ring and the support ring are integral.

According to rotation the distance between the eccentric ring at the middle and the base varies. The middle eccentric ring contacts the surface of paint layer, the graduation at the position when begins adhering to eccentric ring of paint indicates the thickness of paint layer. An example of device is shown in Fig. 8 and the principal figure, in Fig. 9.

Fig. 8. An Example of Wet Film Thickness Gauge of Rotary Type

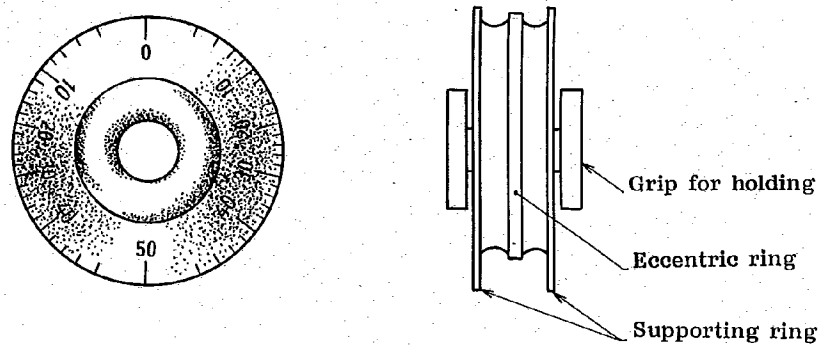
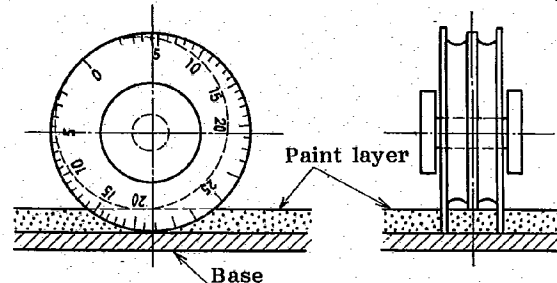


Fig. 9. Principle Figure of Wet Film Thickness Gauge of Rotary Type



- (b) Wet Film Thickness Gauge of Comb Type The palte having continuous several concave-and-convex parts at the periphery, and the convex part at the intermediate part is made at inside from convex part at both ends. At the respective convex parts, the distance from the line connected the convex parts at both ends are marked and scratched. The heights at both ends are equal, and the intermediate convex part is apart by the distance of marked numerical value from the line connecting the both ends. The numerical value of not more than the marked numerical value of adhered paint indicates the thickness of paint layer. An example of device is show in Fig. 10 and the principle figure is shown in Fig. 11.

In the case of Fig. 11, the paint adheres from the tooth of 35 μm to part of tooth of 50 μm , and therefore, the paint film thickness can be measured as not less than 50 μm and less than 55 μm .

Fig. 10. An Example of Wet Film Thickness Gauge of Comb Type

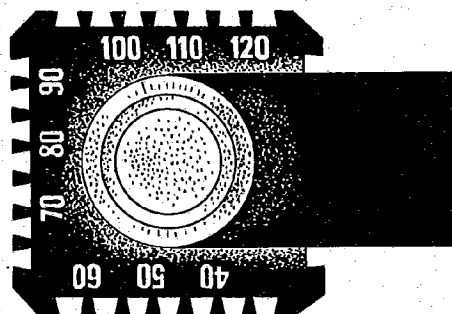
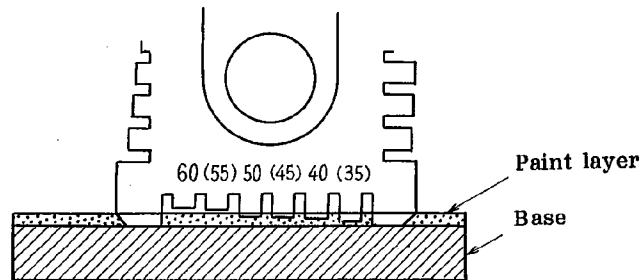


Fig. 11. Principle Figure of Wet Film Thickness Gauge of Comb Type



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

(3.1) In the Case of Rotary Type

- (a) Hold the grip for holding, apply lightly the holding ring with the side having marking of the minimum digit upward, and with the side having marking of the maximum digit downward to the paint film of measuring object uniformly.
- (b) At first rotate by $1/2$ revolution⁽¹⁾ toward the minimum digit, then hold up at other place using the remaining circumference in reverse direction, and rotate by $1/2$ revolution toward the minimum digit⁽²⁾⁽³⁾.

Notes ⁽¹⁾ Measure by slowly rotating at a definite speed so as the paint film of measuring object not to be pushed off by eccentric ring or not to be overlapped.

⁽²⁾ The measurement on such base that gives influence on the distance between the support ring and the eccentric ring can not be carried out.

⁽³⁾ In the case of measuring the uneven surface such as internal and external surface of pipe, measure by rotating the circular circumferential line direction.

- (c) Read out the numerical values at the place where the paint at first begins adhering and at the cut of adhering paint, and take the average value of two numerical values as the measured value.

(3.2) In the Case of Comb Type

- (a) Hold the middle part of wet film thickness gauge of comb type, and in the case of the one with handle, hold the handle, and lightly apply so as to be vertical to the paint layer of measuring objective⁽⁴⁾.

Note ⁽⁴⁾ In the case of uneven surface such as internal and external surface of pipe, or the like, measure on the line at right angles with the circumferential direction.

- (b) Read out the maximum value at a portion where the paint adhered and take it as the measured value.
- (4) Record Record the name, type, measuring range of used measuring instrument, minimum graduation, each measured value, average value, the maximum value and minimum value.

3.5 Measurement of Dry Film Thickness

- (1) Summary The thickness of dry film is measured by using either one of the electromagnetic film thickness gauge, eddy current film thickness gauge or micrometer callipers for external measurement.
- (2) Apparatus and Materials The apparatus and materials shall be as follows:
- (a) Electromagnetic Type Film-Thickness Gauge Measure the thickness of nonmagnetic paint film coated on iron base (including ferrite stainless steel) by converting the variation of alternative field generated on the probe⁽¹⁾ by alternating current circuit, generated by the distance from the iron base to the paint film. An Example of apparatus is shown in Fig. 12 and the principle figure is shown in Fig. 13.

Note ⁽¹⁾ The measuring surface of probe and the magnetic poles are kept always clean.

Fig. 12. An Example of Electromagnetic Type Film Thickness Gauge

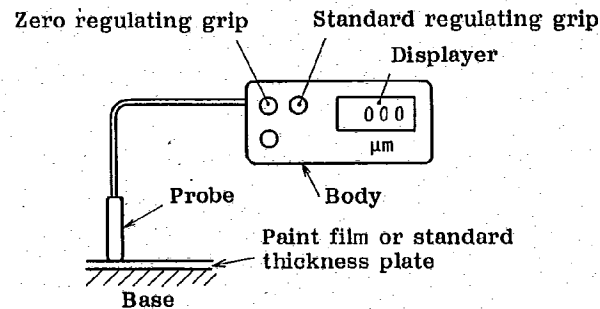
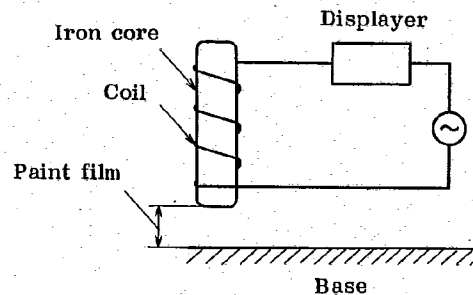


Fig. 13. Principle Figure of Electromagnetic Type Film Thickness Gauge



- (b) Eddy Current Type Film Thickness Gauge Measure the thickness of paint film on nonferrous metallic base by using the change of eddy current introduced on the surface of base metal when flowing high frequency current into a probe generated by the distance between the probe⁽¹⁾ and the base. An example of apparatus is shown in Fig. 14 and the principle figure is shown in Fig. 15.

Fig. 14. An Example of Eddy Current Type Film Thickness Gauge

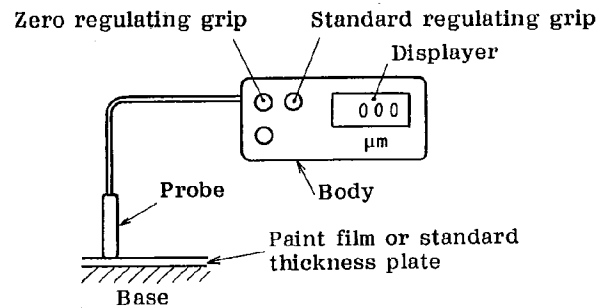
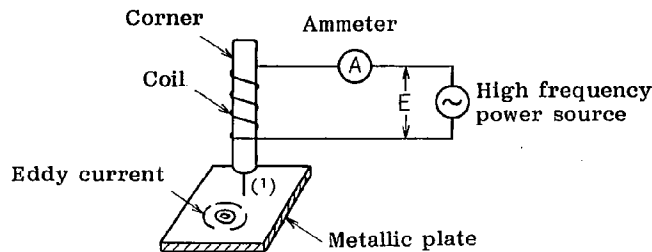


Fig. 15. Principle Figure of Eddy Current Type Film Thickness Gauge



- (c) Micrometer Callipers for External Measurement The micrometer callipers for external measurement specified in JIS B 7502 shall be used.
- (d) Base Plate The base plate which is required for zero regulation and standard regulation and of the same quality and same thickness as the test plate used for the test piece shall be used.
- (e) Standard Thickness Plate The standard thickness plate attached to the measuring apparatus.
- (3) Operation The operation shall be carried out as follows:
- (3.1) In the Case of Electromagnetic Type or Eddy Current Type

- (a) Zero Regulation and Standard Regulation Apply a probe⁽¹⁾ to the base plate⁽²⁾⁽³⁾⁽⁴⁾⁽⁵⁾, after coinciding the zero point by zero regulating grip, place a standard thickness plate near the film thickness to be measured on the base plate, apply the probe⁽¹⁾ from above this⁽³⁾⁽⁴⁾⁽⁵⁾, coincide the thickness of standard thickness plate by standard regulating grip, and repeat the above-mentioned operation until the error of zero point disappears.

Notes (2) Because at the back side of specially thin base if the magnetic substance such as nickel plating, and the like exist, the error on the measured value may be caused in some cases, and therefore cares shall be taken.

(3) In the case of soft paint film and the like, use a constant pressure type probe or such jigs as to be capable of obtaining the constant pressure.

(4) At the time of regulation and measuring, press lightly at a definite force to apply to the measuring surface.

(5) At near the end parts, corner parts and protrusions, because error may be generated on the measuring value in some cases, cares shall be taken.

Further, in the case of double pole type probe⁽¹⁾, measure with the measuring direction changed by 90 degrees and use the mean value.

- (b) Measurement Apply a probe⁽¹⁾ to the paint film surface of test piece⁽³⁾⁽⁴⁾, and read out the displayed film thickness value. Measure at three places per one sheet of test piece.

- (c) Record Record the minimum value, maximum value and average value.

(3.2) In the Case of Micrometer Callipers for External Measurement

- (a) Loosen the clamp so as the thimble to be able to be rotated⁽⁶⁾.

After wiping with gauze, deer skin, or good quality paper the measuring surface of anvil and spindle, rotate the thimble to bring the measuring surface of anvil and spindle in contact. At this time rotate the ratchet stop, and when the ratchet sound generated 4 to 5 times, confirm that the scale of veneer indicates zero point.

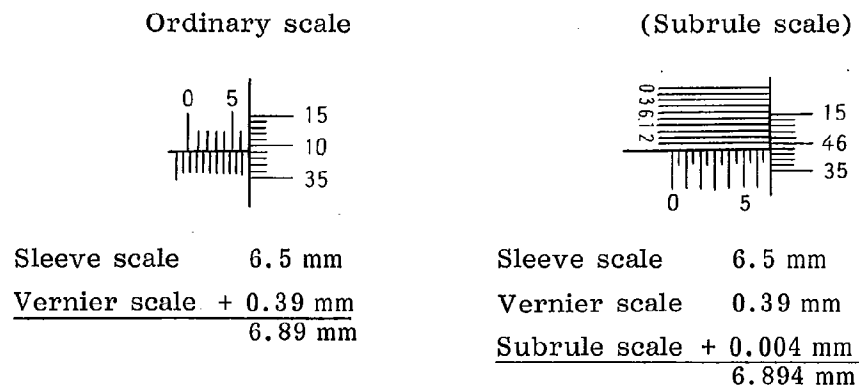
In case where zero point is not indicated, the part may be corrected.

- (b) Next, while rotating the thimble return the spindle, place the test piece between the anvil and the spindle, and while rotating the thimble push out the spindle slightly before this side⁽⁷⁾.

Rotate ratchet stop to press out the spindle until ratchet sound is caused four or five times.

- Notes (6) It shall not give the body strong impact, nor rotate the thimble ratchet stop while the clamp is fastened.
- (7) The measurement, when the frame of micrometer callipers is fixed to the stand, is easy in operation.
- (c) For measurement, read out the scale of sleeve and vernier and scale of subrule. The reading method of scales shall be as shown in Fig. 16.

Fig. 16. Reading Out of Scale



- (d) Measure at three portions of test piece and one portion having no paint film and record them(8).

Informative Reference: After completion of measurement, wipe the anvil and spindle with a gauze, thereafter coat rust preventive oil, place a rust preventive paper between the both measuring surfaces or place a slight clearance to fasten the clamp, fix the thimble and then wrap the body with a oil paper to preserve.

From the average value of three portions of paint film surface, subtract the measured value at the portion having no paint film and take it as the thickness of paint film.

3.6 Samples and Scales for Evaluation When evaluating the quality of paint and paint film, samples and scales for evaluation specified in product specification are used to evaluate as objectively as possible on the test items to be evaluated by sensory test.

The samples and scales for evaluation are divided into the following two types: The evaluation sample (paint sample or film sample) used for comparing with each test sample and the evaluation scale, for determining the quality grade by each test item.

3.6.1 Evaluation Sample (or Eval. Sample)

- (1) **Summary** The division, effective period, control, renewal, etc. of the evaluation sample specified to evaluated by comparing with it in each product specification, are specified.

- (2) Classification of Evaluation Sample The evaluation sample shall be divided as follows according to its form, approval system and quality level.

And in case of specifying the evaluation sample in product specification, the required combinations shall be specified out of these divisions.

- (2.1) Division by Form The evaluation sample shall be divided into the following two types according to its form.

- (a) Paint Sample The evaluation results on the test items other than the item⁽¹⁾ specified to evaluate by comparing with the evaluation sample in each product specification, shall conform to the specification.

However, it may be the composition table of such a paint that can give the expected performance on the test items specified in each product specification.

Note ⁽¹⁾ In case of using for weather resistance, the evaluation sample previously confirmed its quality level according to accelerating test, etc. shall be used and the weather resistance of itself may be confirmed after the fact.

- (b) Film Sample The film sample shall be used for the colour sample⁽²⁾ or for evaluating appearance of film such as gloss, pattern, texture, etc. and which shall be prepared or approved by an official testing agency, prepared in accordance with the agreement between the parties concerned or using the paint registered previously as evaluation sample by its manufacturer.

Note ⁽²⁾ Colour samples shall be made of coloured materials as little in discoloration as possible and if the surface conditions are close to those of the objective paint, it may not be necessary to be made of the same material that of the objective paint.

Informative Reference: As the typical colour sample, there are "JIS Standard Colour Chart", "Standard Colour Sample Chart" by Japan Paint Industry Association, etc.

- (2.2) Division by Approval System The evaluation sample shall be divided into the following three types according to its approval system.

- (a) Approved Sample The approved sample shall be specified in Japanese Industrial Standard of product and prepared or approved in accordance with the approval test at an official testing agency.
- (b) Agreed Sample The agreed sample shall be preliminarily approved in accordance with the agreement between the parties concerned and applied to only the parties concerned.

- (c) Manufacturer's Sample The manufacturer's sample shall be preliminarily prepared and registered by a manufacturer as the evaluation sample which gives the adequate quality level, and applied to the products for many and unspecified user's.

Reference Example: Paint sample or colour sample for trade use.

- (2.3) Division by Quality Level The evaluation sample shall be divided into the following two types according to its quality level.

- (a) Standard Sample The standard sample shall be the sample giving the central (average) quality of test samples.

Reference Example: The evaluation sample to use for evaluating the colour of gloss of a test film.

- (b) Boundary Sample The boundary sample shall be the evaluation sample giving the permissible limit of the quality of test samples.

Reference Example: The evaluation sample to use for evaluating the degree of unevenness in colour and gloss, brushmarks, sagging or wrinkling of a test film.

- (3) Effective Period of Evaluation Sample The effective period of evaluation sample shall be specified as follows according to its form.

- (3.1) Paint Sample The effective period shall be the period specified in each product specification respectively. However, unless otherwise specified, it shall be 6 months.

- (3.2) Film Sample The effective period shall be the period specified in each product specification respectively. However, unless otherwise specified, it shall be one year.

- (4) Control and Renewal of Evaluation Sample The control and renewal of evaluation sample shall be carried out as follows.

- (4.1) Control of Evaluation Sample

- (4.1.1) Evaluation sample shall be used for giving a certain quality level at evaluating and therefore kept at such an adequate place that the quality of the sample does not change during its effective period.

- (4.1.2) In order to make clear the hysteresis of the selected evaluation sample, the following items shall be recorded.

- (a) Types of evaluation sample

Form: Paint sample, Film sample

Approval system: Approved sample, Agreed sample,
Manufacturer's sample

Quality level: Standard sample, Boundary sample

- (b) Product specification and test items to be used
- (c) Date of manufacture and registration
- (d) Effective period
- (e) Registrant and controller
- (f) Others required for control

Reference Example: Keeping conditions and place

(4.2) Renewal of Evaluation Sample

(4.2.1) Paint Sample

- (a) The paint sample for renewal shall be prepared until one week prior to expiration of the effective period.
- (b) When preparing the paint sample, the same paint as close in quality as possible to the one before renewal shall be prepared so as not to make its quality different.

The paint sample to be used for a long period performance test shall be previously confirmed for its quality according to accelerated test and the long period performance test of itself may be confirmed after the fact.

In case of selecting from the production process of a manufacturer, the following cares shall be taken: To select from the batch having the average quality among batches and for the test items capable of numerical evaluation to determine previously the control level (tolerance) to make the difference in quality between before and after renewal as little as possible.

(4.2.2) Sample Film

- (a) The sample film for renewal shall be prepared until one week prior to expiration of the effective period.
- (b) When preparing the film sample, the sample as close in quality as possible to the one before renewal shall be prepared not to make its quality different.
- (c) For the test items capable of numerical evaluation, for example, colour difference, specular gloss, etc., the control level (tolerance) according to the numerical value shall be previously determined.

- (5) Conditions to Be Specified in Product Specification The conditions to be specified in product specification shall be specified as follows:

- (a) Type of evaluation sample (Form, Approval System, Quality Level)
- (b) Effective period
- (c) Test items to be used in product specification

3.6.2 Evaluation Scale

- (1) Summary The division, effective period, control, etc. of the evaluation scale used for determining the quality grade when evaluating mainly defects of a test film, are specified.
- (2) Division of Evaluation Scale The evaluation scale shall be divided as follows:
 - (a) The evaluation scale specified in Japanese Industrial Standard.
Reference Examples 1. JIS L 0804
2. "Photograph for Evaluation" specified in 9.6 of JIS K 5400
3. "Rating number standard chart" specified in Appendix of JIS Z 2371
 - (b) The evaluation scale prepared by an official testing agency.
Reference Example: "Standard for Evaluation of Paint Film" made by Japan Paint Inspecting Association
 - (c) The evaluation scale in accordance with the agreement between the parties concerned.
- (3) Effective Period of Evaluation Scale The effective period of evaluation scale, unless otherwise specified, shall be until discoloration, staining or breaking occurs. However, in case that the evaluation scale is revised, it shall be renewed with the revised one.
- (4) Control of Evaluation Scale The control of evaluation scale shall be carried out as follows.
 - (4.1) Evaluation sample shall be used as the scale for determining the quality grade at evaluating a test sample and kept at such an adequate place that the quality of the scale does not change during its effective period.
 - (4.2) The following matters shall be recorded in order to make clear the hysteresis of the evaluation scale.

- (a) Name and type (photograph, chart, etc.) of evaluation scale
- (b) Evaluation items and product specification to be used
- (c) Manufactured and purchased date
- (d) Registrant and controller
- (e) Others required for control

Reference Example: Determining method for discoloration of evaluation scale

- (5) Conditions to Be Specified in Product Specification They shall be as follows:

- (a) Division or type
- (b) Effective period
- (c) Test items to be used

4. Test Methods for Characteristics of Paints at Package Condition

4.1 Condition in Container

- (1) Summary Examine whether the paint in the container has become suitable condition to use or not by contact feeling when mixing by stirring by using a spatula or rod.
- (2) Operation and Evaluation The operation and evaluation shall be carried out as follows:

- (a) In the Case of Liquid Paint Open the opening of container, if on the surface skinning is found, after removing it, examine by mixing by stirring the content with a spatula or rod.

Even a part of component is precipitated on the bottom of container, but there is no specially rigid lump, after loosening out the precipitates by rubbing little by little the bottom part, mix by stirring and when the whole content becomes uniformly easily, take it as "when mixing by stirring it becomes uniform without lump". However, in the case of synthetic resin emulsion pattern paint of the type in which the gel phase and solid phase are dispersed in dispersion medium, examine whether the size of dispersed gel particles and solid grains including the density distribution become uniform or not.

(b) In the Case of Paste Paint Open the opening of container, if skinning is found on the surface, remove this and thereafter examine the state of content by inserting a spatula or rod to move. If the content is soft, the lump is not felt and approximately uniform, take it that "without lump it is uniform". Even a part of liquid component is divided into the upper layer, when mixing by stirring the whole content, it becomes uniform, similarly take it that "without lump it is uniform".

(c) In the Case of Paint Separatable Solid Content Easily Open the opening of container, when skinning is found on the surface, remove it. Then, examine whether becomes uniform or not by mixing the precipitated component on the bottom by kneading with a spatula or rod.

In this operation the precipitated component on the bottom becomes uniform, take it that "if mix by kneading it becomes uniform".

4.2 Transparency

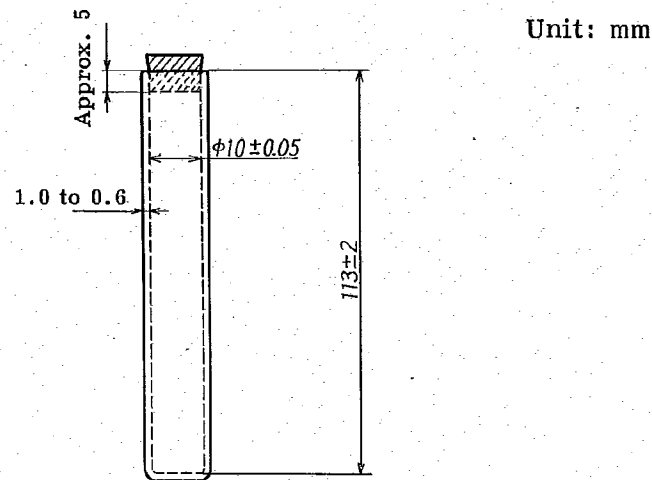
- (1) Summary Examine the turbidity due to water, dust, foreign matters, separated matters, etc. in a transparent paint (reducing liquid, clear, varnish) and examine existence of turbidity due to separation of liquid phase.
- (2) Devices Two Test Tubes of approximately 15 mm x 150 mm, colourless, transparent, having equal bore and wall thickness.
- (3) Eval. Sample The eval. sample shall be the paint sample specified in product Standard.
- (4) Operation Respectively mix by stirring the sample and eval. sample, immediately put into individual test tubes up to approximately 100 mm in depth, arrange these in contact with each other, and view from the side face transparently under the diffuse daylight.
- (5) Evaluation When the sample is not inferior to eval. sample in transparency, and when floats, precipitates and separation of liquid phase are not found, take it that "it is transparent".
- (6) Specified Conditions of Product Standard Evaluation Sample

4.3 Colour Number (Gardner)

- (1) Summary Express the density of colour of boiled oil, oil varnish, etc. by the nearest number of the Gardner colour standard solution most resembled in the colour.
- (2) Devices Gardner Colour Number Tubes The gardner colour number tubes⁽¹⁾ shall be of colourless transparent glass tubes as shown in Fig. 17, made of one set of 18 tubes attached with colour numbers of 1 up to 18 and in tubes attached with respective colour number the gardner colour standard solutions⁽²⁾ of composition shown in Table 5 are contained.

The colour numbers of iodine standard solution equal in density of gardner colour standard solution shall be in accordance with Informative Reference Table.

Fig. 17. Gardner Colour Number Tube



- Notes (1) A tube of 10 ± 0.05 mm in bore may be used instead. In that cases, for all standard solutions and samples the tubes of the same bore shall be used.
- (2) The colour of gardner colour standard solution, when the transmitted light is measured with the layer of solution making 1 cm according to the method specified in JIS Z 8722, the chromaticity coordinates shall comply with the numerical values of Table 5.

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Table 5. Composition of Gardner Standard Colour Solution and Chromaticity Coordinates

Colour number	Potassium chloro-platinate solutive ⁽³⁾	Iron cobalt solution			Chromaticity coordinates	
	Dissolve potassium hexachloro-platinate(IV) in hydrochloric acid (0.1 mol/l) (Potassium chloro-platinate) g	Iron chloride solution ⁽⁴⁾ ml	Cobalt chloride solution ⁽⁵⁾ ml	Hydrochloric acid (1+17) ml	x	y
1	0.550				0.3190	0.3271
2	0.865				0.3241	0.3344
3	1.330				0.3315	0.3456
4	2.080				0.3433	0.3632
5	3.035				0.3578	0.3820
6	4.225				0.3750	0.4047
7	6.400				0.4022	0.4360
8	7.900				0.4179	0.4535
9		3.8	3.0	93.2	0.4338	0.4648
10		5.1	3.6	91.3	0.4490	0.4775
11		7.5	5.3	87.2	0.4836	0.4805
12		10.8	7.6	81.6	0.5084	0.4639
13		16.6	10.0	73.4	0.5395	0.4451
14		22.2	13.3	64.5	0.5654	0.4295
15		29.4	17.6	53.0	0.5870	0.4112
16		37.8	22.8	39.4	0.6060	0.3933
17		51.3	25.6	23.1	0.6275	0.3725
18		100.0	0.0	0.0	0.6475	0.3525

- Notes (3) Potassium Chroloplatinate Solution Take hydrochloric acid (0.1 mol/l) 1 l, dissolve in this the potassium hexachloroplatinate (IV) of quantity shown in Table 5 to prepare.
- (4) Iron Chloride Solution Take iron (III) chloride ($\text{FeCl}_3 \cdot \text{H}_2\text{O}$) approximately 25 g, add hydrochloric acid (1 + 17) 6 ml to dissolve, and add hydrochloric acid (1 + 17) so as to be equal to the colour of solution immediately after dissolving potassium dichromate 3.0 g in sulphuric acid (specific gravity 1.84) 100 ml to prepare.
- (5) Cobalt Chloride Solution Take cobalt (II) chloride ($\text{CoCl}_2 \cdot 6 \text{H}_2\text{O}$) 100 g, add hydrochloric acid (1 + 17) 300 g and dissolve to prepare.
- (3) Operation Put a sample into a blank gardner colour number tube, arrange in contact with the gardner colour number tube containing the gardner colour standard solution, view under the diffuse daylight through from the side face, and compare the colours relating to the part of the same thickness as that of the liquid layer. However, instead of gardner colour number tube containing standard colour solution, a colour glass⁽⁶⁾ of equal colour may be used.
- (4) Evaluation The evaluation shall be by colour number of the gardner standard colour solution equal in density to the colour of sample. When the colour of sample is thinner than the colour of gardner colour standard solution, it shall be taken that "the colour number is small".

Note (6) As for the colour glass plate, there are heligvarnish colorimeter, and the like. There is a heligvarnish colorimeter marked by colour number corresponding to the gardner colour standard. In this case, the glass plate and the standard colour solution are in some degrees different in hue, and therefore the colour numbers of the both might not coincide accurately.

In the case of heligvarnish colorimeter, append the colour number to the test record.

Informative Reference: The gardner colour standard solution and the colour number of iodine standard of the equal brightness of colour are shown in informative reference Table.

Informative Reference Table Colour Number of Iodine Standard Solution Equal to Gardner Colour Standard Solution in Colour Brightness

Colour number of gardner colour standard tube	1	2	3	4	5	6	7	8	9
Colour number of iodine standard solution	1.3	1.9	2.4	3.1	4.3	7.2	9.0	12.0	20.4

Informative Reference Table (Continued)

Colour number of gardner colour standard tube	10	11	12	13	14	15	16	17	18
Colour number of iodine standard solution	40.3	70.3	105	133	182	243	343	425	540

4.4 Spot Test of Thinners and Solvents

- (1) Summary Examine whether in the reducer such substances that remains stains after evaporation are included or not.
- (2) Material Filter Paper The filter paper of class 1 specified in JIS P 3801 having diameter of 110 mm.
- (3) Operation The operation shall be carried out as follows:
 - (a) Drop the sample of approximately 0.2 ml on the filter paper made horizontal by supporting the edge, make the part so as not to touch the device, and stand as it is for 2 h to evaporate the sample.
 - (b) Examine existence of stains visually on the part where the sample is dropped.
- (4) Evaluation When confirmed no stain, take it as "no stain remains".

4.5 Viscosity For evaluation of flow ability of paint, measure the viscosity to be resistance to flow of liquid by using a viscometer. This viscosity measurement shall be carried out by selecting the suitable method out of the methods of Table 6 according to the state of paint and measuring purpose.

Table 6. Measuring Methods for Viscosity

	Type of measuring method	State of paint	Unit
4.5.1	Gardner viscometer method	Transparent paint	Alphabete symbol or stokes
4.5.2	Stormer viscometer method	Non-Newton liquid	KU value
4.5.3	Brookfield type viscometer method	Newton or non-newton liquid	mPa·s (cP)
4.5.4	Ford cup No. 4 method	Diluted comparatively low viscosity paint	s

4.5.1 Gardner Viscometer Method

- (1) **Summary** By comparing the foam rising speed by using a standard viscosity tube preliminarily sealed in with the kinematic viscosity for measuring transparent paints such as clear, varnish, etc. and by using a viscosity tube of the same size sealed in with the sample, and from the kinematic viscosity of corresponding standard viscosity tube obtain the kinematic viscosity of sample.
- (2) **Apparatus and Devices** The apparatus and devices shall be as follows:
- (2.1) **Gardner Viscometer** The Gardner viscometer shall be constituted of the following standard viscosity tube and the viscosity tube for measurement.
- (a) **Standard Viscosity Tube** The standard viscosity tube shall be a hard glass tube sealed in with viscosity standard liquid and air, make 41 pieces from A 5 (0.00505 stokes) up to Z 10 (1066 stokes)⁽¹⁾ as a set, of which shape is shown in Fig. 18 and of which dimensions are shown in Table 7.
- (b) **Viscosity Tube for Measurement** Shapes and dimensions of viscosity tube for measurement shall be as given in Fig. 18 and Table 7.

Fig. 18. Viscosity Tube used for Gardner Viscometer

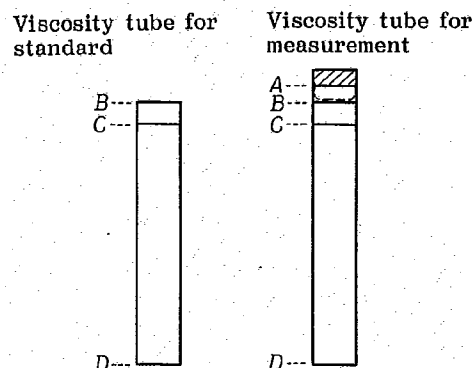


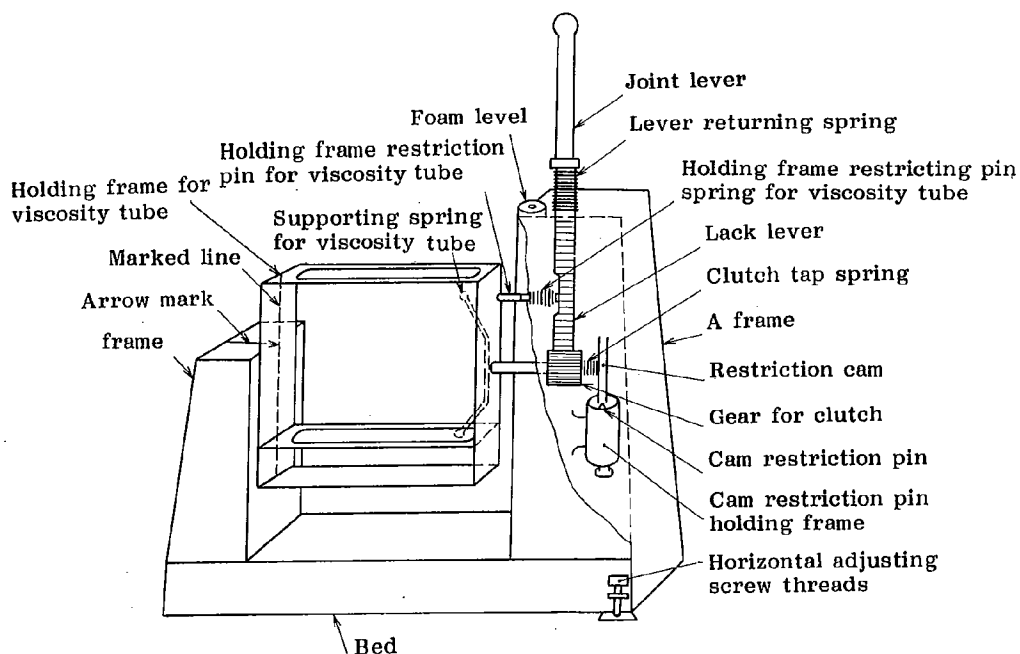
Table 7. Dimensions of Viscosity Tube used for Gardner Viscometer Method

Unit: mm

	Viscosity tube for standard	Viscosity tube for measurement
Bore	10.65 ± 0.05	10.65 ± 0.05
External diameter	13.0 ± 0.1	13.0 ± 0.1
A to B	—	Approx. 5
B to C	8 ± 1	8 ± 1
C to D	100.0 ± 0.5	100.0 ± 0.5

- (2.2) Thermometer The thermometer symbol VIS of Thermometer number 17 specified in JIS B 7410.
- (2.3) Thermostatic Water Tank A thermostatic water tank capable of keeping a definite temperature $\pm 0.5^{\circ}\text{C}$, having such depth that the liquid surface of water becomes higher the liquid surface of sample.
- (2.4) Stand An example of stand is shown in Fig. 19.

Fig. 19. An Example of Stand



Note (1) The relation between the viscosity standard liquid symbol and the Stokes shall be as given in Table 8.

- (3) Operation The operation shall be carried out as follows:
- Enter the sample up to the C line of viscosity tube for measurement, and remaining the space from C line to B line, apply exclusive use cork stopper (hereinafter referred to as sample tube).
 - Select 2 to 4 viscosity tubes for standard near the rising speed of foam of sample tube, and stand as it is in a thermostatic water tank kept at a temperature of $25 \pm 0.5^{\circ}\text{C}$ (2) for not less than 30 min.

- (c) Arrange the standard viscosity tube and sample tube on a stand, rotate the stand by 180 degrees to raise the foam at the bottom of viscosity tube, and arrange the liquid surface in the standard viscosity tube and the height of liquid surface in the sample tube.
- (d) Again rotate by 180 degrees to return to the original position, and compare the rising speed of standard viscosity liquid and foam of sample liquid in the sample tube.

Note (2) According to agreement between the parties concerned, the measuring may be carried out at a temperature of $20 \pm 0.5^\circ\text{C}$. However, in that case, for the thermometer, use thermometer symbol VIS, thermometer number 16 and describe in the test results that the measurement is carried out at 20°C .

- (4) Evaluation Examine the symbol of standard viscosity tube nearest to the sample in rising of foam; and express the kinematic viscosity by alphabet symbol or its stokes.

Table 8. Relation between Viscosity Standard Solution Symbol and Stokes

Symbol	Stokes	Symbol	Stokes	Symbol	Stokes
A 5	0.00505	K	2.75	Z	22.7
A 4	0.0624	L	3.00	Z 1	27.0
A 3	0.144	M	3.20	Z 2	36.2
A 2	0.220	N	3.40	Z 3	46.3
A 1	0.321	O	3.70	Z 4	63.4
A	0.50	P	4.00	Z 5	98.5
B	0.65	Q	4.35	Z 6	148
C	0.85	R	4.70	Z 7	388
D	1.00	S	5.00	Z 8	590
E	1.25	T	5.50	Z 9	855
F	1.40	U	6.27	Z 10	1 066
G	1.65	V	8.84		
H	2.00	W	10.70		
I	2.25	X	12.9		
J	2.50	Y	17.9		

4.5.2 Stormer Viscometer Method

- (1) Summary Put a sample into a definite container, rotate the wing of specified dimensions by the force of weight to be fallen freely, and from its rotary speed obtain the viscosity (KU value) of sample.