

**Library of Congress Preservation Directorate**  
**Specification Number 700-713 – 16**  
**Specifications for Pressure Sensitive Adhesive Labels**  
**For Application to Plastic and Metal Substrates**  
**For Use in Thermal Transfer Printers**

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## **Scope**

Labels that meet the requirements set forth in this specification are intended for use on plastic and metal materials used in storage containers for collection materials only. *These labels are not intended for use on rare or highly valuable materials, or application to photographic materials.*

## **1. Composition and Chemical Requirements**

### **1.1 Face Stock**

The type of face stock will be specified on the purchase order, selected by the user for the intended application, from the following list of options. The selected material must meet the composition requirements as stated.

#### **1.1.1 Polyester**

The polyester may be a clear, colorless, or white opaque film, 1 – 2 mil thick. The polyester must be biaxially oriented, non-recycled film, with no plasticizers added.

#### **1.1.2 Polypropylene**

The polypropylene may be a clear, colorless, or white opaque film, 1 – 2 mil thick. Biaxial orientation is preferred.

### **1.2 Adhesive**

The pressure-sensitive adhesive layer must possess high permanence characteristics such that labels, once applied, remain attached permanently and can be removed only with difficulty. The adhesive must be clearly identifiable as an acrylic polymer or copolymer by its infra-red spectrum.

## **2. Physical and Performance Requirements**

### **2.1 Color – Brightness**

The color of the face stock should be white, off-white, or as specified on the purchase order. White pigmented face stocks must have a minimum brightness of 82% as measured by directional

reflectance at 457 nm, as described in TAPPI T 452. Colored labels: samples of the desired color will be provided to the vendor when available.

## **2.2 Color – Brightness Retention**

The brightness of white pigmented face stocks must not change more than 10 points when subjected to 28 days of dark aging at 90°C and 50% RH, or when exposed 24 hours to a Xenon arc lamp in an Atlas Weatherometer under the following conditions: Irradiance Level: 1.0 watts/m<sup>2</sup> at 420 nm. Inner filter: Borosilicate glass. Outer filter: clear soda lime glass. Black panel temperature: 50°C. Wet bulb depression: 8.5°C. The change in brightness will be measured according to TAPPI T 452. Colored labels: acceptable levels of discoloration will be determined between the vendor and the user.

## **2.3 Color Bleeding and Water Resistance**

The color must show no bleeding when soaked in distilled water for 48 hours while held under suitable weight in contact with white bond paper. The label will be applied to a white bond paper support for this test. The label must remain adhered to the paper support during the immersion period.

## **2.4 Bond Strength**

The adhesive must demonstrate sufficient initial bond strength for the label to support a test weight of 200 grams for 10 minutes.

### **2.4.1 Test Method**

This procedure is a 90 degree peel test, modified from ASTM D 2860. The bonding strength of the adhesive to different plastic and metal substrates is assessed. Test Panels used in this test are LC Standard Test Panels PM-1, PM-2, PM-3, PM-4, PM-5, MM-1, and MM-2. The materials used for these LC Standard Test Panels have been selected to represent the wide range of non-paper based storage housings encountered in any large collection. For a collection of mixed media, this peel test is performed on two substrates, LC Standard Test Panels PM-1, PM-2 and MM-1. For collections consisting of only one type of media the label will only be tested on that particular substrate, using the LC Standard Test Panel that most closely represents that media. Information on the composition of LC Standard Test Panels can be obtained from the Library of Congress Preservation Research and Testing Division.

#### **2.4.1.1 Application and Curing**

A set of three labels, size 1 x 2 1/2 inches is applied to each of the selected Test Panels over a Mylar window that permits only a one inch square area of the adhesive side of the label to be in contact with the substrate, as illustrated in ASTM D 2860, procedure B. The labels are set in place by applying firm pressure with the edge of a 3M plastic applicator, model no. P.A.-1., to the labels in four downward strokes. The test samples are then allowed to cure for 7 days in an environmental chamber conditioned to 23°C and 50% RH.

#### 2.4.1.2 Test and Evaluation

At the end of this dwell time a 200 gram weight is suspended from the free end of the label and timed for 10 minutes. At the end of this test period, labels must not have peeled away from the substrate by more than 10 millimeters. Failure of this test will disqualify the stock and no further testing need be performed.

### **2.5 Bond Strength after Accelerated Aging**

The adhesive, once set after the initial 7-day dwell time, must remain permanently affixed to both the face-stock and the substrate with no loss of adhesive strength for the life of the object to which it is applied, under conditions of normal use.

#### 2.5.1 Test Method

This procedure is a 90 degree peel test, modified from ASTM D 2860. Test Panels used in this test are LC Standard Test Panels PM-2 and MM-1, unless a single substrate has been selected.

##### 2.5.1.1 Application and Exposure

A set of three labels is applied to each of the selected Test Panels in the same manner as described in section 2.4.1.1. The labels are then subjected to accelerated aging at 80°C and 50% RH for 28 days. At the end of the aging period the test samples are placed in an environmental chamber conditioned to 23°C and 50% RH for 24 hours.

##### 2.5.1.2 Test and Evaluation

At the end of the conditioning period the peel test is performed as in section 2.4.1.2. At the end of this test period, labels must not have peeled away from the substrate by more than 10 millimeters.

### **2.6 Curling, Lifting, Ooze**

The labels must not show any sign of curling, lifting, buckling, or puckering, nor any evidence of the adhesive oozing beyond the label edges. Test Panels used in this test are LC Standard Test Panels PM-1 and MM-1, unless a single substrate has been selected.

#### 2.6.1 Test Method

A set of three labels, size 1 × 1 inch, is applied to each of the selected Test Panels so that the entire adhesive side of the label is in contact with the substrate. The labels are set in place by applying firm pressure with the edge of a 3M plastic applicator, model no. P.A.-1, to the labels in four downward strokes. The labels are then subjected to accelerated aging at 80°C and 50% RH for 28 days. At the end of the aging period, the labels are examined visually.

### **2.7 Print Fastness**

The label stock must be able to accept and retain a clean, legible image from a thermal transfer printer.

## 2.7.1 Test Method

The label stock will be printed with a test pattern consisting of a sample phrase or barcode centered on each label using the thermal transfer ribbon recommended by the vendor as compatible with the label stock. The printer model to be used in this test will be noted on the purchase order.

### 2.7.1.1 Printing Samples

Inability to print the stock on the selected printer, to obtain a clear, crisp and complete image, or read the bar-code with a scanner will constitute a failure. Any failure of the label stock during the printing process will disqualify the stock and no further testing will be performed.

### 2.7.1.2 Test and Evaluation

A strip of 3M Tape #230 is applied over the printed test pattern on the label by rubbing down the tape using three fingers in six firm strokes. The tape is then peeled back at a 180 degree angle. Legible characters visible on the test tape, and/or degradation of the printed image on the face-stock, constitute a failure. (This method is described in Archival Copies of Thermofax, Verifax and Other Unstable Records, Technical Information Paper No. 5, Washington, D.C., National Archives and Records Administration, 1990).

## 2.8 Abrasion Resistance of Printed Image

The printed image on the label must be able to resist moderate abrasive forces with minimal smudging of the ink.

### 2.8.1 Test Method

This procedure follows ASTM D 5264. Labels will be printed as described in section 2.6.

#### 2.8.1.1 Application and Abrasion

Printed labels are attached to a piece of LC Standard Test Paper P-1 which has been cut to fit the base of the Sutherland Rub Tester. The test specimen is placed on the rubber pad on the base of the Sutherland Rub Tester, as described in ASTM D 5264, printed side facing the receptor block. The test specimen is then rubbed for 20 strokes using the A-1 Standard Receptor, Imperial Lapping Film with aluminum oxide 9- $\mu$ m particles.

#### 2.8.1.2 Measurement and Evaluation

The extent of smudging is evaluated by selecting an area of the greatest density of smudged ink, 3 – 5 mm away from a printed character, and measuring its optical density using a reflectance densitometer. The density of the smudged area is compared to the density of a clean, unprinted, area of the label stock. Density changes above 0.03 constitute a failure.

## **2.9 Suitability for Cold Storage**

The label stock must be able to remain adhered to its substrate without lifting, curling, flagging, or peeling during long-term exposure in the Library of Congress cold temperature storage vaults, down to minimum conditions of -4°C and 30% RH.

## **3. Product Requirements**

### **3.1 Construction**

The label stock must be provided in roll form on a hard core, with a release liner that will allow for easy and complete peeling of the face-stock without shearing of the adhesive layer.

### **3.2 Workmanship**

All edges of the sheet, and of each label on the sheet, must be cut square and clean, and sizes accurate.

### **3.3 Dimensions**

Dimensions of the label stock, roll, and the core will be specified on the purchase order.

### **3.4 Odors**

The label stock must not emit odors deemed objectionable or hazardous to the work environment by the Library of Congress, when evaluated as described in TAPPI T 483.

### **3.5 Shelf-Life**

The adhesive must have a minimum one year usable shelf-life such that the initial adhesion strength will be the same for labels applied up to one year after the original delivery date under ambient storage conditions. The labels must also maintain their capacity to be printed upon.

### **3.6 Thermal Transfer Ribbon Compatibility**

The label stock must be compatible with hard-resin thermal transfer ink ribbons. Wax ribbons or wax-resin ribbons are not acceptable. The vendor must recommend compatible printing ribbons for the label stock, provide specification sheets (and/or performance data), a sample ribbon to be used for testing, and purchasing information for each ribbon recommended.

## **4. Packaging and Identification**

### **4.1 Inner Packages**

Each package must plainly identify the type, size and number of items within, the name of the supplier or manufacturer, year of manufacture, and manufacturing run or batch number.

### **4.2 Outer Package**

The items must be packed in standard commercial containers that are constructed to ensure that they arrive at the Library of Congress in dry, undamaged condition. The outside of each container

must be identified by type, size and number of items within; manufacturing run or batch number; LC Purchase Order / Contract number and line number.

## 5. Compliance with Specification

### 5.1 Quality Assurance Testing

The Library of Congress has the right to perform any of the tests set forth in the specification where such tests are deemed necessary to ensure that supplies conform to prescribed requirements.

### 5.2 Sampling

To sample for testing, shipments will be sampled according to ANSI/ASQ Z1.4, inspection level S-2, AQL 2.5%.

### 5.3 Methods

Tests will be conducted in accordance with specified test methods of the American National Standards Institute (ANSI), the American Society for Testing and Materials (ASTM), the Technical Association of the Pulp and Paper Industry (TAPPI), and the International Organization for Standardization (ISO). Publications describing these tests may be ordered directly from the technical associations, their websites, or other on-line standards vendors.

### 5.4 Acceptance

Materials will be accepted when the Library of Congress has ascertained that the products comply with all parts of the specification. A partial list of the physical and chemical requirements and test methods used to ascertain compliance is provided in a quick reference table in section 5.5.

## FAILURE TO MEET ANY PART OF THE SPECIFICATION WILL BE CAUSE FOR REJECTION

### 5.5 Table of Physical and Chemical Requirements and Test Methods

Property	Requirement	Test Method
Adhesive Composition	Acrylic	FTIR
Color - Brightness, initial	≥ 82%	TAPPI T 452
Color – Brightness Retention, after light/dark aging	≤ 10 pts change	TAPPI T 452
Color Bleeding	No bleed / lift in 48 hours	See section 2.3
Bond Strength, 7 day dwell	200g, ≤ 10 mm peel	ASTM D 2860 (modified)
Bond Strength, aged	200g, ≤ 10 mm peel	ASTM D 2860 (modified)
Curling/Lifting/Ooze	None	Visual, after aging
Print Fastness	No image degradation	NARA T.I.P. No. 5
Print Abrasion	≤ 0.03 pts density change	ASTM D 5264

## Configuration Management

Date	Revision History
22-Oct-2002	Initial release of document on website, html format.
14-Dec-2009	Revised and reformatted for release as PDF document.
30-Sept-2016	Revised sections 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 5.5. Editorial update to footer.