## SECTION 3. INSPECTION AND TESTING

**2-30. GENERAL.** All components of the covering should be inspected for general condition. Loose finishing tape and reinforcing patches; chafing under fairings; brittle, cracking, peeling, or deteriorated coatings; fabric tears and rock damage; broken or missing rib lacing; and rodent nests are unacceptable. The entire fabric covering should be uniformly taut with no loose or wrinkled areas, or excess tension which can warp and damage the airframe.

**a. Excess Tension.** There are no methods or specifications for measuring acceptable fabric tension other than observation. Excess tension may pull and warp critical components, such as: longerons; wing ribs; and trailing edges out of position, weakening the structure.

**(1)** Excess tension with cotton, linen, and glass fiber fabric covering is usually caused by excessive dope film on a new covering, or continuous shrinking of an originally satisfactory dope film as the plasticizers migrate from the dope with age. Heat from sun exposure accelerates plasticizer migration.

**(2)** Excess tension with polyester fabric, coated with dope, is usually caused by the combined tension of the heat tautened polyester fabric and continuous shrinking of the dope film as the plasticizers migrate from the dope with age.

**b. Loose Fabric.** Fabric that flutters or ripples in the propeller slipstream, balloons, or is depressed excessively in flight from the static position, is unacceptable.

**(1)** Loose or wrinkled cotton, linen, and glass fabric covering may be caused by inadequate dope film; poor quality dope; fabric installed with excess slack; or by a bent, broken, or warped structure.

**(2)** Loose or wrinkled polyester fabric covering, finished with coatings other than dope, may be caused by inadequate or excessive heat application; excess slack when the fabric was installed; or bent or warped structure. Polyester fabric which does not meet aircraft quality specifications will very likely become loose after a short period of time.

**(3)** Glass fabric covering should be tested with a large suction cup for rib lacing cord failure and reinforcing tape failure caused by chafing on all wing ribs and other structural attachments throughout the airframe. Particular attention should be given to the area within the propeller slipstream. If failure is indicated by the covering lifting from the static position, the rib lacing cord and reinforcing tape must be reinstalled with double the number of original laces.

**NOTE: Temporary wrinkles will develop in any fabric coated and finished with dope, when moisture from rain, heavy fog, or dew is absorbed into a poor-quality dope film, causing the film to expand. Temporary wrinkles may also develop with any type of thick coatings, on any type of fabric, when an aircraft is moved from a cold storage area to a warm hangar or parked in the warming sunshine, causing rapid thermal expansion of the coating.**

**c. Coating Cracks.** Fabric exposed through cracks in the coating may be initially tested for deterioration by pressing firmly with a thumb to check the fabric's strength. Natural fibers deteriorate by exposure to ultraviolet radiation, mildew, fungus from moisture, high acid-content rain, dew, fog, pollution, and age. Polyester filaments will deteriorate by exposure to UV radiation.

**(1)** Glass fabric will not deteriorate from UV exposure, but will be deteriorated by acid rain, dew fallout, and chaffing if loose in the prop blast area.

**(2)** Cotton, linen, and glass fabric coverings are dependent solely on the strength and tautening characteristics of the dope film to carry the airloads. Dope coatings on heat-tautened polyester fabric will also absorb all the airloads because the elongation of polyester filaments are considerably higher than the dope film. Polyester fabric that is coated with materials other than dope, is dependent solely on the heat tautening and low-elongation characteristics of the polyester filaments to develop tension and transmit the airloads to the airframe without excess distortion from a static position.

**(3)** Cracks in coatings will allow any type of exposed fabric to deteriorate. Cracks should be closed by sealing or removing the coatings in the immediate area and replace with new coatings, or recover the component.

**2-31. FABRIC IDENTIFICATION.** Cotton Fabric meeting TSO-C15 or TSO-C14 can be identified by an off-white color and thread count of 80 to 94 for TSO-C14b and 80 to 84 for TSO-C15d in both directions.

**a. Aircraft linen** conforming to British specification 7F1 may be identified by a slightly darker shade than cotton fabric and irregular thread spacing. The average thread count will be about the same as Grade A fabric (TSO-C15d). The non-uniformity of the linen thread size is also noticeable, with one thread half the size of the adjacent thread. When viewed under a magnifying glass, the ends of the cotton and linen fiber nap may be seen on the backside. The nap is also seen when the coating is removed from the front or outside surface. A light-purple color showing on the back side of cotton or linen fabric indicates a fungicide was present in the dope to resist deterioration by fungus and mildew.

**b. Polyester fabric** conforming to TSO-C14b or TSO-C15d is whiter in color than cotton or linen. The fabric styles adapted for use as aircraft covering have a variety of thread counts, up to ninety-four (94), depending on the manufacturing source, weight, and breaking strength. Polyester is a monofilament and will not have any nap or filament ends showing.

**c. Glass fabric** is manufactured white in color, and one source is precoated with a blue-tinted dope as a primer and to reduce weave distortion during handling. Thread count will be approximately 36 threads per inch. Glass fabrics are monofilament and will not have any nap or filament ends showing unless they are inadvertently broken.

**d. When a small fabric sample can be removed** from the aircraft and all the coatings removed, a burn test will readily distinguish between natural fabric, polyester, and glass fabric. Cotton and linen will burn to a dry ash, polyester filaments will melt to a liquid and continue burning to a charred ash, and glass filaments, which do not support combustion, will become incandescent over a flame.

**2-32. COATING IDENTIFICATION.** Nitrate or butyrate dope must be used to develop tension on cotton, linen, and glass fabrics. When a small sample can be removed, burn tests will distinguish nitrate dope-coated fabric from butyrate dope-coated fabric by its immediate ignition and accelerated combustion. Butyrate dope will burn at less than one-half the rate of nitrate dope. Coating types other than nitrate or butyrate dope may have been used as a finish over dope on cotton, linen, and glass fiber fabric coverings.

**a. If the fabric type is determined to be polyester,** coating identification should start by reviewing the aircraft records and inspecting the inside of the wings and the fuselage for the required fabric source identification stamps for covering materials authorized under the STC. The manual, furnished by the holder of the STC-approved fabric, should be reviewed to determine whether the coatings are those specified by the STC.

**b. Coating types,** other than those authorized by the original STC, may have been used with prior FAA approval, and this would be noted in the aircraft records. The presence of dope on polyester can be detected by a sample burn test.

**2-33. STRENGTH CRITERIA FOR AIRCRAFT FABRIC.** Minimum performance standards for new intermediate-grade fabric is specified in TSO-C14b, which references AMS 3804C. Minimum performance standards for new Grade A fabric are specified in TSO-C15d, which references AMS 3806D.

**a. The condition of the fabric covering** must be determined on every 100-hour and annual inspection, because the strength of the fabric is a definite factor in the airworthiness of an airplane. Fabric is considered to be airworthy until it deteriorates to a breaking strength less than 70 percent of the strength of new fabric required for the aircraft. For example, if grade-A cotton is used on an airplane that requires only intermediate fabric, it can deteriorate to 46 pounds per inch width (70 percent of the strength of intermediate fabric) before it must be replaced.

**b. Fabric installed on aircraft with a wing loading less than 9 lb. per square foot** (psf), and a Vne less than 160 mph, will be considered unairworthy when the breaking strength has deteriorated below 46 lb. per inch width, regardless of the fabric grade. Fabric installed on aircraft with a wing loading of 9 lb. per square foot and over, or a Vne of 160 mph and over, will be considered unairworthy when the breaking strength has deteriorated below 56 lb. per inch width.

**c. Fabric installed on a glider or sailplane** with a wing loading of 8 lb. per square foot and less, and a Vne of 135 mph or less, will be considered unairworthy when the fabric breaking strength has deteriorated below 35 lb. per inch width, regardless of the fabric grade.

**2-34. FABRIC TESTING.** Mechanical devices used to test fabric by pressing against or piercing the finished fabric are not FAA approved and are used at the discretion of the mechanic to base an opinion on the general fabric condition. Punch test accuracy will depend on the individual device calibration, total coating thickness, brittleness, and types of coatings and fabric. Mechanical devices are not applicable to glass fiber fabric that will easily shear and indicate a very low reading regardless of the true breaking strength. If the fabric tests in the lower breaking strength range with the mechanical punch tester or if the overall fabric cover conditions are poor, then more accurate field tests may be made. Cut a 1-1/4-inch wide by 4-inch long sample from a top exposed surface, remove all coatings and ravel the edges to a 1-inch width. Clamp each end between suitable clamps with one clamp anchored to a support structure while a load is applied (see table 2-1) by adding sand in a suitable container suspended a few inches above the floor. If the breaking strength is still in question, a sample should be sent to a qualified testing laboratory and breaking strength tests made in accordance with American Society of Testing Materials (ASTM) publication D5035.

**NOTE: ASTM publication D1682 has been discontinued but is still referred to in some Aerospace Material Specification (AMS). The grab test method previously listed in ASTM D1682, sections 1 through 16, has been superseded by ASTM publication D5034. The strip testing method (most commonly used in aircraft) previously listed in ASTM D1682, sections 17 through 21, has been superseded by ASTM publication D5035.**

**2-35. REJUVENATION OF THE DOPE FILM.** If fabric loses its strength, there is nothing to do but remove it and recover the aircraft. But if the fabric is good and the dope is cracked, it may be treated with rejuvenator, a mixture of very potent solvents and plasticizers, to restore its resilience. The surface of the fabric is cleaned and the rejuvenator sprayed on in a wet coat, and the solvents soften the old finish so the plasticizers can become part of the film. When the rejuvenator dries, the surface should be sprayed with two coats of aluminum-pigmented dope, then sanded and a third coat of aluminum-pigmented dope applied, followed with the colored-dope finish. When repairing, rejuvenating, and refinishing covering materials approved under an STC, instructions in the manual furnished by the material supplier should be followed.

**2-36.—2-41. [RESERVED.]**