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MATERIAL PERFORMANCE AND SOURCING: BOVINE LEATHER

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EXECUTIVE SUMMARY

The purpose of this report is to assist material scientists, entrepreneurs, and start-ups in understanding how brands in the fashion, automotive, and home goods industries examine materials through testing methods. Our goal in this report is to assist these audiences in understanding the metrics their material will need to meet in order to be considered a replacement for animal leather.

Although we have provided guideline metrics in this report, each brand will have their own specific metrics in each category. These metrics will vary by brand as well as by product category and even within different functional pieces of those categories.

MATERIAL STANDARDS ORGANIZATIONS

Standards organizations are not-for-profit organizations that develop and publish test methods for materials in order to ensure uniform standards across the industry. The standardized test methods serve as a uniform language for brands and material companies to ensure the materials meet the product specifications and will perform as expected for the consumer. Testing centers follow these standards when conducting material tests.

The majority of testing standards for leather in fashion, automotive, and home goods are set by ASTM International, International Organization for Standardization, and American Association of Textile Chemists and Colorists. We have summarized information about each of these organizations below. Each has different testing methods from the other organizations for the same performance analysis. They may also have different testing methods within their organization for the same performance analysis. Each brand using leather will have a preferred testing method and may even require different testing methods for different products or product components.

Although leather is not universally considered a textile, it is composed of fibers and used in many of the same applications. Synthetic leather is sometimes classified as a nonwoven textile, which simply means that it is a collection of fibers bonded together by adhesive, heat, or chemicals. Because leather occupies a unique space in the textile industry, most testing bodies publish separate performance standards for textiles and for leather. Some brands and testing centers still prefer to use textile performance standards on leather, leaving the classification of leather as a textile up to each brand.

Leather suppliers are expected to test their material and supply the test results to brands. Suppliers may be held liable for a faulty material that does not match performance test results. For this reason, many suppliers have in-house testing labs with strict environmental control systems for humidity and temperature. Suppliers without in-house testing labs use approved third-party testing centers.

It should be noted that standards are not enforced unless mandated by a government. Government standards vary between countries and even within countries. Manufacturers should be familiar with the regulations and standards enforced in their markets. We outline some of the government regulations in the following section.

American Association Of Textile Chemists and Colorists (AATCC)

AATCC is a professional textile association that focuses on education, technical applications, and research. AATCC publishes internationally recognized standard methods for testing dyed and treated fibers and fabrics for performance characteristics including: color fastness, dimensional stability, soil release, and water resistance. AATCC is a joint administrator on the ISO subcommittees on tests for colored textiles and colorants, as well as cleansing, finishing and water resistance tests. The organization is headquartered in the Research Triangle Park region of North Carolina in the United States.

ASTM International (ASTM)

ASTM International is an international standards organization that publishes technical standards for a variety of materials, services, and products. Though ASTM was formerly known as American Society for Testing and Materials, the name was changed in 2001 to reflect the international standards published by the organization. ASTM publishes textile standards that give test methods and specifications for mechanical, physical, and chemical textile properties. These standards are published to make sure that textiles can be properly tested for qualities pertaining to their end use.

International Organization for Standardization (ISO)

ISO is an international organization that sets standards for a wide range of products, services, systems, and materials. The organization comprises 164 national standards bodies. ISO has consultative status to the United Nations Economic and Social Council, which means they are permitted to work with the United Nations.

GOVERNMENT REGULATIONS

Complying with Government Regulations

Although this report is focused on performance standards for leather, it is important to note that government regulations also restrict substances used in the manufacturing process and ensure safety of the end product. For safety concerns, the most important regulations on material are flammability standards.

Many brands will follow the regulations of the most restrictive market. Japan and Germany generally have the strictest regulations followed by the Nordic countries and then the United States. Within the United States, each state has its own regulations.

The best way to ensure compliance with U.S. regulations on leather is to adhere to guidelines set by the state of California, known to have the highest environmental and safety standards within the country. European Union standards apply to most of the European market, though countries such as Germany may have stricter national regulations. The European Union is currently developing a comprehensive strategy for textiles as part of the EU Circular Economy Action Plan. Although this plan has not yet been implemented, suppliers should be aware that it could affect future material standards and regulations.

Restricted Substance Lists

In addition to government regulations, suppliers should also be aware of Restricted Substance Lists (RSLs). RSLs are lists of chemicals restricted in consumer products by government regulation.[1] Some brands may have substance restrictions that go beyond government regulations. Most brands make their RSLs publicly available. TFL is a chemical manufacturing company that has published a guide to RSLs in leather manufacturing.

Flammability Regulations

The United States has two important fire safety codes and both specify tests for upholstered furniture. The NFPA 101 Life Safety Code focuses on protecting building occupants from fire, smoke, and toxic fumes and has been adopted by 43 states. The International Building/Fire Code establishes minimum requirements for fire prevention and protection systems. This code has been adopted by most United States jurisdictions. Both codes specify similar tests and only differentiate in terminology used. The designated tests are based on type of

[1] What is a Restricted Substance List (RSL)?

occupancy, not on building size. Table 2 lists the required tests for upholstered furniture used in public buildings.[2] Additional notes below the table indicate differences between the NFPA 101 Life Safety Code and the International Building/Fire Code.

The European Union has two types of flammability standards for upholstered furniture: harmonized and national. Harmonized standards refer to standards required in every EU country.[3] These include EN 1021-1 and EN 1021-2, which test the material as an ignition source to a smoldering cigarette and a match flame. National standards only apply to certain countries. An example of this is NF P92-503, an electrical burner reaction test required in France. Companies producing leather for upholstered furniture should check both EU standards and national standards for compliance.

2 Fire Test Requirements for Upholstered Furniture Used in Public Buildings
3 Furniture Regulations in the European Union: A Complete Guide

LABELING FOR PERFORMANCE STANDARDS

Regulations restrict how you can label the performance designations of your material. The United States Code of Federal Regulations Title 16 has labeling regulations on leather and imitation leather used in footwear, apparel, and accessories. This code clarifies how composition should be labeled, as well as when a material can be called water proof, dust proof, warp proof, scuff proof, scratch proof, scuff resistant, or scratch resistant.[4]

Currently, there is no leather apparel labeling system that applies across the European Union.[5] This may change in the future as at least one study has explored the effect of requiring social and environmental labeling, as well as animal species and leather authenticity labeling in the EU.

Labeling regulations are important to note when marketing your material. The exact requirements for labeling are outside the scope of this report. Please consult with an attorney for additional information.

[4] https://www.govinfo.gov/content/pkg/CFR-2015-title16-vol1/pdf/CFR-2015-title16-vol1-part24.pdf
[5] Leather industry | Internal Market, Industry, Entrepreneurship and SMEs

APPEARANCE AND TEXTURE

Summary

The physical appearance and texture of leather can be the most influential factors for buyers. No performance metrics exist to assess the appearance and texture of leather. Instead, brand leather sourcers consider leather assessment an art they have learned. High quality leather has a unique look and is prized for the patina that it gradually develops over time. Leather patina refers to the weathered look that naturally occurs as leather ages.[6] Hand, a term that describes how the texture of material feels, is also important. High quality leather is soft yet durable. There are a multitude of factors that affect appearance and texture of traditional leather, but they can be narrowed down to the following characteristics: tannage, finish, and grain.[7]

Tannage

Tannage describes the tanning process used to ensure that the hide will not putrefy. This also prepares the hide for the next step in the leather process: dyeing. The most widely used tanning methods are chrome tanning, vegetable tanning, and synthetic tanning.[8] Chrome tanning is known for producing toxic effluent that has been shown to harm workers. Vegetable tanning is time consuming and costlier than chrome tanning. Vegetable tanning produces the woody smell associated with leather. Using aldehydes and oils as tanning agents softens leather. This tanning method, known as synthetic tanning, is commonly used to tan car seats and washable apparel leather.[9] Tanning makes a leather hide more durable and can sometimes alter the color of the hide,

Finish

Finishing is the process that comes directly after dyeing. The finish of grain leathers can be classified as aniline, semi-aniline, or pigmented.[10] Aniline leathers are dyed with soluble vat dye all the way through the hide. The lack of further treatment means that the leather retains its natural texture, but is more susceptible to fading, scratching, and staining. Semi-aniline

[6] What is a Leather Patina?
[7] Automotive Leather
[8] Leather Tanning: The Tanning Process Explained
[9] Leather Tanning: The Tanning Process Explained
[10] The differences between aniline, semi-aniline and pigmented leathers

leather is also dyed with soluble vat dye, but is finished with a slightly protective coating that may also contain additional pigment to slightly conceal discoloration. This protective coating can also contain stain repellent and sun resistant additives. Like aniline and semi-aniline leather, pigmented leather is dyed completely with soluble vat dye. After dyeing, pigmented leather is coated in a heavy protective finish with pigmentation. This heavy topcoat is then buffed to remove texture imperfections and embossed with an artificial grain. Artificial grains can add a more pebbled or smooth surface, depending on the buyer's desire. If durability is top priority, then pigmented leather is the recommendation. If the focus is authentic texture or aesthetic appeal, then either aniline or semi-aniline leathers are recommended.

Grain

Grain is another leather characteristic that describes the portion of the hide from which the leather is made and is indicative of quality. Before discussing the different grain categories, it is necessary to understand the three layer composition of a cow hide. The visible outermost layer is called the grain. The grain's fibers are tightly woven, dense, and tough. The next layer is called the junction. The fibers in this part of the hide are looser. The split, also known as suede, is the innermost layer of a cow hide. These loose fibers make up most of the hide. The split is the softest and weakest part of the hide.[11]

From highest to lowest grade, grain categories are as follows: full grain, top grain, corrected, and bonded leather.[12] Full grain leather is the highest quality, making it the only type of leather suitable for saddlebacks and other high quality products. It is composed of the grain layer with no surface modifications, which makes it the toughest and best quality type of leather sold. Full grain leather is also popular because it develops a patina over time.

The next best grain categories is top grain. Top grain leather is sanded to remove surface imperfections and does not include the entire grain. The removal of the top layer makes top grain leather smoother and more flexible than full grain. However, it also makes top grain leather weaker and prone to permanent stretching over time. Most high-end handbags and jackets are made from top grain leather.

Corrected grain leather, also called split grain leather, is the remainder of the hide after the grain layer is split off. The texture of corrected grain leather is tough, and it is used in products that do not require much softness, including furniture backs and sides, footwear, messenger bags, jackets, and accessories. Corrected grain leather, like top grain, is sanded to remove surface imperfections. It is also spray painted and embossed with a pattern to resemble the natural appearance of leather. This process has a negative impact on the natural breathability of leather.

[11] Full Grain Leather vs. Genuine Leather & Lesser Grades
[12] Leather Buying Guide | How To Identify Different Types of Leather & Leather Quality

The lowest grade is bonded leather. It is made by bonding hide leftovers, dust, and shavings together with latex or polyurethane on a fiber sheet. Bonded leather will usually be spray painted to resemble higher quality leather. It is used in furniture, bookbinding, and fashion accessories. Like configuration, grain is not a metric inherently applicable to alternative leather, but each quality of grain has the potential to be synthetically replicated.

PERFORMANCE STANDARDS

Summary

The leather market is driven by consumer desire for quality. Any viable leather replacements should target traditional leather performance and sensory standards. This is best done by replicating familiar tactile characteristics of leather and conducting performance testing to ensure the material meets the industry's needs. The specific performance standards that a material should be tested for are dependent on the end use. For example, automotive leather and apparel leather do not experience the same strains and therefore have different requirements for durability.

The performance standards listed below represent the main ways in which automotive, upholstery, and apparel leathers are evaluated by buyers. These ranges are meant to be a guideline for the development of alternative materials. If innovators plan on pitching or marketing their material to a specific brand, we recommend they research the specific material requirements. Some brands publish their standards online and innovators can reach out to the brand directly. Contact MII for specific testing requirements for brands with whom we work.

Performance standards for automotive leather are the strictest of all leather standards. In general, this is because cars are exposed to extreme cold and heat, unlike many home goods and fashion products, and people can be exposed to materials in an enclosed space for extended periods of time. Standards depend on the manufacturer and most manufacturers will have their own test methods.[13] The broad categories that luxury automotive manufacturers test are abrasion resistance, tensile strength, tearing strength, color fastness, cold climate exposure, and humidity exposure.[14]

Color fastness

Color fastness describes the propensity of dyed leather to fade or otherwise change color.[15] Whether the leather is colored with dye or pigment, color fastness is one of the strongest indicators of dyed leather quality. Good color fastness will help leather goods maintain a new appearance for a long time, thereby increasing customer satisfaction. Sunlight, friction, water, and other fluids can all affect color fastness, and a brand will test for each of these depending on the material's end use. Most color fastness tests grade a sample on a scale of

[13] Car leather
[14] Audi Interior: Car Interiors - Leather Seats
[15] What is Color Fastness | Classification of Color Fastness | Different Types of Color Fastness | What is Crocking | Define Crocking

one to five, where one signifies extremely poor color fastness and five signifies very good resistance to color change.

Light Fastness

The light fastness of leather quantifies how vulnerable the material is to the deterioration caused by sunlight. Apparel, accessory, and automotive leathers will be exposed to significant amounts of sunlight over their lifetime. This makes light fastness integral to quality for those finished goods.

Light fastness can be measured by the blue scale test. The blue scale involves placing the leather sample and eight blue wool strips of decreasing light fastness under ultraviolet light. Light fastness is rated from 1 (very low) to 8 (outstanding). Additionally, grade 1 corresponds with five days of sunlight exposure and grade 8 corresponds with seven hundred days of exposure time. These values are based on a Central European climate. Both the leather sample and blue wool strips are partially covered and compared after UV exposure. A grade of 6 is considered acceptable for leather, since it fades faster than other textiles.[16] Upholstery and shoe upper leather should score a minimum grade of 3 on this scale.

Some lab equipment, such as the xenon tester, can automatically measure fading sensitivity of a textile sample. A xenon arc lamp acts as a radiation source, providing levels of radiation comparable to long term sunlight exposure.[17]

Apparel and accessory brands use AATCC 16 to determine light fastness. Apparel should have a minimum score of Class 3.5 for light or medium colored leather and Class 4.0 for dark colored leather. Upholstery leather uses either options 1 or 3 of AATCC 16.2. Under AATCC 16.2, upholstery leather should be at least Class 4 at 40 hours of UV exposure.

Crock Fastness

Crocking describes the transfer of color from a dyed textile surface to another textile surface due to rubbing. The less color that transfers, the more crockfast the material is. All leather should have a good crock fastness score, since automotive, upholstery, apparel, and accessories will all be exposed to some form of friction. Incorrect dyeing, washing, or finishing methods can result in poor crock fastness. Nubuck and suede will have poor crock fastness compared to tougher leathers.

The most common test standard for crock fastness is AATCC TM 8. The test is performed under controlled conditions and involves rubbing the leather sample with a white crock test cloth and then grading the color transfer.[18] Crocking tests should be performed on wet and

[16] Colour fastness - Light fastness of leather
[17] https://www.leather-dictionary.com/index.php/Leather_quality#Test_equipment
[18] Fashion Product Testing: Basic Tests You Should Do

dry samples. Class 5 indicates no color transfer and Class 1 indicates a high degree of color transfer. Wet leather will have lower crock fastness than dry leather. Apparel leather should have a minimum dry crocking score of Class 3.0 and a minimum wet crocking score of Class 1.5. Accessory leather should have a minimum dry crocking score of Class 3.0 and a minimum wet crocking score of Class 2.0. Upholstery leather should be a minimum of Class 4 when dry and Class 3 when wet.

Water Spotting

Water spotting, like light fastness, is important for any leather that will be exposed to an outdoor environment. Leather for handbags and shoe uppers is usually evaluated for water spotting. This can be tested by AATCC TM 104. The test evaluates resistance to water spotting, but not whether the discoloration can be removed. Shoe uppers should not show any water spotting.

The performance standard for water damage will vary depending on the end use. For most applications in apparel and accessories, leather will need to be at a minimum 3.0 under AATCC 107.

Solvent Spotting

Similar to water spotting, solvent spotting describes the amount of color transfer caused by dry cleaning solvents. The common dry cleaning solvent perchloroethylene is used in AATCC TM 157. In this test method, the leather sample is fixed on top of white blotting paper. Perchloroethylene is added to the center of the sample and the blotting paper is evaluated for staining.

Brands may refer to solvent spotting as "appearance after dry cleaning" and each brand will do a visual inspection per their own standards. It should be noted that most brands will only perform this test on finished garments, not raw materials. These standards will still follow the same five class grading scale as AATCC TM 157. Apparel leather should be a minimum Class 3.0 for color change and Class 4.5 for staining. Accessory leather must be a minimum Class 4.0 in color change and Class 3.0 for staining.

Perspiration

Leather items that will be frequently exposed to perspiration may experience color change if not dyed and finished properly. This is most applicable to apparel and footwear leather.

AATCC TM 15 is a common standard for testing color fastness to perspiration. It involves wetting the sample with an artificial perspiration solution, applying a fixed mechanical pressure to the sample, then slowly allowing the sample to dry over time at a slightly raised temperature. Both the color of the sample and the transfer of color to other materials are graded. Apparel leather should be at least Class 4.5 in both color change and staining. Upholstery leather should be a minimum of Class 3.

Durability

Durability is a combination of strength, flexibility, and crack resistance. These factors all indicate the physical longevity of leather. Elongation and tensile strength describe the breaking strength of the leather. Finish adhesion, finish flexibility, crack resistance, and cold crack resistance measure the durability of the leather surface when subject to ageing and extreme environments.

Elongation and Tensile Strength

Elongation measures how much a material can be stretched before breaking. It is important to know how much bending and stretching a material can withstand before it is permanently deformed. Elongation is typically expressed as a percentage comparing the size difference between the stretched and unstretched original sample. The standard applied load and test conditions are specified in ASTM D2211, which can be used on all types of leather.[19] Shoe upper leather should not have elongation below 40 percent. Elongation and tensile testing are often conducted simultaneously, though most brands only ask for tensile strength.

Tensile strength describes how much load is needed to rupture a sample of a half inch (1.27 cm) width.[20] Tensile strength is affected by finish, age, and stiffness of the leather.[21] In traditional leathers, higher fat content produces higher strength. Both elongation and tensile strength are strong indicators of quality and durability.

Tensile strength of leather can be evaluated using either ASTM D2208 or ASTM D2209, depending on the end use. Light, soft leathers, narrow strap, welt, lace and round belt leathers should be tested with ASTM D2208, since they are too delicate for ASTM D2209. Measurements are given in newtons or pounds. Accessory leather should have a minimum tensile strength of 25 lbs (111 N) using ASTM D2208. Apparel leather should be able to withstand at least 40 lbs (178 N) of force using ASTM D2208. Shoe upper leather should withstand a minimum of 34 lbs (150 N). Upholstery leather should withstand a minimum of 50 lbs (222 N). Automotive leathers are often required to have a tensile strength of 200 N per 5 cm. This means that automotive leather is the strongest type of leather and takes the most strength to rupture.

[19] ASTM D2211 - 00(2015) Standard Test Method for Elongation of Leather
[20] ASTM D2209 - 00(2015) Standard Test Method for Tensile Strength of Leather
[21] Tensile strength - Tear strength

Flexibility and Adhesion of Finish

Durability of finish is important for any finished leather, since a flaky or peeling surface will severely undermine any claims of quality. Adhesion of finish refers to the force required to pull leather away from its finish layer at a 90˚ angle to a plate to which the finished side of the leather has been bonded.[22]

ASTM D6182 is a test method that evaluates the strength, flexibility, and adhesion of the finish. The test subjects the sample to repeated flexing, usually on a Bally flexing tester.[23] The sample's finish is then assessed for discoloration, cracking, and delamination on a scale of 1 to 5. A rank of 1 means there is no damage and a rank of 5 means that the finish has cracked, peeled, or flaked off.[24] A comparable flex resistance standard is ISO 5402. Upholstery leather should be able to withstand at least 20,000 cycles before cracking.[25] Footwear leather for shoe uppers should be able to withstand a minimum of 50,000 cycles when dry and 10,000 cycles when wet. A comparable standard for adhesion of finish is ISO 11644. Upholstery leather should have a minimum finish adhesion strength of 2 newtons/cm. Coated leather for shoe uppers should have a minimum finish adhesion strength of 10 N/cm for both dry and wet samples.

Standard Crack Resistance

Crack resistance is a valuable quality control metric in leather that will be bent or folded in its final application such as belts, upholstery, and shoe uppers. Cracking will degrade the appearance of leather, roughen the feel, and trap dirt within the cracks.

ASTM D6075 tests crack resistance of the leather grain or finish surface on a pass/fail basis.[26] This test is applicable to heavy leathers like belts and bags, as well as lighter leathers like garments and upholstery.

Cold Crack Resistance

Automotive leather should be additionally tested for crack resistance in cold temperatures. Unlike apparel, accessory, and upholstery leather, automotive leather may be exposed to cold weather for months at a time. The temperature stress can lead to loss of moisture and eventual cracking. If a material is susceptible to cold cracking, it is only suitable for non-automotive uses.

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[22] ISO 11644:2009 Leather — Test for adhesion of finish
[23] ASTM D6182 - 00(2015) Standard Test Method for Flexibility and Adhesion of Finish on Leather
[24] Vartest Report on Reishi Brown Natural from MycoWorks
[25] Acceptable Quality Standards in the Leather and Footwear Industry
[26] D6075 - 13 Standard Test Method for Cracking Resistance of Leather

ASTM D1912 is a test standard for cold crack resistance that replicates cold exposure in laboratory conditions.[27] Failure of this test is defined as when a leather sample sustains a crack in the finish or in the leather itself. Another comparable test for cold crack resistance is ISO 17233.

Strength/Toughness

Automotive and upholstery leather suppliers should put extra emphasis on the following performance standards: tear strength, stitch tear strength, and abrasion resistance. These qualities quantify how much force and stress the material can withstand. Apparel and accessory brands do not usually ask for tear strength or abrasion resistance, but most ask for seam tear strength values.

Tear Strength

Tear strength evaluates how much force is required to tear a material and is measured in newtons or pound-force. Automotive and upholstery brands will ask for tear strength. Materials with low tear strength values are more suitable for accessories.

There are several different standards, dependent on the end use of the material. For example, the Lastometer method measures the bursting strength of leather shoe uppers. The procedure is available as ASTM D2207 and involves forcing a ball-tipped rod through the sample. The Baumann tear is a test method that uses force on a double-edged tear to measure tear strength.[28] The Baumann tear test method was originally developed for leather garments but can be used on all types of leather.[29] The standard procedure is detailed in ISO 3377. Using ISO 3377, upholstery leather should be able to withstand a minimum of 20 N per 1 mm of leather thickness. Shoe upper leather should be able to withstand 50 N when used unlined; if it cannot meet this threshold, the recommendation is to add lining for additional reinforcement.

Stitch Tear Strength and Seam Slippage

Stitch tear strength, sometimes called seam strength or seam rupture, is an important quantity since almost all leather will be stitched in its final application. The purpose of a stitch tear test is to measure how well leather can resist tearing at its seams, especially the tearing stress involved in manufacturing upholstery, apparel, and shoes.[30]

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[27] ASTM D1912 - 00(2016) Standard Test Method for Cold-Crack Resistance of Upholstery Leather
[28] Baumann tear test
[29] ISO 3377-2
[30] ASTM D4705 - 18 Standard Test Method for Stitch Tear Strength of Leather, Double Hole

Stitch tear strength can be tested in leather with ASTM D4705, though some brands use ASTM D1683 or ISO 23910. When using ASTM D1683, apparel leather should withstand a minimum of 25 pounds. Accessory leather should withstand a minimum of 20 pounds when using ASTM D1683. When using ISO 23910, footwear leather should withstand a minimum of 65 N per mm.

Abrasion Resistance

Abrasion resistance is how resistant a material is to rubbing. The difference between crock fastness and abrasion resistance is that crock fastness tests for color transfer, while abrasion resistance tests for material degradation. Abrasion resistance is an especially important quality in upholstery and automotive leather, as these leathers are exposed to significant amounts of friction over their lifetime. Handbags and certain shoe components should also be tested for abrasion resistance.

There are multiple abrasion resistance test methods, but the test method most suited to leather is ASTM D7255. This method involves applying a frictional force on the leather sample by means of a rotary platform abraser.[31] The rotating abraser simulates a friction that is more similar to consumer wear and tear than a simple back and forth abraser motion. Depending on which machine this test is performed with, this may also be called the Martindale method. It should be noted that athough this test standard is similar to ISO 17076, the results cannot be directly compared. Standard upholstery leather should generally be able to withstand 20,000 cycles without showing signs of deterioration. Heavy duty upholstery leather should be able to withstand 40,000 cycles before any change in appearance.[32]

Stability

Stability is important in leather apparel, because material that can withstand laundering without significant shrinkage is a necessity to designers. As mentioned earlier in this report, thinner leathers will often have a fusible polyurethane backing to lend the material dimensional stability. Most brands only run stability tests on finished garments. If a material lacks dimensional stability, then it should be used in non-washable products, such as upholstery.

The most common way to test dimensional stability is by washing a garment according to care instructions and measuring the percent shrinkage. Generally, accessory leathers can have a maximum shrinkage of 3 percent. Apparel leather can have a maximum shrinkage of 5 percent. Additionally, there should not be any distortion between different components of the same garment. ASTM D6013 is the test method for leather and AATCC 150 is the test method for garments.

[31] D7255 - 14 Standard Test Method for Abrasion Resistance of Leather (Rotary Platform, Abraser Method)
[32] Textile Quality Standards

Flammability

Both automotive and home goods leather must be tested for flammability, but it is not common practice to test apparel or accessory leather for flammability.

CAL-117 is a California state requirement used by manufacturers across the United States to test smolder resistance of materials used in upholstered fabric.[33] The purpose of the test is to evaluate the cigarette ignition resistance of upholstery cover fabrics. The test is binary, with the only possible outcomes being pass or fail. It should be noted that CAL-117 does not test the resistance of cover fabrics to open flames. Additionally, CAL-117 lists procedures for three tests: cover fabric test, barrier materials test, and resilient filling material test. The cover fabric test is the only test applicable to leather.

NFPA 260 and ASTM E1353 are both comparable standards to CAL-117.[34] It is advisable to use ASTM E1353 if selling to a non-US market, since ASTM is an internationally recognized standards body.

[33] Technical Bulletin 117-2013 (Attachment 11)
[34] NFPA 260: Standard Methods of Tests and Classification System for Cigarette Ignition Resistance of Components of Upholstered Furniture

SOURCING

Summary

In addition to material testing standards, it is important to note what brands expect when sourcing leather. In this section, we discuss the range in leather pricing, the width and thicknesses of a standard hide, and issues with material continuity.

Price

Leather is sold by square foot and price will vary based on grain, finish, and hide origin. Leather coming from India ranges between 2 to 3 USD per square foot. Aniline and semi-aniline leather cost between 9 and 12 USD per square foot.[35] Contemporary brands such as Club Monaco, Kate Spade, and Banana Republic will pay 2 to 12 USD per square foot for leather depending on the end use. Luxury brands will often be willing to pay upwards of 12 USD per square foot.

Width

A full cowhide is the largest hide that leather suppliers sell and it is approximately 50 square feet (4.5 square meters). The best quality leather comes from the butt, which only makes up between 18 and 20 square feet (1.7 to 2 square meters) of the full cowhide. Calfskins, which are prized for having a softer feel and finer grain than cowhides, are 16 to 18 square feet (1.5 to 1.7 square meters).[36] Because leather is cut from cowhide, it cannot be measured by the yard like standard fabric. The standard conversion formula is as follows: one linear yard of 54 inch (1.4 m) wide fabric is equivalent to 18 square feet (1.7 m) of leather. One of the biggest advantages to sourcing next gen leathers is the ability to create material in any width.

Thickness

A cowhide has varied thickness, with the thickest part of the hide at the butt. This is where thick leather, leather greater than 1.4 millimeters in thickness, comes from. Unsplit cowhide has an average thickness of 45 millimeters. However, leather is difficult to stitch at this thickness and is usually split into two or more layers. Millimeters are the most common unit

[35] Textiles Price List
[36] Hide Types and Sizes

of thickness. Thickness is occasionally measured in ounces, where one ounce equals 0.4 millimeters.[37]

Thinner leathers, such as kidskin, come from younger cows and are often backed with polyurethane to add stability and shape. It is not advisable for leather finishes and adhesives to be thicker than 0.15 millimeters.[38]

Ideal thickness of leather depends on end use. Upholstery and automotive leather should be between 0.9 and 1.2 millimeters. Apparel leather is usually between 0.5 and 0.9 millimeters.[39]

Continuity

Leather is a unique material that varies in quality from animal to animal, based on genetics and environment. Cows in hotter climates will have scars on their hides from insect bites, whereas hides obtained from cooler climates will not have this problem. Different breeds have adapted to their climates with hairier or thicker skins.

Quality also varies based on the area of the animal's body. There are generally four grades of leather quality and only about 13 percent of a cow hide yields the best quality leather.[40] This is partly due to how thickness varies across the hide. It is also due to the variation of "fiber" density across the hide; for example, the leg portion of a hide is spongier than the butt and absorbs water. The neck and legs are more wrinkled than other parts of the hide. These wrinkles are extremely difficult to remove through processing and impact the appearance of the final leather piece. Additionally, lower parts of the hide are more likely to have marks from insect bites and barbed wire fencing.

Lead Time

Beef cattle are raised for an average of 18 months before being slaughtered, at which point the process of turning hides into leather begins.[41] The full tanning, dyeing, and finishing process takes between six to eight weeks.[42] After the hide is processed, it may be shipped to finished goods companies to be cut and sewn into products like apparel. Large luxury brands will usually order their leather between six to eighteen months in advance. Some footwear companies with well-established supplier relations will have lead times of two to four weeks.

37 Leather Buying Guide - Tandy Leather
38 Benefits of Leather Physical Testing For Manufacturers
39 Thickness of leather
40 Leather Buying Guide | How To Identify Different Types of Leather & Leather Quality
41 The Environmental Impact of Cow Leather
42 How To Make Leather

APPENDIX: LIST OF TESTING FACILITIES

The following list of testing facilities is provided by reference only. We do not have any relationship with any of these facilities.

VARTEST

- Technology Overview
- Headquarters: 19 W 36th St 10th floor, New York, NY 10018
- Countries with Testing Facilities: 99% of testing done in-house in NY

ITS

- Textile Testing (including leather)
- Headquarters: Plot No. 91, Phase-II, Block A, Sector 80, Noida, Uttar Pradesh 201305, India
- Countries with Testing Facilities: Testing done on-site, in India

BUREAU VERITAS

- Headquarters: 67/71, Boulevard du Chateau Neuilly-Sur-Seine, 92200, France
- Countries with Testing Facilities: Mainland China, Hong Kong, Bangladesh, India, Korea, Singapore, Taiwan, Guatemala, Mexico, USA, Germany, Turkey, UK, and others (laboratories across 140 countries)

QIMA

- Textiles Testing
- Leather Testing
- Headquarters: Sino Plaza 8th Floor, 255-257 Gloucester Road, Causeway Bay, Hong Kong
- Countries with Testing Facilities: Mainland China, Hong Kong, Philippines, India, Vietnam, Spain, UK, France, USA, Canada, Mexico, and others

Intertek

- Textiles & Apparel Services
- Leather Testing
- Headquarters: 33 Cavendish Square, London, UK
- Countries with Testing Facilities: Mainland China, Hong Kong, Korea, India, Vietnam, Malaysia, Turkey, USA, Mexico, and others

SGS

- Textiles & Shoes
- New Leather Testing Lab Opens in Pakistan
- Headquarters: 1 Place des Alpes, P.O. Box 2152, 1211 Geneva 1, Switzerland
- Countries with Testing Facilities: Mainland China, Hong Kong, Taiwan, Singapore, India, Pakistan, Vietnam, Turkey, Germany, Mexico, and others

TUV

- Services for Clothing
- Headquarters: 30519 Hannover, Germany
- Countries with Testing Facilities: Mainland China, Hong Kong, Singapore, India, Thailand, Vietnam, Bangladesh, USA, Turkey, Germany, and others

CMA Testing

- Textiles & Garments (includes leather and feathers)
- Headquarters: Room 1302, Yan Hing Centre, 9-13 Wong Chuk Yeung Street, Fo Tan, Shatin, N.T. Hong Kong
- Countries with Testing Facilities: Mainland China, Hong Kong

Eurofins

- Materials Testing & Analysis
- Apparel & Fashion
- Leather Testing
- Headquarters: 23 Val Fleuri, 1526 Luxembourg
- Countries with Testing Facilities: Mainland China, Hong Kong, Malaysia, India, Vietnam, USA, Turkey, UK

Precision Testing

- Textile & Apparel Testing
- Leather Footwear
- Headquarters: 313 Hill Avenue, Nashville, TN 37210
- Countries with Testing Facilities: US, on-site in TN