

## Recommended Minimum Performance Standards for VINYL SWIMMING POOL LINERS – IN-GROUND

### 1. Scope

**1.1** This document sets forth recommended minimum performance standards for vinyl and other polymeric films, plain and printed, which are used as in-ground swimming pool liners.

**1.2** This specification is not applicable to vinyl or polymeric films used in other applications.

### 2. Applicable Documents\*

For applicable documents used in this specification, refer to CFFA Standard Test Methods Pamphlet, most recent Edition.

### 3. Definitions

Accelerated Light Aging - Artificial accelerated tests to predict the weathering characteristics of a polymeric film.

Density - Measure of Weight per unit Volume (Grams/CC).

Dimensional Stability - A measure of the re-orientation (shrinkage or growth in one or more directions) of a polymeric film at an elevated temperature.

Elongation at Break (Ultimate Elongation) - A measurement of the percent elongation from the original sample length at the moment when the material breaks during a tensile test.

Layflat - A measure of the uniformity of the contour of a roll of polymeric film.

Low Temperature Impact - A measure of the ability of a polymeric film to resist cracking at low temperature.

Mildew Resistance - A determination of the ability of a polymeric film to resist fungal growth.

Modulus - A measure of the ability of a polymeric film to resist deformation under an applied tensile stress.

Pink Stain - An evaluation of the performance of a polymeric film against staining by a pink staining organism, *Streptovorticillium Reticulum*.

Print Abrasion Resistance - A measure of the degree to which a polymeric film is able to retain a surface print when abraded.

Roll Contour or Racetracking - A measure of deviation in the ability of a roll of polymeric film to be rolled out in a straight line.

Snap Back - A measure of the machine direction shrinkage of a polymeric film after being unwound from a roll and allowed to relax at ambient temperature.

Soapy Water Extraction - A determination of the weight loss or the extraction of solubles in polymeric film after extended immersion in soapy water at a given temperature.

Tear Resistance - A determination of the force required to initiate or propagate a tear in a polymeric film.

Tensile Strength - A measure of the force required to break a polymeric film.

Thickness - A measure of gauge.

Volatility - The measure of weight loss of a polymeric film when subjected to an elevated temperature.

### 4. Performance Requirements

**4.1** Vinyl and other polymeric films, depending upon application, will be colored, decorated and/or textured to provide an aesthetically pleasing appearance and feel while maintaining minimum performance standards under non-abusive consumer usage.

**4.2** Properties described in [TABLE 1](#) for polymeric films collectively make up the minimum performance standard. The CFFA Standard Test Method Pamphlet outlines the tests to be used, describing their purpose and relating the properties tested to various aspects of performance.

**TABLE 1**

PROPERTY	TEST METHOD	VALUE
Accelerated Light Aging* Xenon Arc	CFFA 2b	200 hours for min. color change.
QUV	CFFA 2c	1500 hours for min. polymer degradation.
Density (range)**	CFFA 21	1.23 – 1.29
Dimensional Stability*** (% change max., 212°F (100°C) for 15 min. or 158°F (70°C) for 30 min.)	CFFA 22	MD -4.0
Elongation @ Break (% min.) (Ultimate Elongation)	CFFA 27	MD 300 TD 300
Layflat (Belly or Baggy Center)	CFFA 221	-0%, +1.8%
Low Temperature Impact (Pass, degrees F, +/-2°)	CFFA 23	-20
Mildew Resistance	CFFA 120	No Growth
Modulus @ 100% Elongation (psi. min.)	CFFA 27	MD 950 TD 950
Pink Stain	CFFA 121	No Stain
Print Abrasion Resistance **** Taber Method (CS 17 Wheels, 500 gram weight)	CFFA 200b	300 Cycles
Roll Contour or Racetracking	CFFA 240	+1.8%
Snap Back (% max.)	CFFA 241	-2.0
Soapy Water Extraction: % weight loss, max., 24 hrs @ 158°F (70°C)	CFFA 25	0.35
Tear Resistance : Graves Method (lbs./in. min.)	CFFA 26a	MD 220 TD 220
Tensile Strength (psi. min.)	CFFA 27	MD 2300 TD 2000
Thickness, mils, +/-5%	CFFA 220	Nominal
Volatility (% weight loss, max.)	CFFA 270	1.5

\*Either method may be used. Exposure test for 200 hours on material should show minimal color fading of base film by visual inspection.

\*\*Density may vary with color

\*\*\*Either method may be used.

\*\*\*\*Abrasion test should show minimal wear.

**4.3** The test results for polymeric films, when tested in accordance with the CFFA Standard Test Methods, must attain the minimum values of all properties listed in [TABLE 1](#) in order to conform to this standard.

## 5. Test Procedures

**5.1 Accelerated Light Aging** – See CFFA Standard Test Method 2. 200 hours for minimum color change and 1500 hours to minimum polymer degradation in a Xenon Arc or QUV test chamber.

**5.2 Density** – See CFFA Standard Test Method 21, Water Displacement Method.

**5.3 Dimensional Stability** – See CFFA Standard Test Method 22. Measure dimensional change after 15 minutes at 212°F (100°C), or 30 minutes @ 158°F (70°C).

**5.4 Elongation at Break (Ultimate Elongation)** - See CFFA Standard Test Method 27. Percent elongation of a polymeric film at the breaking point.

**5.5 Layflat** – See CFFA Standard Test Method 221. Determines the uniformity of contour of a roll of film by measuring its diameter on at least three points across the roll.

**5.6 Low Temperature Impact** – See CFFA Standard Test Method 23. Sample is folded in a loop, conditioned at low temperature, and struck by a falling weight.

**5.7 Mildew Resistance** – See CFFA Standard Test Method 120. Samples are exposed to a mixed fungal spore suspension for 28 days at 82° F (29° C).

**5.8 Modulus @ 100% Elongation** - see CFFA 27 Using a Scott or Instron type universal tester, measures the force required to stretch a polymeric film to twice its original length.

**5.9 Pink Stain** – Samples are exposed to an organism that causes pink staining in an incubator for 14 days at 82°F (29°C)

**5.10 Print Abrasion Resistance** - See CFFA Standard Test Method 200b, Taber Method.

**5.11 Roll Contour or Racetracking** – See CFFA Standard Test Method 240. Unroll a segment and measure deviations from rolling

out in a straight line.

**5.12 Snap Back** – See CFFA Standard Test Method 241. Accurately measure and mark a 100 inch segment from a newly unwound roll of film, laid flat on a table. After 24 hours, re-measure the distance between the marks.

**5.13 Soapy Water Extraction** – See CFFA Standard Test Method 25. Sample is immersed in soapy water at 158°F (70°C) for 24 hours.

**5.14 Tear Resistance** - See CFFA Standard Test Method 26a. Graves Method.

**5.15 Tensile Strength** - CFFA Standard Test Method 27. Measures the force required to break or pull a sample apart.

**5.16 Thickness** - See CFFA Standard Test Method 220. A gauge having a presser foot 0.375

inch in diameter, applying a total force of 6 ounces, equivalent to exerting a pressure of 3.4 psi, is used.

**5.17 Volatility** - See CFFA Standard Test Method 270. Sample exposed for 24 hours @ 158°F (70°C) in the presence of activated charcoal.

**\*Test Methods may be accessed on line at <http://cffaperformanceproducts.org/cffa-pages/publications.asp>**

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