Quality Assurance in Apparel Industry

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Abstract

This article is about the evaluation of the quality and testing methods used in the apparel industry. Testing is the key to continued improvement of products and get an idea of how to improve performance in the future. Physical as well as chemical testing is performed on fabrics for quality assurance and identification. Several quality parameters and testing methods are described in this article starting from physicomechanical properties such as yarn count, GSM of fabric, tensile strength, strain, modulus, comfort properties such as moisture management, wicking, fastness, etc. Aesthetics of the fabrics on extended time usage is also very important in fashion wear and hence properties such as colour fastness to light, washing rubbing, etc are also discussed. A detailed description of the significance of each test and expected results are also discussed.

Key words:

Testing, Apparel testing, mechanical properties, physical testing, chemical testing

Citation

Shreyasi Nandy and T V Sreekumar - "Quality Assurance in Apparel Industry", *BTRA Scan* - Vol. LII No. 1 Jan. 2023, Page no. 4 to 12

1.0 Introduction:

Maintaining quality and consistency is one of the major challenges in any industry. For every apparel industry or business, it is important to maintain a level of quality to get increased sales and a better brand name amongst consumers and fellow companies. High quality is the main factor that ensures global business as a high level of quality will ensure the brand value and ensure better business globally. Strict quality control measures are required for sustainable business especially if the company is exporting its products. Good quality control of their products is very essential as export houses earn foreign exchange for the country. In the garment industry quality control is practiced right from the sourcing of the raw materials to the finished garment. In this industry, product quality is determined in terms of quality and standard of fibres, yarn, fabric construction, surface designs, fastness properties, and the final finished garment products. The quality expectations for export are related to the type of customer segments and the retail outlets.

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Several factors influence the quality fitness of a garment which is based on factors such as - performance, durability, and reliability, visual and perceived quality of the garment. Regulatory quality certifications such as the national regulatory quality certification and international quality programs like ISO 9000 series lay down the broad quality parameters based on which companies maintain the export quality in the garment and apparel industry. Quality needs to be defined in terms of a particular framework of cost. Some of the main fabric properties that are taken into consideration for garment manufacturing for export are the overall look of the garment, the right formation of the garment, feel and fall of the garment, physical properties, colour fastness of the garment, finishing properties, and final produced garments presentation.

2.0 Testing Requirements for Quality Assurance:

Assess the quality of your apparel materials and workmanship, using a number of quality control checks and tests, including:

Physical/ Chemical/ performance	Mechanical	Aesthetics
Fibre Content	Seam slippage /Strength (for woven garments)	Dimensional Stability to washing and dry cleaning
Count & Construction	Tensile Strength	Appearance after wash and dry cleaning
GSM	Pocket Attaching Strength	Pilling Resistance
Stitch Density	Tear Strength	Abrasion ResistancePile Retention
Cover Factor	Bursting Strength (Only for knitted fabric/garment)	Stretch and Recovery (All Stretch Woven Fabrics containing spandex) Spirality/Torque
Wicking Test	Fasteners fatigue and zip quality test	Color fastness to washing, dry cleaning, rubbing, perspiration, water, light, phenolic yellowing, and ozone.
Free formaldehyde	Button Pull Test	DP Rating
Oil/ Water Repellency, Soil Release, Rain Test		Stoll Flex Abrasion
Antibacterial Activity assessment		Whiteness Index(For White Fabric)
Burn Test (100% cotton garment)		Size fitting test
Mold contamination prevention		Care Labelling
Metal Contamination prevention		Needle damage Check (Knitted Fabric)
Ventilation Test		Adhesive check (logos, printings, markings fastness), Barcode Scanning Test

3.0 Test Methods

A number of test methods are available from country to country. Internationally, most organizations prefer the following testing and analysis standard methods:

- American Association of Textile Chemists and Colorists (AATCC)
- American Society for Testing and Materials (ASTM)
- International Organization for Standardization (ISO)
- British and Indian Standards (BS&IS)

Some of the most common and important parameters in the apparel industry are discussed below.

3.1 Grams per Square Meter- GSM

One of the most important parameters is the GSM of the fabric which indicates the weight of the fabric in gm/square meter. This parameter helps to easily understand which fabric is heavier and which is lighter. It is a way of comparing two fabrics. GSM helps to decide processing conditions and also helps to ensure whether the fabric will be able to take a particular force. While dyeing a fabric, it is the GSM that is taken into account to decide how much dye is to be used and what should be the processing conditions. For calculating, GSM one has to cut the fabric with the help of a GSM cutter and take the weight of the cut sample in electronic balance. Then the weight of the cut sample is multiplied by 100. This value is the GSM of the particular fabric. At least 5 readings should be taken for an accurate result. ASTM D 3776 [1] test method can be used for GSM. Tolerance limit should be within +/-5 % as per customer requirements.

Fig. 1. Weighing balance and GSM cutter

3.2 Fibre Content/ blend composition

The performance and price of fabric depend highly on the blend composition and fibre content of the fabric. It is one of the most important properties which will decide the feel,

performance, comfort, etc. The apparel industry performs various tests to identify fibre types and content such as solubility, burning tests, and microscopy. Most natural fibres can be easily identified by the microscopy method and can be distinguished from synthetic fibres. The morphology of every natural fibre is unique. Thus cotton can be easily distinguished from wool and wool can be easily distinguished from coir and linen etc. Most synthetic fibres are circular and smooth surface finish. Acrylic would be either circular, oval, or kidney bean-shaped cross-sections. Thus, microscopical identification is a very reliable method. It gives an accurate result as this method denotes the cross-sectional and longitudinal view of the fibers.

Burning test fiber is another way of identification of fibres by the odour, residue, or how the fiber approaches the flame, burning slowly or rapidly, bead formation on heating, melting or not melting, etc.

Solubility is another easy way to identify fibre materials. Cellulose does not dissolve in most solvents. Cotton dissolves in cuprammonium solution while acrylic fibre dissolves in Dimethyl formamide (DMF) and polyester dissolves in Phenol/TCE (60:40) mixture while nylon dissolves in formic acid. By selecting suitable solvents, fibers can be easily distinguished from each other. AATCC 20/20A test method is mainly used for fibre identification. For single fibre tolerance is null and for blended fibre it should be within +/- 3% as per customer requirement.

3.3 Count

In the textile industry, the count is used to identify the yarn thickness or if the fibre is thin(fine) or thick(coarse). Higher yarn count indicates finer yarn. The finer yarn creates highly dense fabric and coarser yarn produce less dense fabric. It is measured by counting the number of threads present in one square inch or one square centimeter of fabric including both the direction of Warp and Weft. ASTM D 1059 [2] is used as a test method. The tolerance limit should be +/-5 % as per customer requirements.

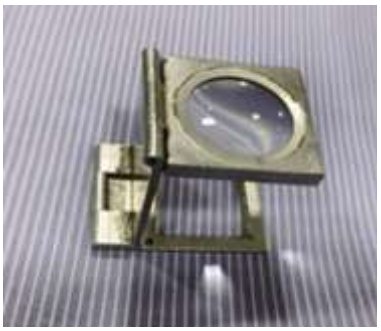

Fig. 2. Pick Glass

3.4 Construction (Ends/Inch& Picks /Inch)

It indicates the thread density of fabric and gives an idea about the compactness of the fabric. For denser fabric, ends per inch (epi) or warp thread density and picks per inch (ppi) or weft thread density should be denser and vice-versa. Generally, ends/inch is higher than picks per inch because weaving cost will be increased if we keep a higher ppi, and width-wise shrinkage is also maintained by maintaining the high epi/ppi ratio to strengthen the fabric. The epi/ppi is measured by the following method.

After marking a 1x1 inch square on the fabric, the warp and weft directions are marked if they are known. Then the number of ends and picks is counted by the pick glass with the help of a needle or pin. For finding epi and ppi, the ASTM D 3775 [3] method is used. The tolerance limit should be +/-3 % as per customer requirements.

3.5 Button pull test

The button Pull test is mandatory for any type of garment product which uses a button. It is used to determine the pulling strength of any type of button and snap used in garments. It is also used to determine the holding or breaking strength of the prong ring attached to snap fasteners onto garments to help button fix the garments properly. For this test, one needs to follow the buyer's requirement of pulling strength. Usually, the buttons subjected to testing are expected to withstand a minimum pull force of 7.72 kg and stay intact without unfastening, breakage, or damage for 10 seconds. Buttons used in child wear are expected to withstand a minimum pull of 90N, while button products designed for adult clothing should withstand a minimum pull of 70N.

3.6 Dimensional Stability and Appearance (After wash and dry clean)

One of the most important properties of garments is Dimensional stability. The significance of dimensional stability is that this property will decide whether a fabric would change its dimension after several processing. For example, one should identify whether the garment shrinks after washing or after dry-cleaning when subjected to standard detergent or solvent in a particular wash cycle, temperature, and time. In an ideal case, the fabric dimension should not change after washing or other processing.

For checking appearance always 2 garments are required. After washing or dry-cleaning washed garment should be compared under the colour matching cabinet in the different light source (Mainly D65) with the original or unwashed garment and check if any changes are happening in terms of puckering, shade change, creasing, etc.

Fig. 3. Dry cleaning machine and washing machine

AATCC 135/150/158 [4] methods are used for all woven fabrics or garments to measure dimensional stability. To obtain wearable condition tolerance limit should be +1/-3 %.

3.7 Tensile Strength

For textiles and apparel, Tensile Strength (TS) is the most important property which decides the longevity of the material. Both quality and performance depend on TS. When a fabric is under a tensile force, it first elongates and after a certain force, it breaks. TS is the maximum force a fabric can withstand before it breaks apart. Material can withstand the maximum amount of braking force. The manufacturer decides how much strength is needed for a fabric or garment depending on the end use. Fabrics used for household applications require only adequate strength to withstand handling at the time of production and use. However, fabrics for industrial applications have to be stronger. The base material and its tensile strength are chosen depending on the end use. Generally, the ASTM D 5034 [5] test method is used for breaking strength. This method is used for woven, nonwoven, and felted fabrics.

The below table shows the minimum breaking strength against GSM

GSM	Minimum Value(Kg) Warp x Weft
<90	10.5x9.5
91-130	11x10
131-180	15x12.5
181-240	18x18
>240	22x19

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Fig. 5. Tensile Strength and Seam Slippage Tester

3.8 Tear Strength

Tear strength is the force required to continue tearing a fabric either in the warp or in the weft direction. It is the resistance of the fabric against tearing. When a cloth gets hooked by a sharp object, the instant tiny puncher is turned into a lengthy rip. Tearing strength is important in the industry where the fabrics are under some stress and the value would determine how well a cloth can survive tearing or cutting when under stress.

The tear strength is a very important property for textiles, industrial wear, military uniforms, tents, apparel, sacks, and jackets. If the tear strength is high, means punctures in the fabrics do not propagate easily. Rip-stop fabrics are made to resist tears after a particular point.

Fig. 6. Elmendorf Tear Tester

The Elmendorf test testing machine uses a falling pendulum to tear a fabric specimen. ASTM D1424 Elmendorf-based tear test is the most popular test for measuring the tearing strength of most fabrics. It measures the amount of energy required to perform the tearing operation by measuring the peak follow-through angle of the pendulum after the tearing action. The lower the follow-through angle the more energy has been transferred into tearing the specimen.

The below table shows the minimum Tear strength against GSM.

GSM	Minimum Value(g) Warp x Weft
<90	650x650
91-130	700x700
131-180	1200x1200
181-240	1300x1200
>240	1400x1200

3.9 Seam Slippage/Strength

Seam strength refers to the strength when the seam finally ruptures or when the fabric breaks. While seaming slippage measures the unacceptable opening in the seam. Seam slippage occurs if the fabric is with a low stitch count, insufficient tension on threads, or improper stitch and seam selection. Seam slippage is weft yarns slipping over warp, or warp yarns over the weft; when the seam is subjected to a given load, its value depends on the fabric construction and finishing applied. Seam slippage causes partial or full distortion of the garment's appearance, but also reduces the usage life of the garment. Seam strength is a comparison between an unseamed test piece of fabric and the seamed fabric specimen. The specimens are subjected to tension and pulled apart till break. The woven textile is said to have 100% seam efficiency if the unseamed portion fails before the seam. If the seam fails at say, half the breaking strength of the regular test piece, the seam efficiency is said to be 50%.

ASTM D1683 covers a test for measuring the seam strength of a woven fabric.

Below table shows the minimum seam strength against GSM

GSM	Minimum Value(Kg)
<90	6x6
91-130	7x7
131-180	9x10
181-240	10.5x11.5
>240	12x13

3.10 Spirality

Spirality or twisting in a garment is appeared after washing (Generally after 3 or 5 washes). It can also be termed as fabric skew or fabric torque. Spirality is the problem that occurs when the wale is not perpendicular to the course direction. As a result one of the side seams comes at front of the garment when the wearer wears it. As the yarn is bent to form a loop, the outer part extends and the inner part compresses. This is the behaviour that results in a change in the geometry of spirals within the yarn, which ultimately results in making it unstable. The spirality percentage depends on fabric torque and garment structure. Percentage spirality is considered the sum of the net spirality caused by the yarn torque and the additional spirality caused by all other factors. Spirality is a serious problem in quality. There are certain standards and quality parameters for checking spirality. Three types of methods are there for spirality measurement. These are Diagonal Marking, Inverted T Marking, and Mock Garment Marking. AATCC 179 [6] test method is used for measuring spirality. It should be within 5 %.

3.11 Bursting Strength

The bursting strength of a fabric is the force required to break the fabric when the force or pressure is vertically applied to the fabric. In apparel, busting strength is normally performed for garments. In the case of a knitted garment equivalent stress is applied from all directions to rupture the fabric. In Diaphragm bursting strength, the sample is covered over the diaphragm by an annular clamping ring. The hydraulic pressure is created by using glycerine as the medium. The glycerine will keep exerting pressure until the sample ruptures.

ASTM D1424 is used as a test method. Min 60 Psi is required for accepting the fabric.

Fig. 7. Bursting Strength Tester

3.12 Pilling Resistance

Small balls of fibres protruding from the fabric due to surface aberration are called pills. Pilling is a fabric surface fault where little 'pills' of entangled fibre cling to the cloth surface and giving the garment an unpleasant appearance. If the fibres are weak, the pills break away from fabric and fall and if the fibres are strong the pills remain. Mostly fabrics made of synthetic fibres such as polyester form more pills and don't break and fall. The pills are formed during wear and washing by the entanglement of loose fibres which protrude from the fabric surface.

Generally, the ICI Piling method is used for pilling evaluation. At first fabric tubes are made and mounted on rubber tubes. In a cork-lined box, these tube samples are tumbled together. The usual number of revolutions used in the test is 18000 which takes 5 hours. Some specimens are required to run for different numbers of revolutions as per customer requirements. After completion of the required revolution, the specimens are removed from the tubes and viewed using oblique lighting to throw the pills into relief. Then the samples are given ratings between 1-5 grades with the help of photographs.

ISO 12945 -1 is used for ICI pilling test method and at 18000revolution 3.5 grade should be required for accepting the fabric.

Fig. 8. ICI Pill Box Tester

3.13 Martindale Abrasion Resistance

Abrasion resistance is the ability of a textile material to resist surface wear caused by flat rubbing contact with another material. It is the ability of a fabric to withstand surface wear due to flat rubbing contact with another material. The durability of textiles and clothing is greatly influenced by their abrasion resistance properties. In the abrasion test, a controlled amount of abrasion is given between fabric surfaces. Circular specimens are abraded under known pressure(Either 12 Kpa or 9 Kpa). Differences in appearance between an abraded and unabraded specimen should be assessed by visual appearance after completion of the test. The number of cycles required to produce a hole or broken threads should be noted and also measure the weight loss of the fabric after abrasion. ASTM D 4966 Part.1 test method is used for the abrasion test. Generally, for trouser, blazer, and suit this test is used to perform. If GSM is less than 150, there

should be no thread breakage up to 10000 cycles and in case of greater than 150 GSM, it should be up to 15000 cycles to meet wearing needs.

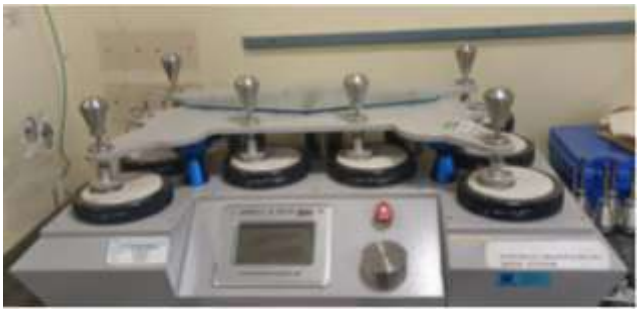

Fig. 9. Martindale Abrasion Tester

3.14 DP Rating

Durable Press (DP) rating gives an idea of the smoothness appearance of fabric, seams, and pressed-increases in garments and other textile products after being subjected to home laundering procedures after general 1st and 5thwash. Washed fabric should be visually compared with different rating replicas.AATCC124/143 methods are used for this test. Generally, the customer acceptance rating is 3.5 after 1st wash and 3.0 after 5th wash.

3.15 Colour Fastness

Colour fastness is the resistance of colour to fade. It is a very important property of dyed fabric or apparel. Colour of dyed fabric is prone to fade when it is subjected to light, water, heat, perspiration, etc. The fastness value gives an idea of after how many washes the fabric retains the required colour intensity or after how much exposure it retains its colour to the required level. It is the property to withstand colour reduction from the surface of textile materials while undergoing different processes and treatments.

There are different types of colour fastness tests such as colour fastness to washing, fastness to dry cleaning, rubbing, perspiration, light, ozone, etc. Important tests are discussed below:

3.15.1 Colour fastness to washing

This measures the colour intensity (as per the gray scale) after subjecting the fabric to a standard soap solution. The rating is from 1-5. Test specimens are attached with a multifibre swatch and stainless-steel balls are loaded into stainless-steel containers to give abrasion to the fabric. The container is then loaded into the machine and the test starts at a fixed temperature and time. After completion of the test, the specimens are dried, conditioned, and evaluated with both grey scales (Colour change and staining). The AATCC 61,2A test method is generally used.

Change in colour (CC):4, Change in Shade (CS):4, Self Staining(SS):4-5 are the grades generally required to meet wearing needs

Fig. 10. Washing Fastness and Dry Cleaning Fastness Tester

3.15.2 Colour fastness to dry-cleaning

This test also is performed in garments as most garments undergo dry cleaning during usage. It gives the fading resistance of a fabric to dry-cleaning. A specimen of the textile is agitated in perchloroethylene for a fixed temperature and time in contact with steel discs of specified quality to simulate the situation in a dry-cleaning machine. The sample is then squeezed or centrifuged and dried in air. Any change in colour of the specimen and coloration of the solvent is then assessed with the standard Grayscale (Grade 1-5).AATCC 132, test method is used for colour fastness to dry cleaning. A colour loss of 4 on the gray scale is acceptable.

3.15.3 Colour fastness to rubbing

Rubbing fastness means a change in colour of dyed textile/apparel after rubbing. Both dry rubbing and wet rubbing fastness are measured in garments. In this test, a crock meter is used to test the specimen. In both cases, the rubbing fastness refers to the situation of fading and staining of dyed fabric when rubbed with a standard white cloth. Crockmeter rubs a finger, covered with cotton rubbing cloth, 10 times to and fro over the sample under test at a fixed pressure. The staining of the two cotton rubbing cloths is assessed using the grey scale for staining. Rubbing fastness test conducted as per AATCC 8 method. Dry/Wet:3/2 grade is usually required to meet wearing needs.

Fig. 11. Rubbing Fastness Tester

3.15.4 Colour fastness to perspiration

Textile materials are in close contact with the skin for a long time and come into contact with the sweat secreted by the skin. This may lead to the transfer of dyes to the skin. So it is important that the dyes do not get extracted with sweat and absorbed in the body. Thus colour fastness to perspiration is a very important test of clothing products. This test method evaluates the colour fading of dyed fabrics to the action of acidic and alkaline perspiration. Acid and alkaline perspiration solutions are treated with two dyed textile specimens differently in contact with multifibre to simulate the perspiration condition which is then subjected to a fixed mechanical pressure and allowed to dry slowly at an elevated temperature. After conditioning, the specimens are evaluated for colour change and colour transfer. AATCC 15 is used as the standard test method. Change in color(CC):3, Change in Shade(CS):3-4, Self Staining(SS):4 These grades generally require to meet wearing needs.

Fig. 12. Screen and acrylic plates for perspiration fastness

3.15.5 Colour fastness to light

Colour fastness to the light of a fabric is the ability to withstand fading when the specimen is exposed to light. In the laboratory, the artificial light is generated by a Xenon arc lamp. The test sample together with a series of eight blue wool standard fabrics is simultaneously exposed to intense artificial light for a certain time of about 24 hours to 72 hours or by customer/buyer demand and compare the change with the original unexposed sample the changes are assessed by Blue Scales. The tests are performed under controlled atmospheric conditions of humidity and temperature. This is one of the most important properties of any fabric used in all wears as fashion or general textiles are always exposed to sunlight. The light fastness rating system is based on the rate of fading of eight blue-dyed wool samples which are rated from 1 (poor) to 8 (excellent). AATCC 16 E (20 AFU) test method can be used for light fastness testing.

Fig. 13. Light Fastness Tester

3.15.6 Colour fastness to ozone

Textile materials while used outdoors get exposed to ozone also along with oxygen and sunlight. This test is used to determine the resistance of colour on textile material to the action of ozone contamination present in the atmosphere. This test is mainly applied on the textile materials which has been dyed with indigo dyes and bleached materials treated with optical brightener. The test is conducted at room temperatures with relative humidities not exceeding 67%. The test sample and the reference sample are exposed in a chamber generating ozone at a specified concentration(ppm) of ozone level with a specified atmosphere to obtain a definite colour change. Depending on the sample cycle should be decided. Usually, denim samples are exposed for 2 cycles, and white fabric is for 1 cycle. Generally, AATCC 109 test method is used for testing. Immediately after the test evaluation should be done with the help of a grey scale.

Fig. 14. Ozone Fastness Tester

Colour fastnesses to phenolic yellowing, Colour fastness to water, etc are also carried out as per customer requirement.

3.16 Free formaldehyde

Free formaldehyde is the uncombined monomeric formaldehyde that exists in a finishing or a textile material. Agencies have classified formaldehyde as hazardous and Acute Toxicity 3. It is carcinogenic and corrosive to skin with irritation. The formaldehyde test method applies to textile fabrics that involve formaldehyde, particularly fabrics finished with chemicals containing formaldehyde. Formaldehyde emission is strictly prohibited due to its harmful nature to human health. If the fabric contains formaldehyde then it can be dangerous to the skin. It is the buyer's one of the important tests which must be passed. This measurement is to determine the level of Formaldehyde present in the fabric or product which will indicate the 'risk' in handling the product. EN ISO 14184 / 1 is generally used as a test method.

3.17 Wicking property

The wicking behaviour of fabrics is a very important property that greatly influences the comfort of textile

materials. It also influences dyeability, filterability, finishing, etc. Wicking property happens due to capillary phenomenon and is the ability of water or any other liquid to penetrate the fine pores of fibres due to liquid to fibre surface interaction. In the case of garments, it is the water wicking that is most important as comfort is the major objective. As wicking is a surface to water interaction behaviour, it is greatly influenced by surface morphology, fibre composition of the yarn, and chemical composition of the materials with which the fibres are made off. Thus the wicking behaviour of cotton is completely different from that of polyester.

During hot summer days, the body produces excessive sweat which gives discomfort to the person wearing any garment. The water droplets produced due to sweat have to be immediately removed for better comfort. Wicking of garments is the property that makes sure how the water droplets are removed from the skin to the fabric and then to the atmosphere keeping the body dry and cool.

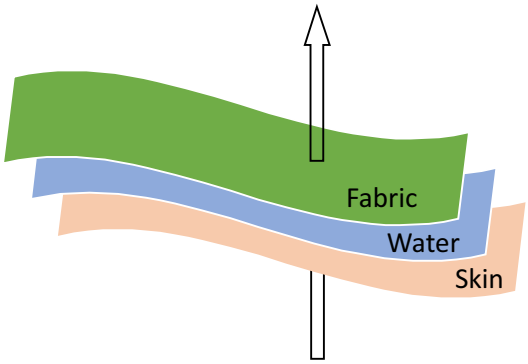

Fig. 15. Wicking mechanism of perspiration through fabrics

AATCC197 (Vertical Wicking Rate of Textiles) is used for checking the wicking property of textiles (Woven, Knitted, and Non woven Fabrics). This test should be done mainly for moisture-absorbent fabrics. Wicking Rate should be 8cm after 10 minutes. This grades generally require to meet wearing needs. The test should be done with the original and after the 5th wash.

3.18 Moisture Management

The controlled movement of perspiration from the skin surface to the environment through the fabric is referred to as Moisture management. It is an important factor that provides comfort to the user and maximizes performance. As wicking refers mostly transport of liquid water, moisture management is the transport of water in the form of vapour from the skin to the atmosphere which regulates the body temperature and maintains heat balance thus controlling the comfort level of environmental conditions and activity. Thus moisture management is essentially a combination of wicking, absorption, and vaporization of sweat.

Cotton has a natural way of moisture management. Polyester microfibers with surface modification, fibres with special grooves, and many such modifications are proposed to improve moisture management. Finer fibres give better moisture management properties. Cotton has an inherent attraction towards moisture due to its cellulosic structure having hydroxyl groups that can form hydrogen bonds with water vapour. This helps in better moisture management. The Moisture Management Tester (MMT) measures, evaluates, and classifies liquid management properties of fabrics per AATCC Test Method 195.

In the apparel industry, some tests like care labeling, colour shading, size fitting test, fatigues and zip quality test, adhesive check, down feather leakage testing, needle damage check, barcode scanning test, burn test, mold-contamination prevention, metal-contamination prevention, ventilation test are sometimes done as per customers requirement.

Some special types of testing are also done as per the needs of the customer.

3.19 Oil Repellency:

Oil repellency is very relevant in industrial fabrics used in the oil industry and work wear involving oily matters. It is required in industries where workers are frequently prone to oily matters, such as the petrochemical industry. Due to low surface tension, oil keeps spreading over surfaces quickly, instead forming into droplets the way water does. Oil spread is very difficult to clean and oil repellency on textiles is so very important. This test method detects resistance to wetting of a surface of the fabric by a selected series of liquid hydrocarbons of different surface tensions. Drops of standard test liquids consisting of selected series of hydrocarbons with different surface tensions are placed on the fabric surface and the wetting and wicking characteristics and contact angle are observed. The oil repellency grade is the highest-numbered test liquid that does not wet the fabric surface. AATCC 118 method is used for oil repellency testing. The original garment is generally compared for oil repellency with the 5th washed and 20th washed garments. Higher the oil repellency grade, the better resistance to staining by oily materials, especially liquid oil substances.

3.20 Water Repellency

Water repellency is the property of a textile material to resist wetting by water or resistance of water to penetrate through the fabric. It depends mostly on the type of fabric construction, the base material composition, and the kind of water-repellent coating applied to the fabric. The effectiveness of the surface layer will determine how efficient the water-repellent fabric, be it an umbrella fabric, outwear, raincoat, or tent and tarp, is in keeping the user dry.

AATCC 22: Water Repellency: Spray Test and AATCC 42: Water Resistance: Impact Penetration are the two main tests carried out for Water Repellency. Under controlled conditions, water sprayed against the taut surface of a test

specimen produces a wetted pattern, whose size depends on the relative repellency of the fabric. Evaluation is accomplished by comparing the wetted pattern with pictures on a standard chart. Water repellency should be compared for the original garment with the 5th washed and 20th washed garment.

3.21 Stretch and Recovery

One of the key consumer requirements in the fashion garment industry is stretch. Elastomeric fibres such as spandex are blended with cotton or polyester to bring this quality to the fabric. Depending on the garments, the extent of elasticity varies. Skinny tight fit garments require super stretch or power stretch and casual garments require medium to low stretch. Stretchable fabrics are widely used in undergarments, casual wear, tights and jeans, performance wear, sports, and swimwear. The right quality of stretch needs to be quantified and assessed to make sure the quality of stretch and recovery. Differences in the level of stretch growth and level of recovery are very important for fabric functionality and performance.

ASTM D 3107 is used for measuring stretch and recovery for all woven fabrics containing spandex. Stretch should be >15%, Growth should be a maximum 5%and recovery should be a minimum of 85%. These grades generally require to meet wearing needs. For knitted garments, ASTM D 2594 method is used to measure stretch and recovery.

Antibacterial Activity Assessment (AATCC 100), Rain Test (IS 392), Whiteness Index (AATCC 110), Pile Retention (AATCC 4685 opt.B),Colour Fastness to Phenolic Yellowing (ISO 105 X18), Soil Release: Oil Stain Release Method (AATCC 130), Stoll Flex Abrasion (ASTM D 3885), etc tests can also be carried out for garment as per customer's requirement.

References

[1] ASTM D3776/D3776M-20 Standard Test Methods for Mass Per Unit Area (Weight) of Fabric Jul 29, 2020
[2] ASTM D1059-17 Standard Test Method for Yarn Number Based on Short-Length Specimens Dec 15, 2022
[3] ASTM D3775-17e1 Standard Test Method for End (Warp) and Pick (Filling) Count of Woven Fabrics Apr 04, 2018
[4] 2-AATCC TM135 150 158 (2018-03)
[5] ASTM D5034-21 Standard Test Method for Breaking Strength and Elongation of Textile Fabrics (Grab Test) Mar 31, 2021
[6] AATCC 179-2019 Skewness Change in Fabric and Garment Twist Resulting from Automatic Home Laundering STANDARD by American Association of Textile Chemists and Colorists, 2019