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**Testing methods for fluoroplastic
coating film on metal substrate**

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Contents

	Page
Introduction.....	1
1 Scope.....	1
2 Normative references	1
3 Terms and definitions	2
4 Test methods	2
4.1 General test conditions	2
4.2 Appearance	3
4.3 Thickness of coating film	3
4.4 Non-wettability test	4
4.5 Non-tackiness test	5
4.6 Adhesion test.....	7
4.7 Pencil scratch hardness test	12
4.8 Abrasion resistance test	14
4.9 Pinhole test	14
5 Quality requirements	15
6 Expression of test results.....	16
7 Test report	16
Annex A (normative) Adhesive tape for non-tackiness test.....	17
Annex B (informative) Pancake release test method (food non-tackiness test)....	18
Annex C (informative) Examples of criteria for quality requirements	20

Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry, through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by Japan Fluoropolymers Industry Association (JFIA)/The Japan Plastics Industry Federation (JPIF)/Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14.

Consequently **JIS K 6894**:1996 is replaced with this Standard.

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Testing methods for fluoroplastic coating film on metal substrate

Introduction

This Japanese Industrial Standard was established in 1972 and has gone through three revisions since then. The revision at this time is for the purpose of responding to withdrawal and shifting of **JIS K 5400** (general test methods for paints) which took place after the last revision made in 1996.

No corresponding International Standard has been established at this point.

1 Scope

This Standard specifies the test methods for the coating films for industrial and domestic use (hereafter referred to as “coating films”) that are obtained by coating the metal substrate with fluoroplastic paint mainly composed of fluororesin and then baking it. This Standard is applicable to the types of fluoroplastic coating films as shown in Table 1.

Table 1 Types of fluoroplastic coating films

Type	Symbol
Polytetrafluoroethylene	PTFE
Perfluoro alkoxy alkane	PFA
Perfluoro ethylene propylene copolymer	FEP
Ethylene-tetrafluoroethylene copolymer	ETFE

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

JIS B 0651 *Geometrical Product Specifications (GPS)—Surface texture: Profile method—Nominal characteristics of contact (stylus) instruments*

JIS B 7507 *Vernier, dial and digital callipers*

JIS B 7721 *Tension/compression testing machines—Verification and calibration of the force-measuring system*

JIS G 4404 *Alloy tool steels*

JIS K 5600-1-1 *Testing methods for paints—Part 1: General rule—Section 1: General test methods (conditions and methods)*

JIS K 5600-1-4 *Testing methods for paints—Part 1: General rule—Section 4: Standard panels for testing*

JIS K 5600-1-7 *Testing methods for paints—Part 1: General rule—Section 7: Determination of film thickness*

JIS K 5600-5-9 *Testing methods for paints—Part 5: Mechanical property of film—Section 9: Abrasion resistance (Rotating abrasive rubber wheel method)*

JIS K 7204 *Plastics—Determination of resistance to wear by abrasive wheels*

JIS R 3257 *Testing method of wettability of glass substrate*

JIS R 6252 *Abrasive papers*

JIS S 6050 *Plastics erasers*

JIS Z 0103 *Glossary of terms used in rust and corrosion preventive technology*

JIS Z 0237 *Testing methods of pressure-sensitive adhesive tapes and sheets*

JIS Z 1522 *Pressure sensitive adhesive cellophane tapes*

JIS Z 8401 *Guide to the rounding of numbers*

JIS Z 8703 *Standard atmospheric conditions for testing*

3 Terms and definitions

For the purpose of this Standard, the terms and definitions given in **JIS Z 0103** and the following apply.

3.1 non-wettability

property of the coating film to repel liquid when its surface is brought into contact with liquid

3.2 non-tackiness

property of a coating film to release a material when brought into contact with the material

3.3 peel strength

force per unit width required to peel the coating film from the metal substrate

3.4 room temperature

standard condition of 23 °C specified in **JIS Z 8703** with the tolerance being ± 2 °C

3.5 baking

procedure of drying, fusing and hardening at high temperature the paint applied on the metal substrate

3.6 adhesive property

property of the fluoroplastic coating film to adhere to the metal substrate

4 Test methods

4.1 General test conditions

4.1.1 General

The general conditions of tests shall be in accordance with **JIS K 5600-1-1** and **4.1.2** and **4.1.3**.

4.1.2 Preparation of test piece

The test pieces shall be in accordance with **JIS K 5600-1-4** and the following.

- a) Where direct sampling from the product is feasible, take a sample from a portion representing the performance of the whole product, and use it to prepare a test piece.
- b) Where direct sampling from the product is unfeasible due to its shape or dimensions, an alternative test piece may be prepared by using a metal base plate of the same material as the product and subjecting it to the same processing as the product.
- c) The test pieces shall be adjusted to be free from warps and waves.

4.1.3 Test conditions and conditioning

The test condition and conditioning shall be as follows.

- a) The tests shall be carried out at room temperature.

When the measurement cannot be carried out at room temperature because of the shape, dimensions or other conditions of the product, the measurement may be carried out at the ordinary temperature.

In this case, the temperature used shall be stated in the quality test result report.
- b) The test pieces for non-wettability test, non-tackiness test, adhesion test, pencil scratch hardness test and abrasion resistance test shall be conditioned at room temperature for at least 1 h prior to the measurement so that the temperature of the whole test piece becomes uniform. The tests shall be carried out consistently under the same conditions.

4.2 Appearance

The appearance test of coating film shall be in accordance with **JIS K 5600-1-1** and the following.

- a) **Test** Comparing with the boundary sample which has been agreed upon between the parties concerned with delivery, visually observe the coating film for the state of colour, gloss, and levelling, as well as degree of defects such as holes, bubbles, alien matters, pittings, wrinkling, lack of hiding, sagging, bleeding, cissing, craterings, mottles or flashing.
- b) **Judgement** The appearance shall be judged acceptable if no significant difference from the boundary sample is observed.

4.3 Thickness of coating film

The thickness measurement of the coating film shall be in accordance with **JIS K 5600-1-7** and the following.

- a) **Procedure** The procedure shall be as follows.
 - 1) Measure the thickness of the coating film using either a micrometer, electromagnetic thickness tester or eddy-current thickness tester. Ensure that the measuring instrument used is suitable for the material and shape of the metal substrate.

A measuring instrument agreed upon between the parties concerned with delivery may be used.

- 2) For measuring method, refer to the method specified for each measuring instrument.
- b) **Evaluation** Obtain the average of thickness measurements at three or more positions made on each sample and take it as the thickness of the coating film under test.

4.4 Non-wettability test

The non-wettability shall be measured in accordance with the sessile drop technique specified in **JIS R 3257**.

The liquid for measurement shall be the purified water specified in The Japanese Pharmacopoeia.

- a) **Procedure** The procedure shall be as follows.
 - 1) Measure the surface roughness of the coated surface by the contact (stylus) instrument specified in **JIS B 0651**.
 - 2) Clean the surface of the test piece.
 - 3) Attach the test piece to the base of an angle measuring device with the coated surface facing upward.
 - 4) Drip water on the surface of the test piece from a microburette. The size of a drip shall be 1 mm to 2 mm in diameter.
 - 5) After dripping, wait until vibration in the droplet settles, then immediately measure the angle between the droplet and the coated surface.

In the case of direct reading method, use a direct reading-type angle measuring device.

Figure 1 shows an example of the direct reading-type angle measuring device.

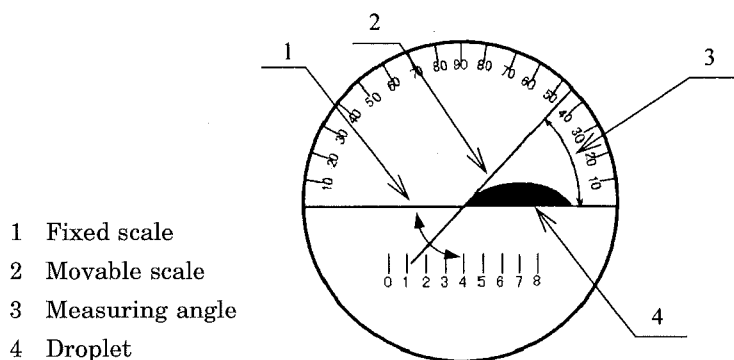


Figure 1 Example of direct reading-type angle measuring device

- b) **Evaluation** The evaluation shall be made as follows.
 - 1) Make measurements at five points on one test piece, and take the average of the five measurements as the contact angle.

- 2) State the contact angle and the surface roughness of the coating film in the quality test result report.

4.5 Non-tackiness test

4.5.1 Adhesive tape method

4.5.1.1 Method using a tensile tester

Employ the tensile tester specified in **JIS B 7721**.

a) **Procedure** The procedure shall be as follows.

- 1) Clean the surface of the test piece thoroughly.
- 2) Use an adhesive tape with a 18 mm width specified in Annex A for measurement.
- 3) Cut off 300 mm of the adhesive tape for measurement, put it over the test piece, and press it against the test piece for firm bonding with a roller of $1\,000\text{ g} \pm 50\text{ g}$ in mass specified in **JIS Z 0237** or a plastic eraser specified in **JIS S 6050**. Leave for 20 min to 40 min for the adhesion of the tape to settle.
- 4) Fix the edge of the test piece between the lower grips of the tensile tester. Peel the edge of the tape, fold it back by 180° , and fix it between the upper grips of the tester, ensuring that the peeling direction does not divert from the vertical.
- 5) The tensile speed shall be approximately 20 mm/min.
- 6) Measure the force needed for peeling the tape from the test piece by a tensile tester.

Figure 2 shows an example of condition of the test.

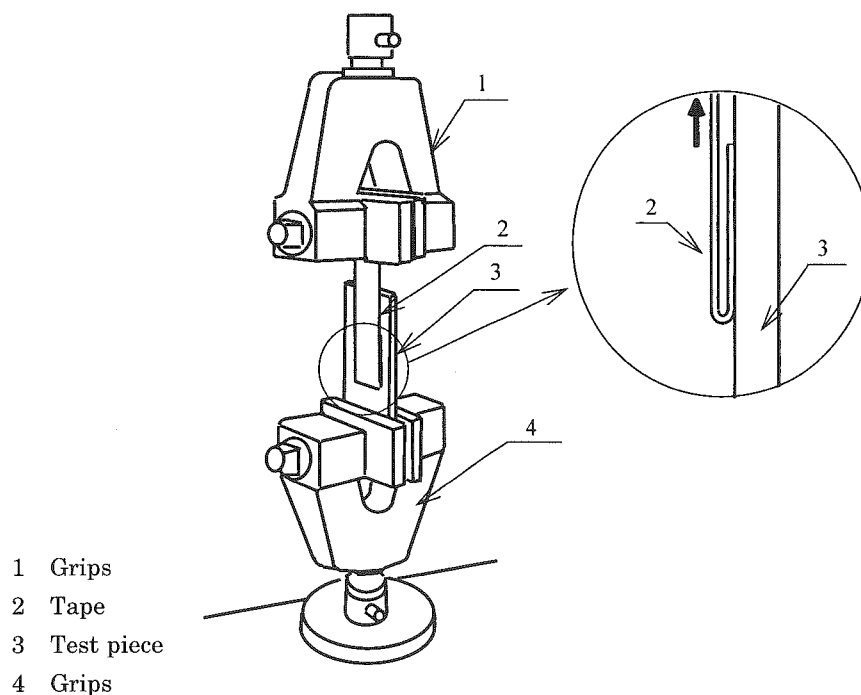


Figure 2 Example of non-tackiness test