CHANGE NOTICES ARE NOT CUMULATIVE AND SHALL BE RETAINED UNTIL SUCH TIME AS THE ENTIRE STANDARD IS REVISED.

FED. TEST METHOD STD. NO. 311
CHANGE NOTICE 3
January 24, 1975

FEDERAL TEST METHOD STANDARD

LEATHER, METHODS OF SAMPLING AND TESTING

The following changes to Fed. Test Method Std. No. 311 dated January 15, 1969, have been approved by the Commissioner, Federal Supply Service, General Services Administration for the use of all Federal agencies.

1. Delete Section 2 and substitute the attached Section 2.

2. Delete methods 3021.1, 3041, 3211.1, 4211.1, 7011 and 8011.1, and substitute the following attached revised methods: 3021.2, 3041.1, 3211.2, 4211.2, 7011.1 and 8011.2.

3. Add the following new methods: 2061, 2171, and 8151.

4. Delete the following methods: 3011 and 8141. Test requirements are contained in methods 3031.1 and 8151.

Military Custodians:

Army - GL
Navy - SA
Air Force - 82

Review activity:

Navy - AS

User activities:

Army - WC
Navy - OS, YD, MC
Air Force - 11

Preparing activity:

Army - GL

Civil Agency Coordinating Activities:

AGR - ARS
GSA - FSS
GSA - PCD
COM - NBS

Project No. 8300-0341

RETAIN THIS COVER PAGE AND INSERT BEFORE THE SCOPE AND CONTENTS PAGE OF THIS STANDARD

FSC 8300

SECTION 2

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2.2 Numerical Index of Test Methods.

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1021.1	Thickness, Specimen
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1121	Area, Unit, Template Method
1211	Width and Length, Unit
1231	Apparent Density of Leather

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q

SHEAR STRENGTH, STUCK-ON RIB

1. SCOPE

1.1 This method is intended for detemining the shear strength between the stuck-on rib and the insole which is to be used for subsequent construction of various footwear items.

2. TEST SPECIMEN

2.1 The specimen shall be a die-cut rectangle 1.00 ± .01 inch (25.4 ± .3 -) by 2.5 ± .1 inch (63.5 ± 3 mm) obtained from an Insole. The long edge of the specimen shall be perpendicular to both the outer edge of the insole and to the rib direction. The one inch (25.4 mm) dimension shall include an inch width of the upstanding rib along with the outer edge of the insole.

3. NUMBER OF DETERMINATIONS

3.1 Unless otherwise specified in the material speciflcatia, one specimen from each sample unit shall be tested.

4. APPARATUS

4.1 A testing machine wherein the specimen is held between two clamps and strained by a uniform movement of a pulling clamp.

4.1.1 The design of the upper clamp shall be such that one gripping surface or jaw may be an intergral part of the rigid frame of the clamp or be fastened to allow a slight vertical imvement while the other gripping surface or jaw shall be completely movable. Unless otherwise specified, the dimension of the stationary rear jaw of this clamp shall measure one inch (25.4 mm) parallel to the application of the load and perpendicular to this direction shall measure one inch (25.4 mm) or more. The face of the movable front jaw shall measure one inch (25.4 mm) by one inch (25.4 mm). Each jaw face shall have a flat knurled gripping surface to prevent slipping during test. The design of the lower clamp shall be as specified in figure 2061.

4.1.2 The machine shall be power driven.

4.1.3 The applied tension shall be accurate to ± 2 percent up to and including a force of 50 pounds (22.7 kg) and ± 1 percent over 50 pounds (22.7 kg) and shall be indicated by a dial, scale or automatic recorder.

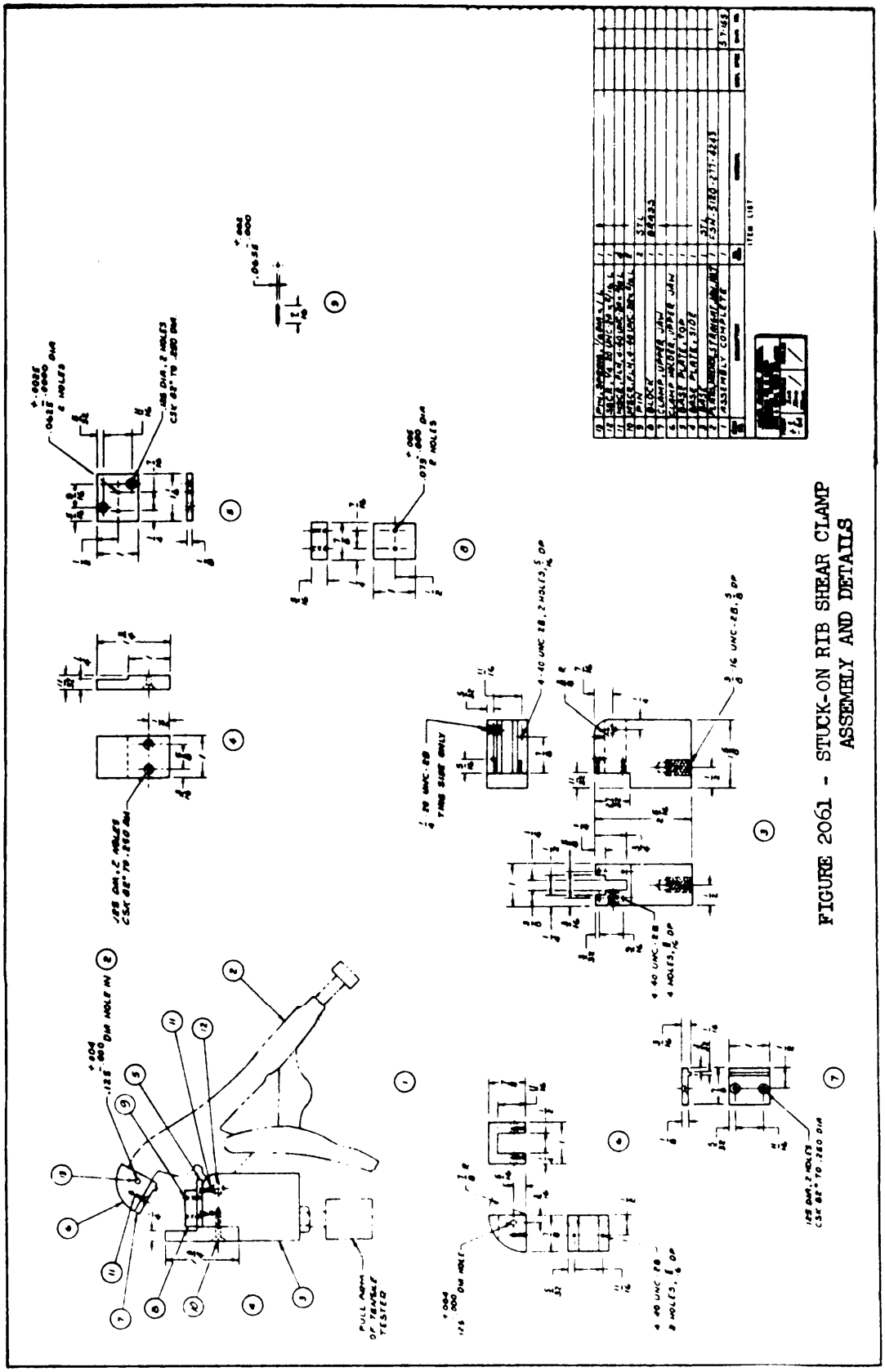


FIGURE 2061 - STUCK-ON RIB SHEAR CLAMP ASSEMBLY AND DETAILS

Drawing No. 5-7-155A

4.1.4 The load indicator shall record or indicate the point of maximum load after separation of the specimen.

4.1.5 The rate of travel of the power actuated clamp shall be 10 + 2 inches per minute (254 ± 51 mm per minute) under no load, and shall be uniforrm at all times.

4.1.6 The machine shall be such capacity that the maximum load required to break the specimen is not greater than 85 percent nor less than 15 percent of the rated capacity.

4.2 A rectangular metal spacer (gage), a minimum of 0.5 inch (13 mm) wide, and 0.0015 ± 0.0005 inch (0.038 ± 0.013 mm) thick.

5. PROCEDURE

5.1 Unless otherwise specified, this test shall be performed under the conditions and on material conditioned as specified in Section 5 of this standard.

5.2 The entire upstanding rib shall be firmly secured by the modified lower clamp of the tensile testing machine. The distance between the inside surface of the side base plate and the opposing surface of the insole specimen shall be approximately 0.0015 inch (0.038 mm). This distance shall be established by seating the spacer (gage) between the side base plate and the opposing surface of the specimen and adjusting the side base plate by turning the adjusting screws so the spacer just fits between the side base plate and specimen, but can be removed without binding. After this adjustment is made the spacer shall be removed. A minimum length of 0.5 inch (13 mm) of the opposite end of the specimen shall be firmly secured in the jaws of the upper clamp. Bending or twisting of the upstanding rib or insole shall not be allowed during the specimen loading operation. A force shall be applied to the specimen at the rate of 10 ± 2 inches per minute (254 ± 51 mm per minute). The force required to shear the rib from the insole shall be noted from the dial, scale, or by means of an automatic recorder and this value recorded as the shearing strength of the stuck-on rib.

6. REPORT

6.1 The shear strength of the stuck-on rib shall be reported to the nearest 1 pound (0.5 kg).

TEARING STRENGTH, STITCH, STUCK-ON RIB

1. SCOPE

1.1 This method is Intended for measuring the two hole stitch tearing strength of the upstanding rib portion of a stuck-on rib while attached to an insole. Data obtained determines suitability for subsequent operations performed during the construction of various footwear items.

2. TEST SPECIMEN

2.1 The specimen shall be a die-cut rectangle 1.00 ± .01 inch (25.4 ± .3 mm) by 2.5 ± .1 inch (63.5 ± 3 mm) obtained from an insole. The long edge of the specimen shall be perpendicular to both the outer edge of the insole and to the rib direction. The one inch (25.4 mm) dimension shall include an inch (25.4 mm) width of the upstanding rib along with the outer edge of the sole.

3. NUMBER OF DETERMINATIONS

3.1 Unless otherwise specified in the material specification, one specimen from each sample unit shall be tested.

4 . APPARATUS

4.1 A testing machine wherein the specimen is held between two clamps and strained by a uniform movement of a pulling clamp.

4.1.1 The design of each of the two clamps shall be such that one gripping surface or jaw may be an integral part of the rigid frame of the clamp *or* be fastened to allow a slight vertical movement while the other gripping surface or jaw shall be completely movable. The dimension of the stationary or slightly movable rear jaw of this clamp shall measure one inch (25.4 mm) parallel to the application of the load and perpendicular to this direction shall measure one inch (25.4 mm) or more. The face of the movable front jaw shall measure at least one inch (25.4 mm) by one inch (25.4 mm). Each jaw face shall have a flat, knurled gripping surface to prevent slipping during test. The jaws of one of the clamps shall be covered with a material suitable for protecting the gripping surfaces from damage by contact with the steel wire specified in 4.2.

4.1.2 The machine shall be power driven.

4.1.3 The applied tension shall be accurate to ± 2 percent up to and including a force of 50 pounds (22.7 kg) and ± 1 percent over 50 pounds (22.7 kg) and shall be indicated by a dial, scale or automatic recorder.

4.1.4 The load indicator shall record or indicate the point of maximum load after tearing the upstanding rib portion of the specimen.

4.1.5 The rate of travel of the power actuated clamp shall be 10 ± 2 inches per minute (254 ± 51 mm per minute) under no load, and shall be uniform at all times.

4.1.6 The machine shall be of such capacity that the maximum load required to tear the rib shall not be greater than 85 percent nor less than 15 percent of the rated capacity.

4.2 A steel wire 0.041 ± 0.001 inch (1.04 ± .03 mm) in diameter and not less than 4 inches (101.6 mm) in length. The wire shall conform to the requirements for type I, style 1, large paper clips as contained in Federal specification FF-C-436.

4.3 An electric drill with a 5/64 inch (2 mm) drill bit suitable for making two holes in the upstanding rib portion of the specimen.

5. PROCEDURE

5.1 Unless otherwise specified, this test shall be performed under the conditions and on material conditioned as specified in section 5 of this standard.

5.2 Two holes shall be drilled in the middle of the height of the upstanding rib using a 5/64 inch (2 mm) diameter drill. These holes shall be 1/4 ± 1/16 inch (6.35 ± 1.59 mm) apart and equidistant from the center line that bisects the one inch dimension of the specimen. The jig shown in figure 2171 may be used to locate the holes for drilling.

5.3 A steel wire 0.041 ± 0.001 inch (1.04 ± .03 mm) in diameter shall be made into a U-shape using a 1/4 inch (6 mm) diameter mandrel and passed through the two holes in the upstanding rib so that both ends of the wire project in the direction of the outer edge of the insole. The bent surface of the wire shall be in contact with the surface of the upstanding rib which is furthest away from the outer edge of the insole. The ends of the wire shall be fastened in the covered clamp of the testing machine. The opposite end of the specimen shall be fastened in the other clamp of the testing machine. Force shall be applied to the specimen at a rate of 10 ± 2 inches per minute (254 ± 51 mm per minute). The maximum force required to tear the upstanding rib shall be noted from the dial, scale or automatic recorder and the value recorded as the stuck-on rib stitch tearing strength.

6. REPORT

6.1 The stitch tearing strength of the upstanding rib section of the stuck-on rib shall be reported to the nearest 1 pound (.5 kg).

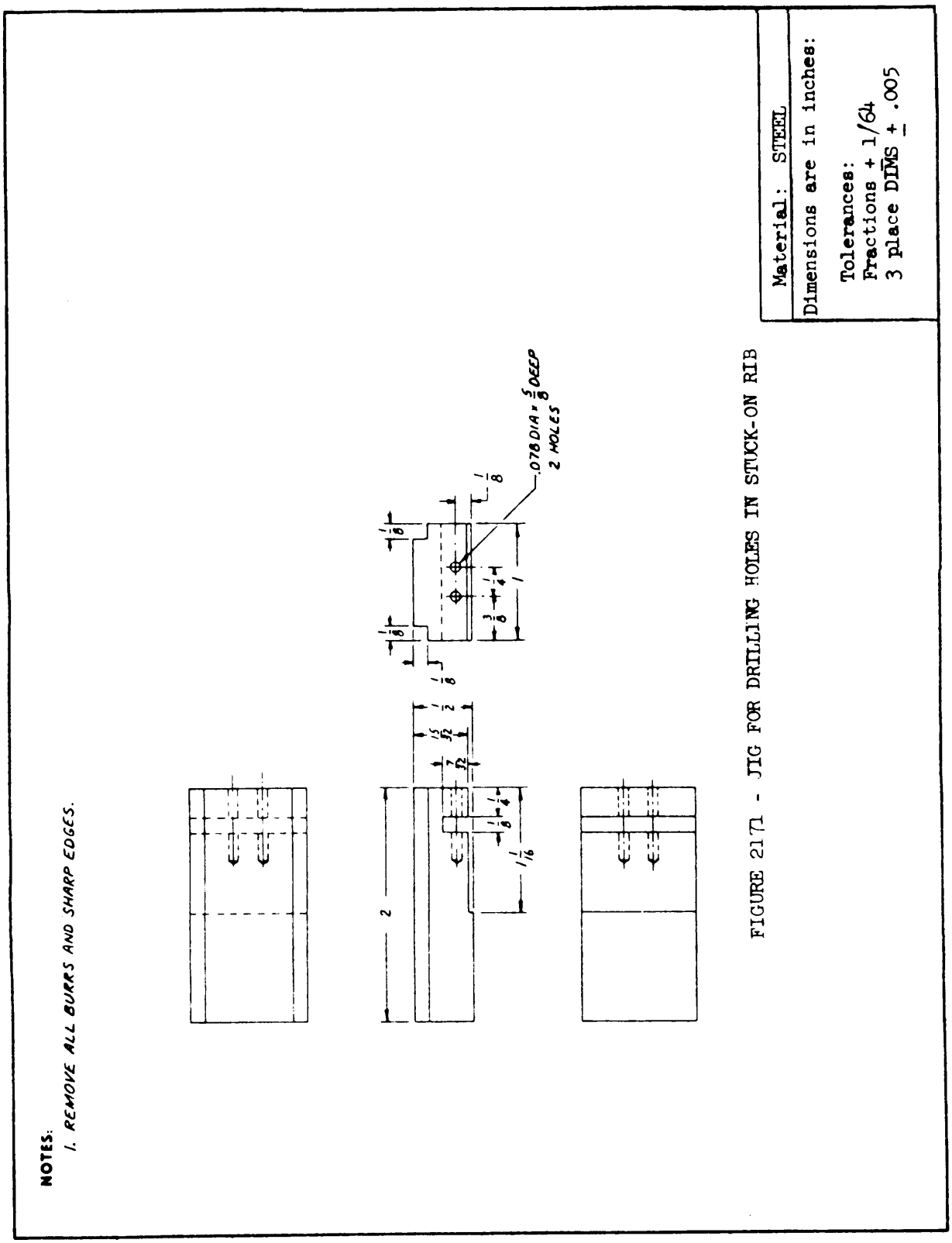


FIGURE 2171 - JIG FOR DRILLING HOLES IN STUCK-ON RIB

Drawing No. 5-7-158

FIGURE 2171.

METHOD 3021.2
January 24, 1975
SUPERSEDING
Method 3021.1
August 27, 1971

STAINING

1. SCOPE

1.1 This method is intended for determining whether glove leather bleeds (erodes coloring matter) when in intimate contact with wet surfaces as indicated by staining produced on wet cloth in contact with the leather.

2. TEST SPECIMEN

2.1 The specimen shall be a square of leather 1.0 by 1.0 inch (25 by 25 mm).

3. NUMBER OF DETERMINATIONS

3.1 Unless otherwise specified in the material specification, one specimen from each sample unit shall be tested.

4. APPARATUS AND MATERIALS

4.1 Apparatus

4.1.1 One or more assemblies consisting of a flat glass or plastic square, same size as transfer pad and a suitable weight placed on top of the square. The combined weight shall be 100 ± 5 grams. (An assembly consisting of a plastic or glass plate and a 1 fluid ounce (29 cc) plastic or glass jar with plastic lid to which the appropriate amount of lead shot or steel balls is added, has been found to be suitable. The plate and jar may be held together by a suitable cement or pressure sensitive adhesive tape).

4.1.2 A flat bottomed heat-resistant plastic container or other similar material with cover (see 7.1) of sufficient size to accommodate a maximum of 15 specimens. A container 12 inches (300 mm) long, 9 inches (230 mm) wide and 4 inches (100 mm) high has been found to be suitable.

4.1.3 A forced circulating-air oven capable of maintaining the required temperature of 38 ± 2°C.

4.1.4 A balance, single beam or high speed.

4.2 Materials

4.2.1 Unless otherwise specified in the material specification, the color transfer cloth shall be a pad of white cloth approximately 5 cm square, made of 4 layers of desized, bleached 96 by 100, combed yarn, cotton lawn cloth. The cloth shall contain no bluing or optical bleach. (See 7.2).

5. PROCEDURE

5.1 The leather specimen and the color transfer pad shall be brought to moisture equilibrium in accordance with standard atmospheric conditions (see Section 5). The conditioned pad shall be weighed to the nearest 0.05 grams. After weighing, the pad shall be wetted with enough distilled water to double the weight of the conditioned pad. (NOTE: The dry weight of the conditioned pad is usually 1.0 to 1.1 grams and the weight of the wet pad is usually 2.0 to 2.2 grams). If necessary, excess water shall be removed from the pad in order to attain the proper weight. The wet pad shall be placed in the bottom of the plastic container and the leather specimen shall be placed approximately in the center of the pad. Unless otherwise specified, the grain side of the leather shall be in contact with the pad. The load assembly shall be immediately placed on top of the specimen. Care should be taken to assure the plastic or glass square portion of the load assembly completely covers the specimen and transfer pad. The container shall be covered and placed on a shelf in the circulating-air oven at 38 ± 2°C for 6 hours. At the end of the required time, the container shall be take; from the oven. The pad shall be removed and allowed to dry at a temperature of 23 ± 2°C. The darkest stain on the pad shall be rated in indirect light by matching-it with the color on the AATCC Chromatic Transference Scale (see 7.3) that is closest to it in chromaticity and hue.

6. REPORT

6.1 The staining result shall be reported according to the following expanded AATCC ratings:

Comparison of Test Pad Stain with Numerical AATCC Values	Expanded AATCC Rating Value
Stain Heavier than 1	0
Stain Equivalent to 1	i
Stain Lighter than 1 by Heavier than 2	+1
Stain Equivalent to 2	2
Stain Lighter than 2 but Heavier than 3	+2
Stain Equivalent to 3	3
Stain Lighter than 3 but Heavier than 4	+3
Stain Equivalent to 4	4

7. NOTES

7.1 A suitable plastic container may be obtained from the regional distributors of the Tri-State Molding Co., Box 337, Henderson, Kentucky 42420.

7.2 Color transfer cloth which meets the requirements of this method may be purchased from Test Fabrics, Inc., P. O. Box 53, 200 Blackford Avenue, Middlesex, New Jersey 08846.

7.3 The AATCC Chromatic Transference Scale may be obtained from the AATCC National Headquarters, P. O. Box 12215, Research Triangle Park, NC 22709.

METHOD 3041.1
January 24, 1975
SUPERSEDING
Method 3041
July 13, 1972

AREA STABILITY OF LEATHER TO LAUNDERING

SCOPE

1.1 This method is intended for determining the launderability of dyed leathers with or without a pigment finish.

TEST SPECIMEN

2.1 The specimen shall be a square of leather 2.0 by 2.0 inches (51 by 51 xmn) cut from the sample unit of leather.

3. NUMBER OF DETERMINATIONS

3.1 Unless otherwise specified in the material specification, three specimens from each sample unit shall be tested.

4. APPARATUS, REAGENTS AND METHOD CITED

4.1 Stainless steel balls, type 316, 1/4 inch (6 mm) diameter.

4.2 One pint (0.5 liter) steel or glass jar with washer and cap.

4.3 Launder-Ometer or similar machine approved by Defense Personnel Support Center, Philadelphia, PA as being capable of producing similar results (see 7.1).

4.4 Circulating-air oven capable of maintaining the required temperature of 120 ± 2°F (49 ± 1°C).

4.5 Blotting paper conforming to Federal Specification NNN-P-35, Paper, Blotting, (Laboratory) (see 7.2).

4.6 Metal die for cutting the specimen to the required dimensions.

4.7 Soap solution prepared by dissolving 5 grams of standard neutral chip soap in one liter of distilled water (see 7.3).

4.8 Method cited. Method 8112 - Water Absorption, Tumble Method.

5. PROCEDURE

5.1 Unless otherwise specified, this test shall be performed in accordance with standard atmospheric conditions (see Section 5). The conditioned samples shall be weighed to the nearest 0.1 gram.

5.2 Two measurements of each dimension of the specimen shall be made and averaged. The measurements shall be made 13 mm in from the edges of the specimen. The grain surface of the specimen shall be indelibly marked to indicate the points of measurement. The average measurement shall be used to determine the original area of the specimen and this area recorded as A (The known dimensions of the die may be used instead of actually measuring the specimen. When this option is taken, the specimen shall still be indelibly marked at the points of measurement indicated above.)

5.3 Three specimens and twenty stainless steel balls, shall be added to a one pint jar together with 150 ml of a soap solution which has been preheated to 120 ± 2°F (49 ± 1°C).

5.4 The jars shall be sealed and clamped into the rotor of a Launder-Ometer or other apparatus producing similar conditions. The apparatus shall then be run at 40 to 45 rpm for 30 minutes at 120 ± 2°F (49 ± 1°C).

5.5 The jars shall be removed and the soap solution poured from the jars through a sieve to avoid losing the steel balls and specimens. The specimens shall then be placed flesh side down on a pad consisting of two 10 by 10 inches (25.4 by 25.4 cm) blotting papers and covered with a pad of two additional blotting papers of the same type. A non-absorbent flat rigid plate large enough to cover the blotters shall be placed on the cover blotter. If necessary, a weight shall be placed on the plate so as to subject the specimens to a 10 gram per square centimeter load for 5 minutes. At the end of this period the load shall be removed and the specimens transferred to a widemouth 1 gallon container previously filled with water preheated to 120 ± 2°F (49 ± 1°C). The volume of water in milliliters shall be approximately 100 times the initial weight of the conditioned specimens in grams.

5.6 The container shall be tumbled for 30 minutes in a machine as described in Method 8112. The water shall be removed and the specimens shall be squeezed by hand and spread next to each other on a flat noncorrosive rigid plate. No specimen shall be closer than 1/2 inch (12.7 mm) to the others.

5.7 The plate with specimens shall be placed in a pre-heated circulating air oven for 30 minutes at 120 ± 2°F (49 ± 1°C). At the end of 30 minutes the dried specimens shall be returned to the pint jars, 3 specimens per jar, together with the steel balls and 100 ml of the soap solution preheated to 120 ± 2°F (49 + lot). The entire procedure shall be repeated again. After the specimens have-been removed from the oven the second time, they shall be returned to the pint jars, 3 specimens per jar, together with the steel balls and 50 ml of the soap solution preheated to 120 ± 2°F (49 ± 1°C). The entire procedure shall be repeated a third time, except that the specimens shall not be squeezed by hand or dried in the oven, after being tumbled in the pre-heated water. Instead, the specimens shall be placed grain side up on a flat noncorrosive rigid surface and allowed to dry under standard conditions for 48 hours.

5.8 Two measurements shall be taken in one dimension, averaged, and the average recorded as B. Two measurements shall be taken in the other dimension, averaged, and the averaged recorded as C. The measurements will be made at the indelibly marked points of measurement described in 5.2. The averages shall be calculated to the nearest 0.1 mm or .02 inch. The average area change shall be calculated as follows:

$$\text{Percent area change} = \frac{A - (B \times C) \times 100}{A}$$

Where: A - original area of the specimen (can be calculated from the known dimensions of the die).

B - average of two measurements in one dimension of the specimen.

C - average of two measurements in the other dimension of test specimen.

In the event of increase in area of the test specimen, the calculations shall be made as follows:

$$\text{Percent area change} = \frac{(B \times C) - A \times 100}{A}$$

6. REPORT

6.1 Area change shall be reported to the nearest 0.1 percent.

7. NOTES

7.1 The Launder-Ometer, stainless steel balls, and one pint jars may be purchased from Atlas Electric Devices Co., 4114 N. Ravenswood Ave., Chicago, IL 60613.

7.2 Blotting paper may be purchased from Standard Paper Manufacturing Co., P.O. BOX 1554, Richmond, VA 23212.

7.3 The standard neutral chip soap may be purchased from AATCC, Box 12215, Research Triangle Pk., NC 27709.

METHOD 3211.2
January 24, 1975
SUPERSEDING
Method 3211.1
July 13, 1972

AREA STABILITY OF LEATHER TO PERSPIRATION

1. SCOPE

1.1 This method is intended for determining the effect of perspiration on glove, garment and lining leather. The leather is subjected to treatment with artificial perspiration, and loss in area caused by subsequent exposure to moisture and heat is measured.

2. TEST SPECIMEN

2.1 The specimen shall be a square of leather 2.0 by 2.0 inches (51 by 51 mm) cut from the sample unit of leather.

3. NUMBER OF DETERMINATIONS

3.1 Unless otherwise specified in the material specification, one specimen from each sample unit shall be tested.

4. APPARATUS AND REAGENTS

4.1 Apparatus

4.1.1 Flat bottomed heat-resistant container made of plastic or other inert material with cover of sufficient size to accommodate a maximum of 15 specimens (a container 30 cm long, 12 cm wide and 10 cm deep has been found suitable). (See 7.1).

4.1.2 Hanger for suspending each specimen shall be made from Nichrome wire having a maximum diameter of 0.3 mm. A loop shall be formed in the center of a piece of dichrome wire. Both ends of the wire shall be shaped into hooks.

4.1.3 Forced circulating-air oven capable of maintaining a temperature of 70 + 2°C for testing chrome tanned leather and 60 ~ 2°C for testing vegetable tanned leather.

4.1.4 Ruler

4.1.4.1 A ruler graduated in thirty-seconds of an inch or finer shall be used when the dimensions of the die used are in inches.

4.1.4.2 A ruler graduated in millimeters shall be used when the dimensions of the die used are In millimeters.

4.1.5 Metal die for cutting the specimen to the required dimensions.

4.1.6 Punch or other suitable instrument for making 2.0 mm diameter holes in the specimen.

4.1.7 Polyethylene wrapping.

4.1.8 Plastic tape to wrap glass rods to stick to outside of container.

4.1.9 Plastic tubing over glass rods for spacers.

4.2 Reagents

4.2.1 A solution of artificial perspiration consisting of the following:

Sodium chloride, grams	9.0
Urea, grams	1.67
Sodium lactate - 60 per-cent solution, grams	86.0
Disodium phosphate (Na_2HPO_4 .12 H_20) grams	0.165
Distilled water to make up 1 liter of solution.	

The pH of the solution shall be adjusted with lactic acid or ammonium carbonate depending on whether acid or base is needed to bring pH to 7.5. The solution can be kept almost indefinitely in the refrigerator over liquid mercury. The portion needed for testing shall be warmed up to 23°C ± 2°C before adding the specimens.

4.2.2 Leather which is not chrome tanned will require an addition of 6 grams of urea and 9.6 grams of ammonium carbonate ($(NH_4)_2C0_3$) per liter of perspiration solution specified in 4.2.1. A second adjustment of pH is not required for this modified perspiration solution.

5. PROCEDURE

5.1 Two measurements of each dimension to the nearest 1/64 inch (0.5 mm) of the specimen shall be made and averaged. The measurements shall be made 13 mm in from the edges of the specimen. The grain surface of the specimen shall be indelibly marked to indicate the points of measurement. The average measurements

all be used to determine the original area of the specimen and this area recorded as A. (The known dimensions of the die may be used instead of actually measuring the specimen. When this option is taken the specimen shall still be indelibly marked at the points of measurement indicated above).

5.2 Two small holes (2 mm in diameter) shall be punched in adjacent corners of the specimen. The specimen shall then be placed in a 500 ml suction flask (not more than 8 specimens per flask) containing not less than 10 ml of artificial perspiration solution (see 4.2.1 and 4.2.2) per specimen at 23 ± 2°C.

5.3 An intermittent vacuum shall be applied to the suction flask as follows: Apply vacuum for 15 to 60 seconds, then release for 15 to 60 seconds. The intermittent vacuum shall be applied until all the specimens settle to the bottom of the flask. The flask shall be gently shaken each time the vacuum is released to prevent specimens that are ready to sink from being entangled with other specimens.

5.4 One hour after the last release of vacuum, the specimens shall be removed from the suction flask and placed in a single row (do not stack one on top of another) on a non-rusting, non-absorbent surface inclined at an angle of 30 to 35 degrees.

5.5 Ten minutes later the nichrome wire shall be inserted into the two holes punched in the specimen. A glass rod shall be passed through the loop. The glass rod shall be suspended over a container or blotter. To prevent the specimens from touching each other as additional specimens are suspended from the glass rod, pieces of plastic tubing 17 mm or longer shall be slipped on the glass rod between the loops. An additional piece of plastic tubing shall be added to each end of the glass rod.

5.6 The glass rod with attached specimens shall be suspended inside a suitable container to which 200 ml of lukewarm distilled water have been added. The glass rod shall be suspended in such a manner that the container can he tightly covered and specimens do not get closer than 1/2 inch (13 urn) from the surface of the water. The glass rod with specimens may be supported by short glass rods attached to the inside wall at each end of the container. The short glass rods may be attached to the walls by wrapping them with plastic tape in a manner that permits the tacky side of the tape to be fastened to the outside of the container.

5.7 After the specimens are mounted, the lid shall be placed on the container. The container shall then be wrapped with polyethylene or placed inside a polyethylene bag and tied closed. The lid shall be weighted down to prevent it from warping when being heated. The container shall be carefully transferred to a shelf in a circulating air oven preheated to 70 ± 2°C for chrome tanned leather or 60 ± 2°C for vegetable tanned leather. The container with specimen shall be kept in the oven at the required preheated temperature for 48 hours.

5.8 The container shall then be removed from the oven and the specimens transferred flesh side up to a flat non-rusting, non-absorbing surface. The specimens shall be allowed to dry under standard conditions until they attain moisture equilibrium.

5.9 To determine area loss, a total of four measurements shall be taken on each test specimen by placing a ruler across the specimen at the points previously marked. Two measurements to the nearest 1/64 inch (0.5 m) shall be taken in one dimension, averaged, and the average recorded as "B". Two measurements shall be taken in the other dimension, averaged, and the average recorded as "C". The averages shall be calculated to the nearest 0.5 mm or sixty-fourth of an inch. The average area change shall be calculated as follows:

$$\text{Percent area change} = \frac{A - (B \times C) \times 100}{A}$$

Where: A - original area of the specimen (can be calculated from the known dimensions of the die).

B - average of two measurements in one dimension of the specimen.

C - average of two measurements in the other dimension of the specimen.

Tn the event of increase in area of the test specimen, the calculations shall be made as follows:

$$\text{Percent area change} = \frac{(B \times C) - A \times 100}{A}$$

REPORT

6.1 Area change shall be reported to the nearest 0.1 percent.

7. NOTES

7.1 The plastic container described in this method may be purchased from Arthur H. Thomas Co., Third and Vine Streets, Philadelphia, PA 19105.

STIFFNESS

1. SCOPE

1.1 This method is intended for determining the stiffness of leather by measuring the force required to bend the material through a given angle.

2. TEST SPECIMEN

2.1 Unless otherwise specified in the material specification, the specimen shall be a rectangle of leather 2.0 inches (50.8 millimeters) in length and 1.0 inch (25.4 millimeters) in width, die cut from the sample unit of leather. Unless otherwise specified, the specimen shall be cut with the long dimension perpendicular to the backbone.

3. NUMBER OF DETERMINATIONS

3.1 Unless otherwise specified in the material specification, one specimen from each sample unit shall be tested.

4. APPARATUS

4.1 A stiffness testing machine. A suitable apparatus is shown in figure 4211.

4.1.1 The machine shall contain a vise for clamping one end of the specimen, mounted on a horizontal shaft which is driven at about 0.2 revolutions per minute by a motor. A pendulum weight system equipped with a set of detachable weights shall be attached to the shaft. The force applied to turn the shaft is regulated by changing the weights on the pendulum. A range of bending moments can be obtained with weights calibrated in inch-pounds as follows: .15, .25, .5, 1.0, 2.0 and 5.0. Any selected moment weight shall be increased by 0.1 inch-pounds to account for the inertia of the apparatus.

4.1.2 The machine shall be equipped with a movable load scale graduated from 0 to 100 percent. The scale shall be adjusted to give a zero reading with the upright pointer at rest and the weight on the pendulum.

4.1.3 The machine shall be equipped with an angular deflection scale graduate in degrees. A pointer that moves over the scale shall be attached to the shaft. The scale shall measure the angle through which the specimen is bent.

4.1.4 The machine shall contain a pin that can be fixed in different positions to regulate the length of the span between the vise and the free end of the specimen that rests against the pin to give spans of 0.25, 0.50 and 1.00 inch.

4.1.5 The machine shall be equipped so that the motor can be thrown in and out of gear, the vise moved to the original position by hand, and the pointers adjusted to zero positions.

4.1.6 Calibration

4.1.6.1 The instrument shall be calibrated using the .004 inch strip from a feeler similar to the 9 blade feeler specified in Federal Specification GGG-G-17 as type VIII, class 1, style B. The strip shall be permanently removed from the set.

4.1.6.2 No strip shall be bent to the extent that the load scale reading exceeds 60. Any strip that appears permanently bent (either because it has been accidentally bent too mch in the apparatus or abused by improper handling) shall be discarded (see 7.2).

4.1.6.3 The machine shall be leveled by placing a leveler on top of it parallel and perpendicular to the long dimension. The specified moment weight shall be placed on the pendulum and the pin shall be adjusted to give the specified span (see 4.1.6.6). The motor shall be started and kept running throughout the test since its vibration minimizes friction effects in the weighting system. The strip shall be firmly clamped in the vise with the hole on the left and the printed figure .004 inch appearing between vise and pin.

4.1.6.4 The apparatus shall be adjusted by hand so that the free end of the strip rests on the pin, showing a 1 percent load scale reading. The pointer for the angular deflection shall be adjusted by hand to 0.

4.1.6.5 The motor engaging level shall be held down and the apparatus maintained in action until the angular deflection scale indicates that the strip has been bent through the required number of degrees (see 4.1.6.6). At that instant, the load scale reading shall be read fromm the position of the pointer on the load scale and the value recorded as the load scale reading. This reading shall be corrected for the initial 1 percent load scale reading by subtracting 1 percent from the load scale reading obtained.

4.1.6.6 The machine shall be considered properly calibrated when the strip gives all of the following load scale readings at the indicated settings:

		LOAD SCALE READING AT: ANGULAR DEFLECTION		
Moment Weight 1/	Span	10°	20°	30°
.25 inch-pound	.5 inch (12.7 mm)	23 ± 1	50 ± 1	--
.5 inch-pound	.5 inch (12.7 mm)	13 ± .5	26 ± .5	39 ± 1
.5 inch-pound	1.0 inch (25.4 mm)	--	15 ± .5	22 ± 1

1/ The moment weight values stated include 0.1 inch-pounds to account for the inertia of the apparatus.

5. PROCEDURE

5.1 Unless otherwise specified, this test shall be performed under the conditions and on material conditioned as specified in Section 5.

5.2 The machine shall be prepared and put in motion as described in 4.1.6.3, 4.1.6.4 and 4.1.6.5, except that the specimen, grain side down and with the long side parallel to the edge of the dial plate, is clamped into the vise in place of the strip. One end of the specimen shall be flush with the left side of the vise.

5.2.1 Load scale reading. When the load scale reading is required in the material specification, the material specification shall specify the umment weight, span and the angle of deflection to which the specimen is to be subjected.

5.2,2 Bending moment. When the bending moment is required in the material specification, it shall be determined using an appropriate moment weight and span as the specimen is bent to a 60 degrees angular deflection. The bending moment shall be calculated as follows:

$$\text{Bending moment, inch-pounds} = \frac{\text{Load scale reading} \times \text{Moment weight}}{100}$$

6. REPORT

6.1 The load scale reading of the specimen shall be reported to the nearest scale division.

6.2 The bending moment shall be reported to the nearest 0.001 inch-pound.

6.3 The size of the specimen, angle of deflection, moment weights and span shall be part of the report.

7. NOTES

7.1 Apparatus which meets the requirements may be purchased from Tinius Olsen Testing Machine Co., 2100 Easton Road, Willow Grove, PA 19090.

7.2 If the load scale readings appear inconsistent, and the strip is undamaged and has been previously calibrated by the manufacturer, the machine may require recalibration.

DIRECTIONAL STIFFNESS CANTILEVER BENDING APPARATUS

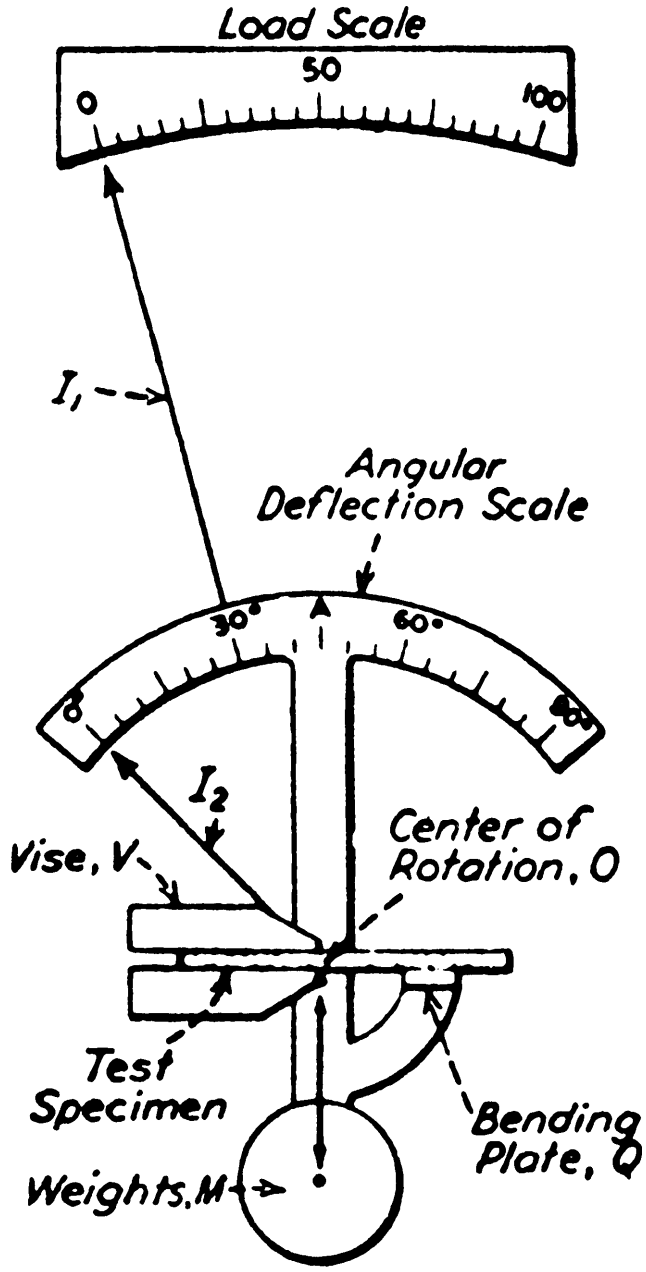


FIGURE 4211

SHRINKAGE TEMPERATURE

1. SCOPE

1.1 This method is intended for determining th~ shrinkage temperature of leather. For the purpose of this method, shrinkage temperature shall be defined as the teverature at which noticeable shrinkage occurs on gradually heating the leather in a liquid medium, specifically water or glycerine-water solution.

2. TEST SPECIMEN

2.1 The specimen for test shall be a rectangle of leather 76.0 ± 0.5 mm in length by 12.5 ± 0.5 mm in width, die cut from the sample unit of leather with the long dimension perpendicular to the backbone.

3. NUMBER OF DETERMINATIONS

3.1 Unless otherwise specified in the material specification, one specimen from each sample unit shall be tested.

4. APPARATUS AND REAGENTS

4.1 Apparatus (see Figure 7011).

4.1.1 Stand for supporting the testing equipment.

4.1.2 Theis shrinkage meter dial. The face is divided in 360 degreesand one revolution of the hand corresponds to .5 inches (12.7 mm), with leeway for four revolutions.

4.1.3 Heating coil, 250-500 watt, with heating element not longer than 5-1/2 inches (140 mm) and depth of immersion not in excess of 6 inches (152 mm) is suitable.

4.1.4 Variable speed stirrer with small blades.

4.1.5 Two spring loaded clamps (alligator type) mounted vertically above each other and sufficiently far apart for gripping the full width of the specimen at the ends. The bottom clamp shall be fastened to the end of a U shaped rod that can be turned sideways. The upper clamp shall be movable sideways as well as up and down.

4.1.6 Metal plate with apertures supporting the stirrer, thermometer, heating element and rod with fastened clamp.

4.1.7 Variable transformer capable of controlling the rate of heating (3°C to 5°C per minute) and capable of Maintaining temperature of 98° + 0.5°.

4.1.8 Thermometer. The thermometer shall be nitrogen filled over mercury, having a white background and a scale from -10°C to 101°C or -1°C to 101″C, graduated in 1°C or finer with ± 0.5°C tolerance.

4.1.9 Tall form liter beaker for holding the heating medium.

4.1.10 Lead shot.

4.1.11 The indicating device is attached to the upper (movable) clamp and equipped with an adjustable weight assembly mounted over a pulley. The assembly shall consist of a small bottle containing lead shot and a lid which shall be attached to the string running over the pulley. The weight assembly shall be approximately 178 grams to counterbalance the weight of the clamp, to overcome any inertia or friction of the indicating device, and to maintain the specimen under a slight tension. The weight shall be adjusted accordingly, so that it will not cause an elongation (prior to shrinkage) of more than 10 percent. The device shall register a ratio of 25:1 between scale reading and shrinkage or elongation of the specimen, and shall accurately detect the point at which shrinkage begins.

4.1.12 Metal die for cutting the specimen to the required dimensions.

4.1.13 1000 cc suction flask.

4.1.14 Nylon string.

4.2 REAGENTS

4.2.1 Glycerine-water medium. When glycerine-water medium is specified for use, it shall consist of 75 volumes of glycerine and 25 volumes of as of water. The specific gravity of the solution shall be adjusted to 1.19 at 23°C. The glycerine-water mixture shall not be heated over 112°C.

5. PROCEDURE

5.1 When shrinkage temperatures at or below 98°C are specified, the heating medium shall be water.

5.2 When shrinkage temperatures over 98°C are specified, the heating medium shall be glycerine-water as described in 4.3.1.

5.3 Prior to mounting the specimen, no more than fifteen specimens shall be placed in a 1000 cc suction flask containing approximately 300 cc of the required heating medium at room temperature. The flask shall be stoppered and a vacuum applied for 15 to 60 seconds and then released for 15 to 60 seconds. An titermittent vacuum shall be continued until all the specimens settle to the bottom of the flask. The flask shall be gently shaken each time the vacuum is released to prevent specimens that are ready to sink from being entangled with other specimens. One hour after the last release of vacuum, the first specimen shall be removed from the flask and mounted in the shrinkagemeter. The other specimens shall remain in the flask, containing the heating medium, until tested. The time lapse between the time when the first specimen is removed from the suction flask and testing of the last specimen is completed shall not exceed six hours.

5.4 The specimen shall be fastened in the two clamps and completely immersed in the heating medium which has been preheated to 50 ± 5°C. The indicator shall be adjusted to a reference point on the dial, by taking the slack out of the specimen. If the specimen should lengthen before it contracts as the temperature of the heating medium is being increased at the rate of 3° to 5°C per minute, the reference point at which the indicator comes to rest shall be the new reference point for observing shrinhge.

5.5 When a shrinkage temperature of 98°C or below is specified, the temperature of.the water heating medium shall be increased at the rate 3° to 5°C per minute until the specimen shrinks or until the specified shrinkage temperature is reached.

5.6 When the material specification requires the specimen not to shrink when subjected to a temperature of 98°C ± 0.5°C for 30 seconds, the temperature of water heating medium shall be increased at the rate of 3° to 5°C per minute until the temperature reaches 98°C. The temperature shall then be kept at 98°C ± 0.5°C for 30 seconds by adjusting the transformer. If the specimen shrinks during the 30 second period, the number of seconds that elapse between reaching the temperature of 98°C and shrinkage of the specimen shall be recorded. If the specimen shrinks before the temperature reaches 98°C, the temperature at which shrinkage occurs shall be recorded.

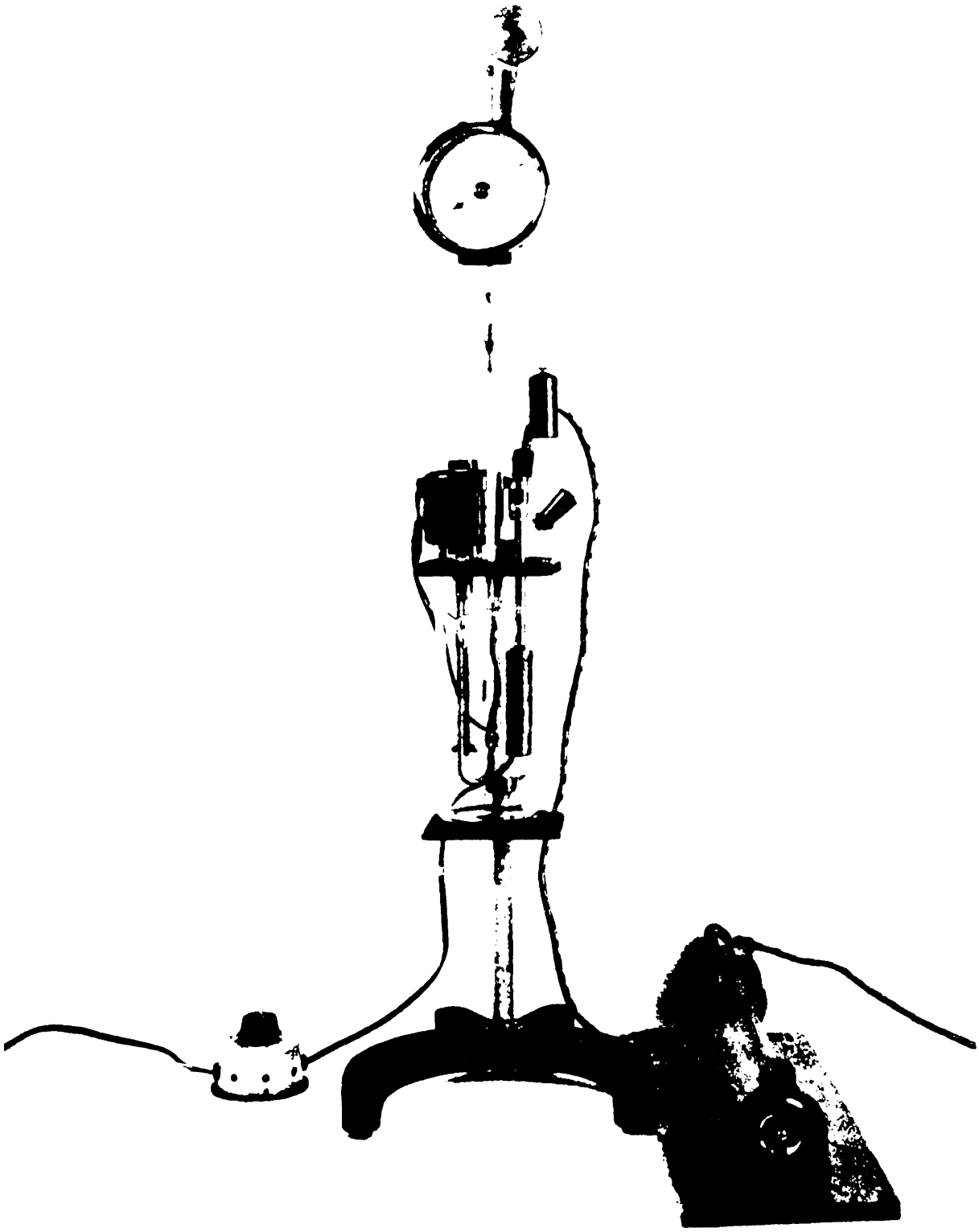
5.7 When a shrinkage temperature of over 98°C is specified, the temperature of the glycerine-water heating medium shall be increased at the rate of 3° to 5°C per minute until the specimen shrinks or until a maximum temperature of 112°C is reached.

6. REPORT

6.1 When the procedure specified in 5.5 is followed, the temperature at which the specimen shrinks shall be reported to the nearest 1°C. If the specified shrinkage temperature is reached without shrinkage, it shall be so reported.

Figure 7011

APPARATUS FOR TESTING SHRINKAGE TEMPERATURE.



6.2 When the procedure specified in 5.6 is followed and shrinkage occurs during the 30 second interval, the number of seconds that elapsed between reaching the temperature of 98°C and shrinkage of the specimen shall be reported to the nearest second. If shrinkage of the specimen does not occur during the 30 second interval, it shall be so reported. If the specimen shrinks before the temperature reaches 98°C the temperature at which shrinkage occurs shall be reported to the nearest 1°C.

6.3 When the heating medium is glycerine-water, the shrinkage temperature shall be reported to the nearest 1°C. If the temperature of 112°C is reached without shrinkage, it shall be so reported.

7. NOTES

7.1 The Theis shrinkage meter dial, heating coil and thermometer may be purchased from the Arthur H. Thomas Company, Third Avenue and Vine Street, Philadelphia, PA 19105.

METHOD 801102
January 24, 1975
SUPERSEDING
Method 8011.1
July 13, 1972

PERMEABILITY , WATER VAPOR

1. SCOPE

1.1 This method is intended for determining the permeability of leather to water vapor by measuring the rate at which vapor passes through the material. Water vapor permeability is one of the several factors contributing to the relative comfort of footwear, handwear and garments.

2. TEST SPECIMEN

2.1 The specimen for test shall be a disc 2-21/32 to 2-3/4 inch (67.5 to 70 mm) in diameter die cut from the sample unit of leather.

3. NUMBER OF DETERMINATIONS

3.1 Unless otherwise specified In the material specification, one specimen from each sample unit shall be tested.

4. APPARATUS AND REAGENTS

4.1 Apparatus

4.1.1 Polystyrene containers having a height of 2-5/16 inches (58.9 mm) and a diameter of 2-1/2 inches (62.5 mm) (see 7.1).

4.1.2 Bakelite caps supplied with polystyrene containers may be used if the liner is removed and an aperture of 2-1/4 inches (57.2 mm) in diameter is machined. Threaded metal screw caps (known as Mason jarlids) with the liner removed, and having an aperture of 2-1/4 inches (57.2 mm) in diameter may be used.

4.1.3 Rubber gaskets, having an inner diameter of 2-1/4 inches (57.2 mmn). These should be available in several thicknesses from 0.02 to 0.10 inches (0.5 to 2.5 mm) as thicker specimens require thinner gaskets.

4.1.4 Strips of stretchable non-porous tape, 3/4 inch (2O m) tide.

4.1.5 Column clamps with worm adjustment for containers 2-1/2 to 3-1/2 Inches (63 mm to 89 mm) in diameter (see 7.2).

4.1.6 Turntable 78 rpm, with mounting support to hold 8 column clamps in a horizontal circle at such elevation above the turntable that the mounted containers clear the turntable by approximately 3.5 inches (90 mm). The clamps are adjusted to allow the center of the specimen to describe a radius of 5.5 inches (140 mm) around the axis of the turntable correspondin~ to a velocity of 224 feet (68 *meters)* per minute.

4.1.7 Circular metal dies for cutting specimens and rubber gaskets.

4.2 Reagents

4.2.1 Desiccant consisting of fresh 8 mesh anhydrous calcium chloride.

5. PROCEDURE

5.1 Unless otherwise specified in the material specification, the test shall be performed under standard atmospheric conditions specified in Section 5 of this Standard.

5.2 The containers shall be filled with 40 to 50 grams of calcium chloride. The gasket shall be placed in the threaded lid. The specimen shall be placed on the gasket with the surface normally worn next to the skin away from the calcium chloride. The assembly shall be screwed on the container.

5.3 The containers shall be turned upside down, gently shaken, so that the desiccant covers the specimen evenly, and mounted on the turntable. The containers shall be removed after revolving for 1/2 to 1 hour and weighed. The containers shall be returned to the turntable to revolve for a definite period of time extending from 1/2 to 8 hours before being weighed again. When the specimen is fairly water vapor permeable, it is possible to time the periods between weighings so as to allow for the use of a balance weighing to the nearest .01 gram and for a weight increase of no less than .020 grams per hour. Specimens with very low water vapor permeability require a balance weighing to the nearest .001 gram. Weight increases for at least two periods, preferably of equal lengths, shall be averaged. In the case of unfamiliar materials, the first period might have to be discarded.

5.4 Calculation

$$\text{Permeability, grams per square meter per day} = \frac{w \times 9340}{T}$$

Where w = increase k weight of the assembly for exposure period, grams
T = time of exposure in hours

6. REPORT

6.1 The water vapor permeability of the specimen shall be reported to the nearest 10 grams per square meter per day when the figure is 1000 or larger, to the nearest 5 grams per square meter per day when the figure is 200 to 999, and to the nearest 1 gram per square meter per day when the figure is below 200.

7. NOTES

7.1 The polystyrene containers are available In case lots from Parkway Plastics, P.O. Box 475, Piscataway, NJ 08854.

7.2 Column clamps used in this method may be procured from Wills Scientific Co., 45 Goble Place, Bronx, NY 10452. No. 8722. Similar clamps msy be procured from other laboratory supply houses.

DYNAMIC WATER ABSORPTION OF LEATHER SURFACES

1. SCOPE

1.1 This method is intended for determining the degree of nettability of a leather surface. It can be used to measure the effectiveness of water resistant treatments of light leathers such as glove and garment leather which have no finish. It can also be used to measure the water absorption capacity of insole materials thus providing a gauge for predicting foot comfort or discomfort.

2. TEST SPECIMEN

2.1 The test specimen shall be a disc of leather no less than 2-21/32 inches (67.5 mm) and no more than 2-3/4 inches (70 mm) in diameter, cut by a die from the sample unit of leather.

3. NUMBER OF DETERMINATIONS

3.1 Unless otherwise specified in the material specification, one specimen from each sample unit shall be tested.

4. APPARATUS

4.1 Mason jar, top inside diameter 2-3/8 inches (60.3 mm) and 4 inches (100 mm) high including thread, with threaded lid and insert (see 7.1).

4.2 Alternate container. A 6 ounce threaded polystyrene container, top inside diameter 2-1/2 inches (63.5 mm) and 2-5/16 inches (58.7 mm) high (see 7.2). Mason jar threaded lids and inserts shall be used with these containers.

4.3 Tumbling machine. The machine shall be of the rotating type, for end over end agitation. The speed of rotation shall be 55 to 60 revolutions per minute (see 7.3).

4.4 Balance sensitive to .01 gram or better (high speed balance preferred for readings to nearest .01 gram).

4.5 Roll of pressure-sensitive adhesive (both sides) paper, 1 inch (25.4 mm) wide (for light leathers).

4.6 Rubber rings, .8 to 1.6 mm thick, type A durometer hardness 50-80, inner diameter 2-1/4 inch (57 mm), to fit into lids (for light leathers).

4.7 Dies, suitable to cut rubber rings and specimens.

5. PROCEDURE

5.1 Unless otherwise specified in the material specification, the test shall be carried out under standard conditions specified in Section 5.

5.2 Unless otherwise specified in the material specification, the grain side of the specimen shall face the water surface.

5.3 For testing light leathers, two strips of the pressure-sensitive adhesive paper shall be mounted cross-wise on the surface of the insert. The insert can be reused many times before these adhesive strips required replacement. The insert is placed in the lid, the specimen is weighed and placed on the lid, and the rubber ring is laid on the specimen. For testing heavy and stiff leather, the insert and rubber ring are not required.

5.4 The assembly shall be tightly screwed onto the plastic container containing 50 cc, or mason jar containing 100 cc, of fresh distilled water at 23°C. The assembly shall be immediately mounted on the tumbling machine and the machine run at 55 to 60 rpm. When either plastic or glass containers are used, approximately equal numbers of containers shall be placed at opposite ends of the tumbler. The containers shall be mounted with the lids toward the axis of rotation. The distance from the axis of rotation to the surface of each specimen shall be 3-3/4 inches ± 1/2 inch (95.25 ± 12.7 mm). No more than four plastic containers shall be placed at each end of the machine.

5.5 After 40 minutes of tumbling, the specimen shall be blotted lightly with a paper towel after being lifted from the lid and shall be weighed grain side down.

5.6 If any container leaks during the tumbling operation, stop the test and remove the leaky container with specimen. If other specimens have become wet because of the leak, remove the containers containing these specimens also. Immediately restart the tumbler and complete the test. Do no retest the same specimen. Prepare a new specimen and test again using caution to prevent leaking. Test is valid only when the container does not leak. A leaky container can be detected by the presence of moisture on the outside of the container and a large volume loss of water during tumbling.

6. REPORT

6.1 The water absorbed by the specimen during tumbling shall be reported to the nearest .01 gram.

7. NOTES

7.1 Mason jars and lids with inserts may be purchased at any hardware store.

7.2 Polystyrene containers may be purchased from Parkway Plastics, P.O. Box 475, Piscataway, NJ 08854.

7.3 Tumbling machine may be purchased from Atlas Electric Devices Company, 4114 No. Ravenswood Ave., Chicago, IL 60613.

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