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Cotton Module Cover Material Performance

Developed by the ASABE Cotton Engineering Committee, PM-23/7/3. Approved by the ASABE Power and Machinery Division. Adopted as an ASABE standard August 2012; revised December 2013; reaffirmed November 2018; revised February 2022.

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1 Scope

1.1 This standard was developed and applies to material covers for rectangular-shaped and cylindrical cotton modules.

1.2 This performance standard applies to materials used to manufacture covers intended to protect cotton modules after harvest from rain and wind exposure during outdoor storage by minimizing the fiber quality damage and fiber loss that can occur under poor storage conditions.

1.3 Rectangular module covers are typically used over multiple harvest seasons where they experience exposure to wind and ultraviolet (UV) radiation (sunlight). For rectangular module covers, mechanical motion from wind and other sources has been found to be the dominant factor contributing to material degradation. This standard specifies a minimum ability to maintain water penetration resistance following mechanical flexing for rectangular module covers.

1.4 Rectangular module cover materials may be constructed of natural or man-made fibers, tapes, film (woven or extruded) or a combination of fibers that may be coated and have UV inhibitors added. Although some covers will include sections of materials that are connected by seams, reinforcements, and/or have fused intersections and have grommets inserted to tie down or secure the cover onto a cotton module with ropes or cords, this performance standard only applies to the material used to form the top surface of the rectangular module cover. For cylindrical module covers, this performance standard applies to single layer and combined layer, natural or man-made materials as specified.

1.5 The physical test requirements for materials used in rectangular module covers are those that can predict functional protection and reasonable durability for extended periods of use. The tests for rectangular covers are intended to evaluate the degradation of resistance to water penetration after repeated mechanical flexing (similar to wind motion).

1.6 Plastic film covers used on cylindrical modules are single use covers that are applied under tension to protect and restrain the cotton in cylindrical form. Unlike rectangular module covers, degradation due to wind exposure is not a primary concern for cylindrical module covers. For cylindrical module covers, the primary focus is on puncture, tear, impact resistance, and the ability to provide structural stability to the module.

1.7 For cylindrical module covers, this performance standard is focused on single use plastic film covers. The use of other materials is not prohibited; however, the testing protocols in this standard may not be appropriate for other materials.

1.8 The laboratory testing methods specified for cylindrical module covers are intended to evaluate tear, puncture, and impact resistance of the material in multi-layer combinations as applied to a cylindrical module, as these have been common modes of failure for the multi-layer film materials in current use. In-field testing of module cover materials applied to cylindrical cotton modules is intended to evaluate the ability for the cover material system to protect and restrain the cotton under prolonged exposure to environmental effects.

2 Referenced Documents

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies unless noted. For undated references, the latest approved edition of the referenced document (including any amendments) applies.

2.1 ANSI/ASAE

ANSI/ASAE S392, Cotton Module Builder and Transporter Standard

ANSI/ASABE S647, Seed Cotton Module Identification System

2.2 AATCC Test Methods

AATCC TM20, Fiber Analysis: Qualitative

AATCC TM42, Water Resistance: Impact Penetration Test

2.3 ASTM International Standards

ASTM D3775, Test Method for Warp (End) and Filling (Pick) Count of Woven Fabrics

ASTM D3776, Standard Test Methods for Mass Per Unit Area (Weight) of Fabric

ASTM D882, Standard Test Method for Tensile Properties of Thin Plastic Sheeting

ASTM D1938, Standard Test Method for Tear-Propagation Resistance (Trouser Tear) of Plastic Film and Thin Sheeting by a Single-Tear Method

ASTM D2582, Standard Test Method for Puncture-Propagation Tear Resistance of Plastic Film and Thin Sheeting

ASTM D3420, Standard Test Method for Pendulum Impact Resistance of Plastic Film

ASTM D6988, Standard Guide for Determination of Thickness of Plastic Film Test Specimens

ASTM E96, Standard Test Methods for Water Vapor Transmission of Materials

ASTM F392, Standard Practice for Conditioning Flexible Barrier Materials for Flex Durability

2.4 National Cotton Council: “Just Tarp It: Selecting a Module Cover” brochure, 2004

2.5 Cotton Incorporated: “Seed Cotton Module Handling and Storage,” 2010

2.6 ISO/CIE (International Commission on Illumination)

ISO/CIE 11664-4:2019, Colorimetry — Part 4: CIE 1976 L* a* b* colour space

ISO/CIE 11664-6:2014, Colorimetry — Part 6: CIEDE2000 colour-difference formula

3 Terminology

3.1 cotton module, n.: a compressed bundle of seed cotton removed from plants at harvest that form a unit of a specific dimension for storage in fields prior to transportation to a cotton ginning facility

3.2 cover, n.: *for rectangular or cylindrical cotton modules*, protective material or combinations of materials sufficient in dimensions and form to protect a cotton module from exposure to rain and wind, and thus minimize fiber and seed quality degradation or loss prior to the ginning process

3.3 cover model, n.: *of a module cover*, a uniquely designed module cover described by a manufacturer, wholesaler or retailer as a marketable product identified by a model designation that is included on the label attached to the cover

3.4 cover top material, n.: *for a rectangular module cover model*, the material (film, coated woven, etc.) selected by the manufacturer to form the portion of the cover intended to resist water penetration into the cotton module during precipitation events

3.5 rectangular module, n.: A rectangular profile module typically 9.75 m (32.0 ft) or 4.88 m (16.0 ft) in length and with a ground level width of 2.3 m (7.5 ft) and height of 2.4 m (8.0 ft). A rectangular module is composed of free-standing seed cotton, and a cover is primarily for the protection of seed cotton from wind and precipitation.

3.6 cylindrical module, n.: A cylinder with circular end diameters of approximately 2.4 m (7.8 ft) and length of 2.4 m (7.8 ft). The cylindrical module relies on the cover for both protection of the seed cotton from weathering and structural stability for the seed cotton to maintain a cylindrical shape.

3.7 module axis, n.: direction parallel to the cylindrical axis of a cylindrical module

3.8 module circumference, n.: direction parallel to the circumference of a cylindrical module and perpendicular to the module axis

4 Uses and Significance

4.1 This standard specifies minimum physical testing criteria for two levels (acceptable and superior) of performance for rectangular module cover materials in providing resistance to moisture penetration. This standard also specifies the minimum physical testing and in-field system performance criteria of cylindrical module covers to maintain module structural integrity and provide resistance to quality losses. This standard offers manufacturers and distributors of module covers a guideline for the development and selection of candidate materials for use in the cotton industry and is intended to discourage the marketing of covers manufactured with inferior quality material, which may lead to quality losses and increased risk of lint bale contamination.

4.2 The performance criteria for cylindrical module covers include laboratory testing of the cover materials in addition to field testing to ensure that the cover adequately restrains and protects the cotton through prolonged exposure to environmental effects. Laboratory tests that mimic use situations for rectangular module covers are an accepted practice that allows for comparable materials or products to be evaluated on the same basis.

4.3 Length of use

4.3.1 Rectangular module covers typically are used in field application for a season lasting for weeks or months and then stored for use again during a subsequent harvest season. Workers apply module covers to the cotton after it is compressed into rectangular module form by a module builder. Rectangular module covers typically are used for two or more seasons, and degradation of the water penetration resistance by ambient exposure can result in loss of cotton fiber and seed quality and associated market value. Therefore, the prediction of satisfactory performance is related to the durability of module covers and the cover top materials from which they are manufactured. Other factors, including storage conditions, age, and handling can affect the performance of covers. See information in Referenced Document 2.4 for proper care guidelines.

4.3.2 Cylindrical module covers are typically single use materials and can remain applied to cylindrical modules for weeks or months prior to being cut from the module and removed at the gin. Cylindrical module covers are applied to cotton modules automatically by the harvester just after the point of harvest. The cylindrical module shape and cover provide resistance to water penetration. Tear, puncture, and impact resistance are critical cover material characteristics that preserve the integrity of the cover, allowing it to protect the cotton and maintain the cylindrical shape. Compromised cover integrity can not only result in a loss of cotton fiber and seed quality but also provide a source of plastic contamination in the seed cotton presented at the gin.

4.4 It should be recognized that rectangular module cover materials can be produced with an almost infinite number of combinations of construction variables (types of fibers, percentage of fibers, fabric count per unit distance, and chemicals). The user of module covers may find acceptable products that do not conform to all of the requirements in Section 9. Hence, no single performance specification can apply to all the various module cover materials that could be utilized for this end use.

4.5 Rectangular module covers are intermittent use products, and manufacturers may only produce or purchase materials from their suppliers annually. As a result, production lots of cover top material with identical specifications will be produced, manufactured, or purchased at different times. Results of performance testing in accordance with this standard will be considered valid for a period of four years, providing none of the material characteristics or suppliers have been changed.

4.6 Each rectangular cover will have the protective top manufactured from a base material with specific characteristics (see Table 1). For the purposes of this standard, changes in the specified characteristics of the primary material of the top will constitute a different material. Modification or any change of the material characteristics or supplier will require testing to this standard performance specification. Testing results obtained from this standard can be applied to any rectangular module cover model that uses the identical top material.

4.7 Results of performance testing on cylindrical module covers will be considered valid for a period of five years, providing none of the material characteristics or cover system design specifications have been changed.

4.8 Rectangular module cover materials that meet or exceed the performance specifications given in Section 9 can be described with the statement, “When manufactured, the material forming the top of this cover met the requirements for acceptable/superior performance under ASABE Standard S615.” Either the word “acceptable” or “superior” should be included based upon meeting the performance criteria specified in Section 9. This statement may be included in the product label attached to the module cover and in advertising materials.

4.9 Cylindrical module cover materials that meet or exceed the performance specifications given in Section 9 can be described with the statement, “The material system forming this module cover met the requirements for acceptable performance under ASABE Standard S615.” This statement may be included in the product label attached to the module cover and in advertising materials.

5 Module Cover Description

5.1 Rectangular module covers

5.1.1 For rectangular module covers, the top material may be constructed of any composition that meets the “acceptable” performance specifications stated in Section 9.

5.1.2 For rectangular modules, the side materials may be the same or different materials as the top piece of a module cover.

5.1.3 The top and sides pieces of a rectangular module cover may have sewn or fused seams, tape or metal reinforcements, and have metal grommets. Acceptable seams, whether sewn with thread or fused, are those that provide both strength and water penetration resistance.

5.2 Cylindrical module covers

5.2.1 The testing protocols in this standard are specific to plastic film materials.

5.2.2 Other materials may be appropriate for cylindrical module covers; however, many of the testing protocols in this standard are only appropriate for plastic films.

5.2.3 Cylindrical module covers should be constructed such that they do not interfere with the continuous operation of the cotton harvester. Adhesive materials used on cylindrical module covers shall not be deposited on any part of the harvester. Cylindrical module covers shall be manufactured to proper width dimensions to prevent tearing of the sides of the film during the application of a cover to a module on the harvester. The cover should form a taught, well-defined shoulder around the edge of both flat faces of a cylindrical module so that the film is not loosely exposed. Loose cover material around the shoulders of a cylindrical module increases the likelihood of the cover being damaged during handling in the field and at the gin. Cylindrical module covers shall be constructed so that they are able to withstand normal wear experienced during handling and transportation from the field to the gin.