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Test Method for Abrasion Resistance of Fabrics: Accelerotor

1. Purpose and Scope

1.1 This test method is intended for evaluating the resistance of fabrics and other flexible materials to abrasion (see 14.1).

2. Principle

2.1 An unfettered fabric specimen is driven by an impeller (rotor) along a zig-zag course in a generally circular orbit within a cylindrical chamber, so that it repeatedly impinges on the walls and abradant liner of the chamber while at the same time being continually subjected to extremely rapid, high velocity impacts. The specimen is subjected to flexing, rubbing, shock, compression, stretching and other mechanical forces during the test. Abrasion is produced throughout the specimen by rubbing of yarn against yarn, fiber against fiber, surface against surface and surface against abradant.

2.2 Evaluation is made on the basis of weight loss of the specimen or grab strength loss of the (woven) specimen when broken at an abraded fold line. Generally, flat woven fabrics may be evaluated by either method. Tufted and other fabrics with raised surfaces, and knit fabrics, are evaluated by the weight loss method.

2.3 Changes in other fabric characteristics may also be useful for evaluating abrasion resistance with the Accelerotor (see 14.1).

3. Terminology

3.1 **abrasion**, *n.*—the wearing away of any part of a material by rubbing against another surface.

4. Safety Precautions

NOTE: These safety precautions are for information purposes only. The precautions are ancillary to the testing procedures and are not intended to be all inclusive. It is the user's responsibility to use safe and proper techniques in handling materials in this test method. Manufacturers MUST be consulted for specific details such as material safety data sheets and other manufacturer's recommendations. All OSHA standards and rules must also be consulted and followed.

4.1 Good laboratory practices should be followed. Wear safety glasses in all laboratory areas.

4.2 The door of the Accelerotor must be kept closed whenever the motor is run-

ning. Manufacturer's safety recommendations should be followed when operating laboratory testing equipment.

4.3 A face mask is recommended for operators who work regularly with the Accelerotor to guard against inhalation of fiber dust.

5. Uses and Limitations

5.1 The results obtained by this method are affected by duration; the size, shape and angular velocity of the rotor; and by the type of liner used. These effects are interrelated, and testing conditions may be varied to produce different degrees of abrasion in a test specimen. For example, it may require only 2 or 3 min at 209.44 rad/s (2000 rpm) with the standard offset rotor to produce a reasonable degree of abrasion in a delicate or fragile fabric, while a heavier or more durable fabric may require 6 min at 314.16 rad/s (3000 rpm).

5.2 When fabrics curl or, for other reasons, do not move about freely in the test chamber, testing should be discontinued.

5.3 The results of this test should not be equated with service life.

6. Apparatus and Materials

6.1 Accelerotor (Fig. 1; see 14.3) equipped with the following parts:

6.1.1 Rotor, offset (elongated S-shape), 114 mm (4.5 in.) (Fig. 2) (see 14.4 for descriptions of alternate rotors).

6.1.2 Collar insert, plastic, lined with 3.2 mm (0.125 in.) polyurethane foam.

6.2 Liner, fine abrasive, 500J grit aluminum oxide cloth (see 14.3; an alternate abrasive liner is described in 14.5).

6.3 Neon lamp or other stroboscopic device.

6.4 Timer, automatic, accurate to ± 1 s.

6.5 White glue.



Fig. 1—Accelerotor fitted with abrasive liner over foam rubber cushion and with 114 mm (4.5 in.) S-shape rotor.



Fig. 2—Elongated S-shape rotor.

6.6 Pinking shears and marking templates, or cutting dies (see 14.8).

6.7 Brush, nylon, for cleaning Accelerotor chamber or small portable vacuum cleaner for chamber and specimens.

6.8 Thread, size E, Type I, Class 1 or 2, Fed. Spec. V-T-295.

6.9 Cotton fabric, 78 ends per in. $\times$ 76 picks per in. print cloth (carded yarns) 1.2 m (46 in.) wide, about 8 m/kg (4 yd/lb), bleached and desized, free from blueing, optical bleach or finishing materials.

6.10 Analytical balance accurate to ± 0.001 g.

7. Test Specimens

7.1 In the absence of applicable specifications, take a minimum of three specimens from each sample to be tested not nearer the selvage than one-tenth the width of the fabric or 64 mm (2.5 in.). Select specimens that are representative of the whole sample to be tested.

7.2 Size of Specimens.

7.2.1 Method A (Evaluation by weight loss)—Cut specimens of heavier or bulkier fabrics smaller than those of lighter fabrics to minimize variations in impact produced when the specimens hit the chamber wall or abradant liner. Table I is a guide to the relationship between fabric weight, in grams per square meter (ounces per square yard), and specimen size. Specimens may be taken with the edges parallel to the warp and filling (courses and wales) or on the bias.

7.2.2 Method B (Evaluation by strength loss)—The specimen size is 100 $\times$ 150 mm (4 $\times$ 6 in.) with the greater dimension in the direction of the yarns to be broken. Take specimens with their edges parallel to the warp and filling yarns.

7.3 Specimen Preparation.

7.3.1 Method A—Cut a specimen with pinking shears or die (see 14.8). If woven fabric is die-cut parallel to yarns, ravel 3.2 mm (0.125 in.) along each edge. Place the specimen on plastic sheet (to protect bench top) and apply a 3.2 mm (0.125 in.) strip of adhesive to each cut or raveled edge (Fig. 3) (see 14.4 and 14.9). Allow the adhesive to dry at room