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Calendered Film and Sheet from Flexible Polyvinyl Chloride

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Calendered Film and Sheet from Flexible Polyvinyl Chloride

1 Scope

This document specifies the requirements for the classification, appearance, dimensions and physical and chemical properties of calendered film and sheet from flexible polyvinyl chloride (hereinafter referred to as “products”), describes the test methods for the products, and specifies the product inspection rules, marking, packaging, transportation and storage requirements.

This document is applicable to the production, inspection and sales of smooth-surface or light-patterned calendered films and sheets from flexible polyvinyl chloride produced by the method of calendering by adding plasticizers, stabilizers and other additives to suspension polyvinyl chloride resin.

2 Normative References

The contents of the following documents constitute indispensable clauses of this document through the normative references in the text. In terms of references with a specified date, only versions with a specified date are applicable to this document. In terms of references without a specified date, the latest version (including all the modifications) is applicable to this document.

GB/T 1040.3 Plastics - Determination of Tensile Properties - Part 3: Test Conditions for Films and Sheets

GB/T 2035-2008 Terms and Definitions for Plastics

GB/T 2410 Determination of the Luminous Transmittance and Haze of Transparent Plastics

GB/T 2828.1-2012 Sampling Procedures for Inspection by Attributes - Part 1: Sampling Schemes Indexed by Acceptance Quality Limit (AQL) for Lot-by-lot Inspection

GB/T 2918 Plastics - Standard Atmospheres for Conditioning and Testing

GB/T 6672 Plastics Films and Sheeting - Determination of Thickness by Mechanical Scanning

GB/T 6673 Determination of Length and Width of Plastics Film and Sheeting

GB 6675.4-2014 Safety of Toys - Part 4: Migration of Certain Elements

GB 11121-2006 Gasoline Engine Oils

GB/T 12027 Plastics - Film and Sheeting - Determination of Dimensional Change on Heating

GB/T 14216 Plastics - Film and Sheeting - Determination of Wetting Tension

GB/T 22048 Determination of Certain Phthalate Esters in Toys and Children’s Products

GB/T 22930.1 Leather and Fur - Chemical Determination of Metal Content - Part 1: Extractable Metals

GB/T 40263 Textiles - Determination of Short Chain Chlorinated Paraffins

GB/T 41792 Plastics - Film and Sheeting - Determination of Cold-crack Temperature

QB/T 1130 Plastics Angle Tear Performance Test Method

3 Terms and Definitions

The terms and definitions defined in GB/T 2035-2008 are applicable to this document.

4 Product Classification

4.1 The classification of products by thickness is shown Table 1.

4.2 The classification of products by haze is shown Table 2.

4.3 The classification of products by purposes is shown Table 3.

4.4 The classification of products by whether subsequent printing is required is shown Table 4.

5 Requirements

5.1 Appearance

The appearance shall comply with the provisions of Table 5, and the cumulative allowable number and dispersion of black spots and impurities shall comply with the provisions of Table 6. When there is an overlap in product categories, the category with the highest indicator requirements shall be followed. There shall be no joints in the middle of the product roll.

6 Test Methods

6.1 Sampling

The samples shall be randomly selected from each batch of delivered products. After removing at least 5 layers of the surface of the sampled roll, the samples shall be cut, and the longitudinal direction of the product shall be marked on the samples.

6.2 Specimen Conditioning and Test Environment

Unless otherwise specified, under the standard environment of temperature (23 ± 2) °C and relative humidity (50 ± 10) % specified in GB/T 2918, the specimen conditioning time shall be not less than 4 h, and the test shall be carried out under this condition.

6.3 Appearance

Visually inspect under natural light and measure with corresponding measuring tools. The particle size of black spots and impurities shall be measured with a 10-fold or more magnifying glass with a minimum division value of not less than 0.1 mm.

6.4 Thickness

In accordance with the provisions of GB/T 6672, carry out the test.

6.5 Width and Length

In accordance with the provisions of GB/T 6673, carry out the test.

6.6 Tensile Strength and Tensile Fracture Strain (or tensile fracture nominal strain)

Test in accordance with the provisions of GB/T 1040.3. Use Type 2 specimen with a width of (10.0 ± 0.2) mm and a test speed of (200 ± 10) mm/min. The test results are expressed as the arithmetic mean of all measured values of the specimen, with the tensile strength retained to the first decimal place and the tensile fracture strain (or tensile fracture nominal strain) retained to the integer place.

6.7 Right Angle Tear Strength

Test in accordance with the provisions of QB/T 1130. Take a single piece specimen and retain the integer place.

6.8 Dimensional Change Rate

Test in accordance with the provisions of GB/T 12027. The test temperature is (100 ± 2) °C and the duration is 30 min.

6.9 Heating Loss Rate

Cut 3 specimens of 40 mm × 60 mm, place the group of specimens in a desiccator for 24 hours, then, take them out, and weigh them piece by piece to an accuracy of 0.1 mg. Place the group of specimens in a non-air-blasting oven at (100 ± 2) °C, hang the specimens on the same horizontal plane with a distance of no more than 80 mm from the temperature measuring device, and no less than 50 mm from the edge of the oven. The distance among the specimens shall be no less than 30 mm. After 6 hours of constant temperature, take them out and immediately place them in a desiccator to cool to room temperature. Weigh them piece by piece again to an accuracy of 0.1 mg.

The heating loss rate is calculated in accordance with Formula (1):

$$n = \frac{m_0 - m}{m_0} \times 100\% \qquad \cdots\cdots (1)$$

Where,

n---the heating loss rate;

m_0---the mass of the specimen before heating, expressed in (g);

m---the mass of the specimen after heating, expressed in (g).

Calculate the arithmetic mean of the test results of three specimens and retain the first decimal place.

6.10 Water Extraction Rate

Cut 3 specimens of 50 mm × 100 mm, place the group of specimens in a desiccator for 24 hours, then, take them out, and weigh them piece by piece to an accuracy of 0.1 mg. Place the group of specimens in a 500 mL beaker, pour 200 mL of distilled water into the beaker, and sink the specimens into the water (if the specimens float on the water surface, use a weight tied by polyamide yarns to make them sink. The specimens shall not touch each other or stick to the wall of the beaker). Place the beaker at a constant temperature of (50 ± 2) °C. After 24 hours, take out the specimens from the beaker, place each specimen between 2 pieces of dry absorbent paper to absorb the moisture, then, place the specimens in an oven at (50 ± 2) °C for 8 hours, take them out and cool them in a desiccator to room temperature. Weigh each piece to an accuracy of 0.1 mg.

The water extraction rate is calculated in accordance with Formula (2):

$$q = \frac{M_0 - M}{M_0} \times 100\% \qquad \cdots\cdots (2)$$

Where,

q---the water extraction rate;

M_0---the mass of the specimen before the water extraction test, expressed in (g);

M---the mass of the specimen after the water extraction test, expressed in (g).

Calculate the arithmetic mean of the test results of three specimens and retain the first decimal place.

6.11 Oil Resistance

With the longitudinal direction as the length direction, cut 3 specimens of 100 mm × 50 mm, and place the group of specimens in the engine oil with a temperature of (60 ± 1) °C and performance meeting the requirements of SG 0W–20 model in GB 11121-2006 for 5 hours, then, take out and cool to room temperature. After using a neutral detergent to gently wipe the surface of the specimens, fold the specimens 180° along the length direction one by one, then, flatten them and check the folded part, and judge with the worst specimen.

6.12 Phthalates

Test in accordance with the provisions of GB/T 22048.

6.13 Migratable Elements

Prepare and extract in accordance with the provisions of 8.2 in GB 6675.4-2014, and determine in accordance with the provisions of GB/T 22930.1.

6.14 Short Chain Chlorinated Paraffins

Test in accordance with the provisions of GB/T 40263.

6.15 Haze

Test in accordance with the provisions of GB/T 2410.

6.16 Wetting Tension

Test in accordance with the provisions of GB/T 14216.

6.17 Low-temperature Elongation

Test in accordance with the method in Appendix A.

6.18 Cold-cracking Temperature

Test in accordance with the provisions of GB/T 41792.

7 Inspection Rules

7.1 Batch

Products are inspected in batches. Products produced with the same equipment, of the same category, formula, thickness and width are considered a batch. The quantity of each batch shall not exceed the shift output or 8 t.

7.2 Sampling

The inspection of appearance and dimensions shall be carried out in accordance with the provisions of GB/T 2828.1-2012, using a secondary sampling scheme with general inspection level II and acceptance quality limit AQL of 6.5. The batch, sample, and judgment array are shown in Table 11.

The physical and chemical properties shall be inspected by randomly selecting one roll from the products that have passed the inspection of appearance and dimensions.

Table 11 -- Sampling Scheme

Batch/roll	Sample	Sample Volume	Cumulative Sample Volume	AQL=6.5	
				Acceptance AC	Rejected Re
2～15	First	2	2	0	1
16～50	First	5	5	0	2
	Second	5	10	1	2
51～90	First	8	8	0	3
	Second	8	16	3	4
91～150	First	13	13	1	3
	Second	13	26	4	5
151～280	First	20	20	2	5
	Second	20	40	6	7
281～500	First	32	32	3	6
	Second	32	64	9	10

7.3 Inspection Classification

7.3.1 Exit-factory inspection

The exit-factory inspection items are appearance, thickness, width, length, tensile strength, tensile fracture strain (or tensile fracture nominal strain), right angle tear strength and dimensional change rate in Chapter 5.

7.3.2 Type inspection

The inspection is carried out in accordance with all the requirements specified in Chapter 5. Under one of the following circumstances, type inspection should be carried out:

a) Pattern evaluation of products or transfer of old products to other factories for production;

b) After formal production, if there are major changes in materials and processes that may affect product performance;

c) When production has been suspended for more than 3 months, and then, resumed;

d) When the exit-factory inspection results are significantly different from the previous type inspection;

e) Every 12 months of normal production.

7.4 Judgment Rules

7.4.1 Quality judgment of sample units

The appearance and dimensions of the samples are inspected item by item in accordance with all the items listed in 5.1 and 5.2. If all the inspected items are qualified, then, the sample unit is judged to be qualified.

7.4.2 Quality judgment of qualified batches

The appearance and dimensions of the samples are judged in accordance with the provisions of GB/T 2828.1-2012.

The physical and chemical properties of the samples are inspected item by item in accordance with all the items listed in 5.3. If there are disqualified items in the inspection results, then, double sampling shall be taken from the original batch, and the disqualified items shall be re-inspected. If all the inspection results are qualified, then, the batch shall be judged as a qualified batch. If one or more of the inspection results are disqualified, then, the batch shall be judged as a disqualified batch.

8 Marking, Packaging, Transportation and Storage

8.1 Marking

Each roll of the products shall be accompanied by a certificate of conformity and have the following markings:

a) Manufacturer’s name and address;

b) Product name;

c) Product category;

d) Product thickness, width and length;

e) Production date or production batch No.;

f) Serial No. of this document;

g) Inspector code;

h) Net mass.

8.2 Packaging

The products shall use hard plastics, metal tube or paper tube as the roll core. The outside of the roll (including the end face) shall be packed with film, kraft paper or other packaging materials.

8.3 Transportation

During transportation, the products shall be prevented from collision or contact with sharp objects, gently loaded and unloaded, and protected from sun, rain and stains, and the packaging shall be kept intact.

8.4 Storage

The products shall be neatly placed in a clean, dry, ventilated and cool warehouse, and the packaging shall be kept intact. The products should not be horizontally placed in more than 6 layers, and should be vertically placed in a single layer, avoiding sunlight and heat sources. The product storage period is 18 months from the production date.

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