

Test Method for Dimensional Changes on Drycleaning in Perchloroethylene: Machine

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Foreword

Drycleaning, a process for cleaning textiles in an organic solvent, dissolves oils and fats and disperses particulate dirt substantially without the swelling and creasing associated with washing or wet cleaning. Small quantities of water and surfactant may be incorporated in the solvent to obtain better soil and stain removal. Some moisture-sensitive articles are preferably drycleaned without the addition of water to the solvent but a surfactant can be used in order to assist soil removal and prevent graying. Different solvents can be used for drycleaning, of which perchloroethylene (tetrachloroethylene) is the most common in many countries. For this reason, the present method prescribes the use of perchloroethylene. Drycleaning is normally followed by an appropriate restorative finishing procedure. In most cases, this comprises some form of steam treatment and/or hot pressing. Dimensional change on drycleaning and steaming and/or pressing is progressive, and in some cases a single treatment may give little indication of the extent of dimensional change that may arise after repeated treatments. Generally, most of the potential dimensional change is released after 3-5 drycleaning and finishing treatments.

1. Purpose and Scope

1.1 This test method specifies a drycleaning procedure, using a commercial drycleaning machine, for the determination of dimensional change of fabrics and garments after drycleaning in perchloroethylene. It comprises processes for normal materials and sensitive materials (see 13.1).

1.2 Very sensitive materials, which can be cleaned only when special precautions are taken, are excluded from the scope of this method (see 13.1).

1.3 The test method is intended only for the assessment of dimensional changes undergone by a specimen subjected to a single drycleaning and finish-

ing operation. When it is desired to determine the amount of progressive dimensional change, the method may be repeated a specified number of times, normally not exceeding five cycles.

2. Principle

2.1 Conditioned fabrics or garments are marked and measured, then subjected to a drycleaning procedure, followed by an appropriate finishing procedure. They are afterwards conditioned and measured. The dimensional change is expressed as a percentage of the original dimensions.

3. Terminology

3.1 **dimensional change**, n.—a generic term for variation in length or width of a garment or fabric specimen subjected to specified conditions.

3.2 **drycleaning**, n.—the cleaning of fabrics with organic solvents such as petroleum solvent, perchloroethylene or fluorocarbon.

NOTE: The process also includes adding detergent and moisture to the solvent, up to 75% RH, and hot tumble drying to 71°C (160°F).

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 be consulted and followed.

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

4.2 All chemicals should be handled with care.

4.3 Perchloroethylene is toxic by inhalation, by repeated contact with the skin and by ingestion; it should be used only in a well vented atmosphere. Toxicology studies with laboratory animals have shown evidence of cancer in rats and mice exposed to perchloroethylene vapors at 100-400 ppm concentrations for prolonged times. Fabric saturated with this solvent should be dried in an adequately ventilated hood. Use chemical

goggles or face shield, impervious gloves and an impervious apron when handling perchloroethylene.

4.4 An eyewash/safety shower should be located nearby and an organic vapor respirator should be readily available for emergency use.

4.5 The drycleaning apparatus should be ventilated to the outside atmosphere in accordance with the manufacturer's instructions.

4.6 Exposure to chemicals used in this procedure must be controlled at or below levels set by governmental authorities (e.g., Occupational Safety and Health Administration's [OSHA] permissible exposure limits [PEL] as found in 29 CFR 1910.1000; see web site: www.osha.gov for latest version). In addition, the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs) comprised of time weighted averages (TLV-TWA), short term exposure limits (TLV-STEL) and ceiling limits (TLV-C) are recommended as a general guide for air contaminant exposure which should be met (see 13.2).

5. Reagents

5.1 Perchloroethylene (commercial), $\text{CCl}_2 = \text{CCl}_2$, drycleaning grade.

5.2 Sorbitan mono-oleate (a typical chemical is Span 80).

6. Apparatus and Materials

6.1 Drycleaning machine. This shall consist of a commercial rotating cage type, totally enclosed machine for use with perchloroethylene. The diameter of the rotating cage shall be not less than 600 mm and not more than 1080 mm. Its depth shall be not less than 300 mm. It shall be fitted with three or four lifters. The speed shall be such as to give a g-factor (see 13.3) between 0.5 and 0.8 for cleaning and between 35 and 120 for extraction. The machine shall be equipped with a thermometer for the measurement of the solvent temperature. The machine shall have suitable facilities so that the emulsion can be introduced gradually into the solvent between the inner and outer cages below the level of the solvent. The machine may be of the single-unit washer/dryer type or a separate dryer may be used. Both types of dryers shall be equipped with temperature control of either the incoming or the outgoing air during the drying cycle. (Information on

solvent recovery is given in 13.4.) The dimensions of the rotating drum of the separate dryer shall comply with those given for the drycleaning machine.

6.2 Apparatus for applying the appropriate finishing treatment to the test specimen.

6.3 Means of producing the standard atmosphere for testing textiles.

6.4 Ballast consisting of clean textile pieces or garments. These shall be white or a light color and consist of about 80% wool and 20% cotton or rayon.

6.5 Pen and ink (indelible) or other suitable marking device.

6.6 Stable measuring scale of dimensions suitable for the article being tested, graduated in millimeters.

6.7 Flat table of dimensions such that the article being tested can be laid flat for measurement.

7. Test Specimens

7.1 Test garments as such.

7.2 Cut fabrics into test specimens preferably not smaller than 500 × 500 mm and stitched on all sides with polyester thread to prevent ravelling.

7.3 Carefully open elastic circular knits by cutting in the direction of the ribs without causing distortion. After marking and measuring according to Section 8, restore the circular state by sewing together the cut edges. After the test, the seam shall be cut again and distances between markings determined in the open state.

8. Preparation of Specimens

8.1 Condition the test specimens and dummy load from the dry side at $21 \pm 2^\circ\text{C}$ ($70 \pm 4^\circ\text{F}$) and $65 \pm 5\%$ RH by laying each test specimen separately on a flat, smooth, horizontal surface for at least 24 h.

8.2 When marking fabric specimens, lay out the specimen without tension on a flat, smooth surface, taking care to see that it is free from wrinkles and creases. Making three pairs of marks, each at least 250 mm apart in the length direction, and three similar pairs of marks in the width direction of the fabric. If the specimen is a garment, mark and measure different parts of the outer fabrics and linings separately.

9. Test Procedures

9.1 Procedure for normal materials.

9.1.1 The mass of the complete load shall be 50 ± 2 kg for each cubic meter of the volume of the inner cage. Ensure that the mass of the textile part of the test specimen(s) is not more than 10% of the total load, the remainder consisting of the ballast unless the mass of the test piece of

garment as such exceeds 10% of the total load.

When loaded into the machine, the specimen(s) and the ballast shall be in equilibrium with the standard atmosphere for testing textiles. Equilibrium is deemed to be attained after exposure for 24 h to this atmosphere.

9.1.2 Place the conditioned load in the machine and introduce perchloroethylene containing 1 g/L of sorbitan mono-oleate so that the liquor ratio, calculated on the volume of solvent in the outer and inner cages, is 6.5 ± 0.5 L for each kg of load (this corresponds to a solvent level of about 30% of the inner cage diameter). Maintain the solvent at $30 \pm 3^\circ\text{C}$ ($86 \pm 5^\circ\text{F}$) throughout the cleaning operation.

9.1.3 Prepare an emulsion by mixing 1 part (by volume) of the sorbitan mono-oleate with 3 parts of perchloroethylene and then adding 2 parts of water (with stirring). Start the machine with the filter circuit shut off and slowly (over a period of not less than 2 min and not more than 12 min) add an amount of emulsion corresponding to 2% of water calculated on the mass of the load, to the machine between the inner and outer cages below the level of the solvent.

9.1.4 Keep the machine running for 15 min after switching it on. The filter circuit test is not used during any part of this test except the initial solvent fill in 9.1.2.

9.1.5 Drain the solvent and centrifugally extract the solvent from the load for 2 min (at least 1 min being at full extraction speed).

9.1.6 Introduce pure dry solvent at the same liquor ratio (see 9.1.2) and rinse for 5 min. Drain and extract again for 3 min (at least 2 min being at full extraction speed).

9.1.7 Dry the load in the machine or in a separate drying tumbler, by tumbling in circulating warm air for an appropriate time, preferably using an automatic solvent-dryness control. Either the outlet air temperature shall not exceed 60°C (140°F), or the inlet temperature shall not exceed 80°C (176°F) (see 13.5). After drying, blow air at ambient temperature through the rotating load for 3-5 min.

9.1.8 Remove the specimens from machine immediately. Place garments individually on hangers and place fabric specimens on a flat surface for not less than 30 min before finishing.

NOTE: If additional information on stability to drycleaning only is required, condition and remeasure the specimen at this stage before completing the procedure. Note details of this procedure in the test report.

9.1.9 Carry out a finishing treatment by the method appropriate for the type of garment or fabric under test. In most cases, this will involve pressing on a garment (steam) press supplied with steam at

a pressure of 370-490 kPa² (3.8-5 kg/cm²) (oven-pressure) or steaming on a steam/air garment former for 5-20 s followed by drying with warm air for 5-20 s.

9.1.10 Condition the specimen according to 8.1 and measure, according to 8.2, the distances previously marked and measured.

9.2 Procedure for sensitive materials.

9.2.1 Proceed as in 9.1.1 but use a total load of mass 33 ± 2 kg for each cubic meter of the volume of the inner cage.

9.2.2 Proceed as in 9.1.2 but increase the amount of solvent to 10 ± 1 L/kg of load (this gives about the same solvent level as in 9.1.2).

9.2.3 Proceed as in 9.1.3 but operating at solvent relative humidity of $63 \pm 2\%$. This means that no water emulsion addition is necessary.

9.2.4 Proceed as in 9.1.4 but reduce the running time to 10 min.

9.2.5 Proceed as in 9.1.5-9.1.10 but reduce the period of extraction at full extraction speed to 1 min.

9.2.6 Lay the specimen out according to 8.2 and measure the distance between marks to the nearest millimeter. Measure overall dimensions of garments to within ± 2 mm. Make all measurements in the standard atmosphere for conditioning and testing textiles as given in 8.1.

10. Calculation and Expression of Results

10.1 Calculate the dimensional change in the length and width directions of each fabric specimen or in the principal dimensions of a garment. Express as average percentage dimensional change, rounded to the nearest 0.2%, using a minus sign to indicate shrinkage and a plus sign to indicate an increase in dimensions.

11. Test Report

11.1 State that the tests were made in accordance with this method and give the following information:

(a) Details of any optional or additional requirements that have been met.

(b) Whether the procedure in 9.1 or 9.2 was used.

(c) The results obtained according to Section 10.

(d) The percentage by mass of specimen(s) in the load, and the type of material comprising the ballast.

(e) The maximum inlet or outlet air temperature during drying.

(f) Details of the finishing treatment used.

(g) The number of treatments given.

(h) Details of the dimensions of the garment or fabric specimen as required by the method.