



Faculty of Engineering

Department of Textile Engineering

REPORT ON

“Investigation on changes on knit garment washing”

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This Report Presented in Partial Fulfillment of the Requirements for the Degree of
Bachelor of Science in Textile Engineering.

Advance in Apparel Manufacturing Technology

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DECLARATION

We hereby declare that, this project, neither as a whole nor as a part therefore has been copied out from any source. We also declare that we develop this project and this report entirely on the basis of our personal efforts made under the sincere guidance of our project supervisor Abdullah Al Mamun, Assistant Professor, Daffodil International University. We further declare that this project and all associated documents and records and partial requirement for the degree of Bachelor of Science in Textile Engineering.

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Finally, we would like to express a sense of gratitude to our beloved parents for their support, strength and assistance throughout writing the project report.

DEDICATION

With the deep sense of or honor to our beloved and dearest parents, Teachers and all other those who devoted their yesterday for our successful and bright today.




Faculty of Engineering

Department Of Textile Engineering

Approval Sheet

This research entitled “ **Investigation on changes on knit garments washing**” at **Daffodil International University** prepared and submitted by Shovon Chakraborty, ID: 113-23-2713, MD. Shahidullah Azizi ID: 113-23-2746, MD. Shoeb Hossain ID: 113-23-2702

In partial fulfillment of the requirement for the degree of BACHELOR OF SCIENCE IN TEXTILE ENGINEERING has been examined and hereby recommended for approval and acceptance.


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ABSTRACT

This project is on “**Investigation on Changes on Knit Garments washing**”. Washing is a very important procedure in garments manufacturing. Every buyer wants to buy good quality product. As a result buyers are very sincere about washing quality of the product. That’s why supplier is facing market leading competition. So it is very important to improve the washing quality and improve the ensure finely washed product. Now a day’s necessary to apply right system and process of wash quality so that only quality goods will be produced. The main purpose of remove washing faults to increase the quality of product to the competitive global market. This paper clearly explains the differences between before and after wash changes on knit garments washing. Mainly two types of wash can be done in the washing industry. One is wet process & other is dry process. During this project work, we found Dimensional stability percentage, GSM are decrease & fastness changes are same before and after wash and rubbing fastness wet and dry same before and after wash .Perspiration and saliva also same before and after wash.

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1. Introduction

Garment washing is very essential part of a garment industry it is the the technology which is used to modify the appearance, outlooks, comfort ability and fashion of garments is called

Garment washing. The main purpose of washing is to create a best wash looks of a garments. Washing techniques creates new fashion such as tagging, grinding, destroy, Blasting, whickering, permanent wrinkle, deep dye, tie dye, p.p. spray, hand crapping, p.p. sponging etc. Which is also seems the best touch of garments. Any dirt, spot or germ if added in the garments during manufacturing is also removed due to washing. Washing is done to attract the customers/Buyer by different types of Fashionable washing and market developments.

Practical knowledge is must be important part for studying engineering. Theoretical knowledge supported by the practical knowledge. Scholars also suggest that practical experience is more effective than theoretical knowledge.

We undertook our project on “INVESTIGASION ON CHANGES ON KNIT GERMENTS WASHING”. During our project, we gathered information about our topic and prepared the project within a short time. That is why, there may have some unexpected mistake and also some lakes in the Project. We are regret very much for this unexpected mistake in this project.

Aim of garments wash:

Garment washing is normally done after stitching. According to fashion trend and customer demand buyers ask for garment washing. For the washing apparel buyers mention exactly what types of washing they need for the order. For example, Tom Tailor buyer asked for washes like – Vintage wash, Cloud wash, softener wash or Acid wash. Each wash has different types of appearance on the fabric surfaces. Wash types mainly depends on the product types. For denim product heavy enzyme is required where for knitted Tee light softener wash may be okay.

Objects of garment washing:

- To remove starch that applied during fabric manufacturing.
- To soften the garment hand feel and improve bulkiness
- To remove dirt, spots, oil stains that accumulate to garment at the garment manufacturing processes.
- To remove chemicals used during printing process and embroidery process.

To fulfill customer demand

- Washed clothes can be worn directly after purchasing
- To give faded look or any other color tinted look to the garment.
- To stabilize garment shrinkage and dimensional instability

To have an idea about washes few washes have been explained below.

1. **Heavy enzyme or Vintage Wash:** Vintage means old look. To get the old or used appearance garments are washed inside washing machine with enzymes. Fleece sweat shirt are washed with heavy enzyme.
2. **Cloud wash:** Cloud wash gives appearance of white patches on the garment surface that looks like cloud in the sky.
3. **Stone wash:** To get faded look on the garment surface white stone are used with enzymes during washing. During washing fabric come in contact with stones and by rubbing color fades. Stone wash generally used for denim product washing.
4. **Acid wash:** For acid wash, base color of the garment taken out by spraying acid on the specified areas.

Possible Scope:

1. Effective Loading/ Unloading:

- Around 35-40 min is lost during loading and unloading.
- If the trolleys are rightly managed and a string is used to load the fabric, almost 40% time can be recovered, i.e. around **10-15 min.** time can be saved.

2. High Pressure improved Fill/Rinse system:

- Around 11-12 times rinse & filling are done sequentially during whole process, which consume around 60-70 min. it depends on the line-water pressure.
- If the water pressure can be maintained around 5 kg/cm² by using the booster pump effectively, the rinse & fill time can be reduced to 40-50 min i.e. at least **20 min** can be saved.

3. Using Progressive Dosing:

- Type of dosing affects the whole time of process as linear dosing is time consuming so progressive dosing is more effective.
- In case of the auxiliaries injection can be easily implied.
- This saves time around 20-30% i.e. **15-20 min.**

4. Using Multi-functional chemicals/ substitute:

- Salt substitute is very effectively used in one of our studied factory. They uses substitute in almost 90% case, which reduces the cost per kg around 5-6 tk. & reduces time of process as number of auxiliaries is not required here also just 50% salt is required.
- Using multi-functional agents also reduces the time consumption.
- Around **15-20min** can be saved by using MFC.

5. Using Pre-heated water:

- If the water in preparation tank is preheated to 50-60°C by using the used steam from heat-exchanger, it will result huge time savings.

- See more at: <http://www.textiletoday.com.bd/newsite/scopes-of-improvisation-in-knit-dyeing-process-of-cotton-in-bangladesh-to-optimize-the-process-time/#sthash.fglTW0FW.dpuf>

2. Literature review

2.1 Garment Washing

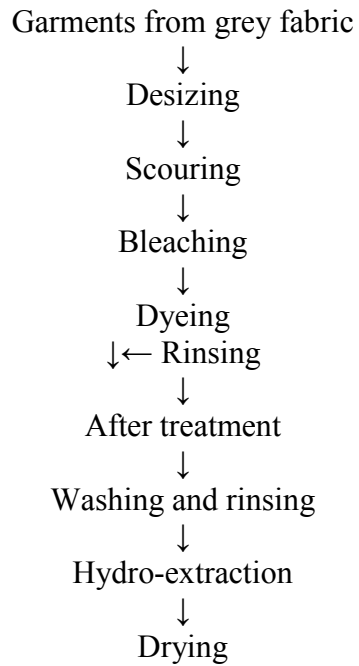
2.1.1 Definition:-

Garments washing are very important part of garments manufacturing technology. It is the technology which is used to modify the appearance, outlook, comfort ability & fashion of the garments is called garment washing. Actually garment washing is normally done after stitching. There are different types of wash. Each wash has different types of appearance on the fabric surfaces. Wash types mainly depends on the product types.

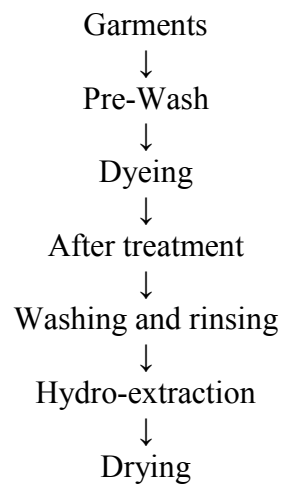


2.1.2 Flow Chart of Garment Washing:

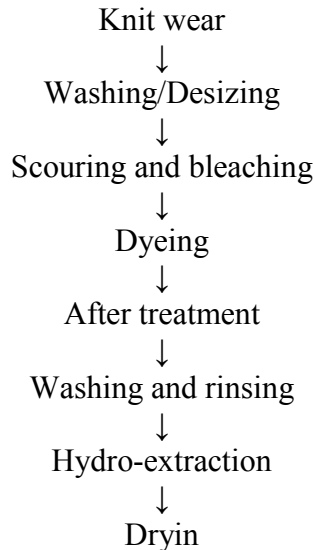
Flowchart for Woven Garments:



Woven garments made of pre-treated fabric:



Flowchart for Knit Garments:



2.2 Why washing is done or the purpose of washing:

1. To remove starch that applied during fabric manufacturing.
2. To create wash look appearance, seems the new touch of fashion.
3. By the washing technique, faded/old, color or tinted affect.
4. Washing technique creates new fashion such as tagging, grinding, destroy, blasting, whickering, permanent wrinkle, deep dye, tie dye, p.p. spray, hand crapping, p.p. sponging etc.
5. To reduce size materials that imports soft hand feels.
6. To attraction the customers/buyer by different types of fashionable washing and market development.
7. Due to washing, dimensional stability occurs in the garments. There is no possibility of further dimensional stability of the wash garments.
8. Any dirt, spot or germ if added in the garments during manufacturing is also removed due to washing.
9. To remove chemicals used during printing process and embroidery process
10. To soften the garment hand feel and improve bulkiness
11. To remove dirt, spots, oil stains that accumulate to garment at the garment manufacturing processes.

2.3 Requirements of garments washing

1. It should be removed size materials from the garments. Hence feels soft during use.
2. It should be removed any dust, dirt, spot, impurities or germ which is present or added in garments during manufacturing.
3. It should be dimensional stability occurred i.e. no possibility of further dimensional stability of wash garments due to washing.
4. It should be attracted the customers or buyer by using different types of fashionable washing and market developments.
5. It should be produced similar or different outlook in the garments by different washing techniques.
6. It should be created wash look appearance in the garments. After washing the garments create a new looks which seems the new touch of fashion.
7. It should be created color or tinted affect in the garments which also seems the best touch of the garments.
8. It should be created faded affect in the garments.
9. It should be possible to wearing directly the garments after purchasing from the shop.
10. Should be used new/ modern/ latest machines.
11. It should also be produced fading affect in the specific area of the garment as per specific design.
12. It should be comparatively more profitable than others.

2.4 Effects of washing on garments products:

1. Washing brings change in size.
2. Washing brings change the appearance of the garments.
3. Washing brings change outlook of the garments.
4. Washing brings change in design.
5. Washing brings change in color.

6. Washing brings change in comfort.
7. Washing brings change in fashion, etc.

2.5 Procedure of garments washing:

1. Garments can be inverted to minimize unwanted abrasion streaks (especially useful when preset creases are present).
2. Load machine with garments.
3. Disize with alpha amylase enzyme and detergent.
4. Drain.
5. Rinse.
6. Fill machine with water and heat to 60°C. The liquor ratio can range from 10:1 to 20:1. A number of synthetic detergents can be used. Also, alkaline products such as soda ash or caustic soda can be added in amounts ranging from 0.5 to 2.0 grams/liter. Some chemical suppliers offer special products that accelerate the wash down process, dependent upon the particular dyestuff used.
7. Wash/tumble action for 20-60 minutes, depending upon desired effect.
8. Drain and rinse.
9. Apply softener.
10. Tumble dry.
11. Invert garments, if previously turned.
12. Press, if required.

2.6 Some soft garments washing process:

- ☐ Normal wash/ garment wash/rinse wash
- ☐ Pigment wash
- ☐ Enzyme wash
- ☐ Acid wash
- ☐ Silicon wash
- ☐ Soft wash

In garments washing technology there are almost twelve processes in dry and wet washing process. But we will discuss about one process among them.

2.7 Process of Normal Wash

Process in which heavy or slight soiling is removed and transferred to the water in the form of a solution or dispersion. Washing has the effect of cleaning surfaces. The resulting effect is several physical/ chemical processes (Washing process). Washing and cleaning constitute a complex process, during which soiling is removed by means of physical separation, with or without substance conversion, from a substrate. Industrial washing processes can be categorized as solution washing, dispersion washing and reaction washing.



Fig: Washing machine Used for Normal Wash

2.8 Objects of Normal Wash:

- ☐ Normal wash is required for the following reasons:-
- ☐ To remove dust, dirt, oil spot, impurities from the garments.
- ☐ To remove size materials from the garments.

2.9 Type of machine used in washing plant

- Sample washing Machine (Horizontal / Vertical Type)
- Washing Machine (Side loading)
- Washing Machine (Front loading)
- Hydro extractor Machine
- Dryer Machine (Steam)
- Dryer Machine (Gas)
- Chemical Mixture Machine
- E.T.P (Effluent Treatment Plant)
- Generator

2.10 Chemical used in washing plant:

- -Enzyme
- -Detergent
- -Acetic Acid
- -Anti-stain
- -Bleaching powder
- -Sodium hyposulfite
- -Caustic Soda
- -Soda Ash
- -Sodium Bicarbonate
- -Potassium permanganate
- -Cationic / nonionic Flax softener
- -Micro Emulsion Silicon
- -Salt (sodium chloride)
- -Buffer
- -Hydrogen peroxide
- -Stabilizer
- -Fixing agent
- -Catanizer
- -Optical Brightener
- -Resin
- -Sodium Meta-bi-sulphite
- -Desizing agent

2.11 Function of chemicals in textiles:

ENZYME WASH:

Enzyme wash is performed with a kind of live cell. Enzyme can break some fibers of fabric and gives the fabric special effect desired on the garment. Enzyme wash provides the fabric a soft, sanded or "peached" effect very desirable on many garments. Enzyme wash is also useful for indigo denim.

In this case enzyme can replace stone but gives denim a stone wash look, with better and nicer blue and white contrast on the fabric. Enzyme wash is, however, costlier than stone wash.

DETERGENT:

Chemical character is fatty alcohol poly-glycol ether in an aqueous, glycolic solution.

Detergent is widely applicable in the continuous and discontinuous pretreatment of all types of fiber and their blends. To remove impurities, mineral oil contamination and sizes from the garments.

PIGMENT WASH:

Pigment Wash is similar to normal wash but a bit costlier. The garment is solid color pigment dye.

The requirement is that the color should fade evenly to lend the garment a prominent washed look. Pigment wash requires a higher temperature of water than normal wash.

- (1) Use hot water 50-60 degree C;
- (2) Load the tumble washer not more than 70 % of its capacity. This enables garment to move inside smoothly. If fully loaded with garments due to friction of the garments with tumble body.

ANTISTAIN:

Anti-stains used to prevent the staining on weft yarn of the denim (white yarn), white pockets of garment, levels, and contacted fabrics of garment and increased the brightness of fabrics; it is also acts as anti-creasing agent.

BLEACH WASH:

Bleach wash means that bleach chemical is used in water while washing in a tumble washer. Strict washing time is a requirement with such wash because otherwise the garment may be over bleached and the color cannot be reversed.

SODIUM HYPOSULPHITE:

Sodium hypo-sulphite is used to neutralize the garments from chlorine bleach.

CAUSTIC SODA:

Caustic created the role in bleach technique without color change the garment and has a good cleaning power. It is work as fading affect/old looking affect come rapidly on garments.

SODA ASH:

Soda ash creates alkaline medium for the breakdown of pigment dye. Soda ash help to uniform bleaching action on bleach bath. It has a cleaning power and help color fading effect of garment. It is used also for color fixing in dye bath.

STONE WASH:

Stone wash means washing garments with special stones so that garments achieve a very strong washed effect. Volcanic stones are used in such wash abrade exposed parts of the garments, this idea of washing with porous volcanic stones is to give the garment a strong and rough wash to achieve the pronounced washed effect through abrasion on the exposed areas, such as the seams and pocket corners.

Sometimes, bleach is added to the wash so that the color fades in a more pronounced manner. This is done to make navy blue jeans into a more faded light blue. Such wash requires a lot of skill, experience; workmanship and expertise so that desired results are achieved. In stone wash the following points should be carefully checked:

(1) Size of the stones: Stone size is very important in stone wash. They have varied affect on the garment being washed. Larger stones give tough abrasion while smaller ones lend less abrasion. Stone should be selected based on the required abrasion affect as well as type of fabric of the

garments. Larger stones may, however, damage comparatively light-weight fabric. Smaller stones give softer abrasion.

(2) Garment-Stone ratio: (Weight of stones relative to the weight of garment) Wash with more stones may lead to more apparent blue/white contrast on the fabric.

(3) Washing time: Washing time also much important in stone wash.

(4) Quantity of bleach: Use of more bleach can shorten wash time and leads to more productivity. Bleach, however, cannot be used indiscriminately. Disproportionate amount of bleach may lead to loss of the desired blue/white contrast on the fabric. In order to achieve better result, one should cut a balance between quantity of bleach, stone size and amount of stone. Sometimes one needs to use the normal quantity of stone and longer washing time to achieve the color standard requirements.



Fig: stone washing machine.

Potassium Permanganate:

Potassium permanganate is used in Acid wash with Punic stone for color out from the garments.

It is used also spray chamber by nozzle for color out (whitish affect) from the garments.

ACID WASH:

This is a patented process and can be used only on permission. This is also a kind of stone wash. The wash is performed in two steps: in the first step garment is washed without water and in the 2nd step with water.

(1) Soak volcanic stones in potassium permanganate solution. Stones absorb chemicals and become saturated. The stones are then dried in normal air or sun. The stones are ready for work.

(2) Denim garments are now made ready for wash. They are desized / destarched in water in a tumble washer and dried in a spin dryer.

(3) The garments are put in a separate tumble washer filled with treated stones. Water is not added. Now run the tumble dryer wash the garments without water.

Tumble washer is run to wash the garments without water. Stone will abrade the garments, especially, the exposed parts. Hidden parts will not be abraded.

(4) Thereafter, the garments are taken out of the tumble and transferred to another tumble filled with water for washing and rinsing. After rinsing is over, the prominent acid wash effect will show up.

The treated stones carry the chemical to bleach the exposed parts and bleach them to white. But the hidden parts remain untouched. Whitening agents are often added to water during rinse to make the white color in the blue jeans whiter to display acid wash.



Fig: Acid washing machine.

FLAX SOFTENER (cationic, non-ionic):

Softener is used to make the garments treated textiles a surface feel that is both sickly and soft and also provides excellent lubricating properties.

Micro Emulsion Silicon:

Amino Silicon is a textile finishing agent consisting mainly of amino modified silicon. When applied on fabrics, it gives durable softness, lubricity, elastic handle, anti-pilling, dimensional stability stability, tear resistance and fabric to be cut and sewn more easily allows and improving wear and easy care properties.

CAUSTIC WASH:

Caustic wash is basically a pre- printing wash. Caustic is a strong chemical with highly corrosive features. Prior to printing on cotton fabrics, grey goods are treated in boiling water with caustic, which has also strong cleaning power especially for grease. This wash can remove all soil, dirt, grease, fine particles of cotton seeds as well as all foreign materials. As a result only pure cotton fiber in the fabric for printing is left. This leads to stability of printing and well cleaned fabric. However, when we want to do caustic wash on garments, we just do the opposite of the above; prior to printing fabric is not treated with caustic wash for cleaning.

Printing is done on the row & unclean fabric so that about 30% of the printing done on the surface may eventually fade away. Finally, printed garments are caustic washed. This leads to, about 30% of the printing washed away along with the foreign materials- leaving about 70% of the printing on the fabric. This eventually makes the design or stripe of desired look. For this type of wash, the printing must be pigment print with binder. Baking treatment should also be performed so that

The color will stay on the fabric more or less securely to coincide with the caustic wash to be done later.

GARMENT WASH AND OVER-DYE:

This type of wash is also used for denim garments to give them a special look. This is performed in the following way:

Wash the denim garments with stone so that the double needle seams, pocket flaps and exposed parts get washed down to light blue color or white.

Put into dye the tumble to dye the garments to get the desired color.

A coat of new color will appear on to the garment, especially, in areas where the garment has been washed to a light shade. This creates a special but different look. In this process of wash, the lining or pocketing will pick up the color too. By this wash, direct dye or reactive dye same as dyeing fabrics or yarn may be used. Direct dye is cheaper. So, direct dye may be used with concomitant use of color fixing agent, after dyeing to make the color more stable. In case of solid color fabric staining within the garment is not a problem. However, if garments of different colors are washed together by the consumers, color may transfer to other garments, so reactive dye is more preferable.



Fig: garments wash and over-dry machine.

WHITENING:

Whitening agents are used to create a super white look. (Unless the garments you wash is all colored namely no white color at all in the fabric, you should use whitening powder in the rinsing process to make the white part more white) In denim where there are colored warp threads and white weft threads. If such garments undergo "stone wash and bleach" whitening powder is used in the final rinsing. This makes the white threads in the fabric whiter and generates a stronger contrast between blue and white on the surface of the fabric.

Chloride (Salt):

It helps to exhaust dye in to the fiber

Buffer:

Buffer is used in washing plant for pH control of enzyme bath, softener bath, desizing bath.

Hydrogen Peroxide:

Hydrogen peroxide creates the prime role in bleach wash technique. In alkaline medium, hydrogen peroxide breaks up and gives some per hydroxyl ion, which discolor the coloring materials and as a result fading effect is developed. Hydrogen peroxide is used in scouring, bleaching bath for white/ready for dyeing of gray fabric garments. It is used also neutralized the garment from alkaline condition.

Stabilizer:

Hydrogen peroxide is work a good condition at temperature above 90°C, when temperature raise to 90°C then break the Hydrogen peroxide. Stabilizer is used to protect break the hydrogen peroxide and peroxide works in bath smoothly.

Fixing Agent:

Fixing agent is used for unfixed dye to fix on fabrics, when fabric color will be proper fixing then color fastness & rubbing fastness will be increased.

Catanizer:

Catanizer is used in pigment exhaust method processing. Pigment is color not dyestuff. Pigment colors have no affinity to fabric when cutinize is used in fabric then increase the affinity between pigment color & fabrics.

Optical Brightener:

Two types of optical brightener are used in the washing plant –a) Red brightener. b) Blue brightener. Mainly optical brightener is used for improve the brightness of garments.

Resin:

Resin is high efficiency textile resin based on etherified diethyl glyoxalinmono-urineurea. Resin is used for the creation of semi-permanent creases in denim and other cellulose fabrics. It is used also cotton and polyester fabric. Fabric retains soft handle after washing.

Sodium Metabi-sulphite:

Sodium Meta bi-sulphite is used in the washing plant to neutralized the garment from potassium permanganate.

Desizing Agent:

Desizing agent is used to remove mainly starches, cmc, waxes, fats pectin's, minerals & unfixed indigo dye from denim, twills, poplin & canvas fabrics etc.

Hydro extractor machine:

Hydro extractor the garments to remove excess water from the garments .Time required 2-4 minutes.

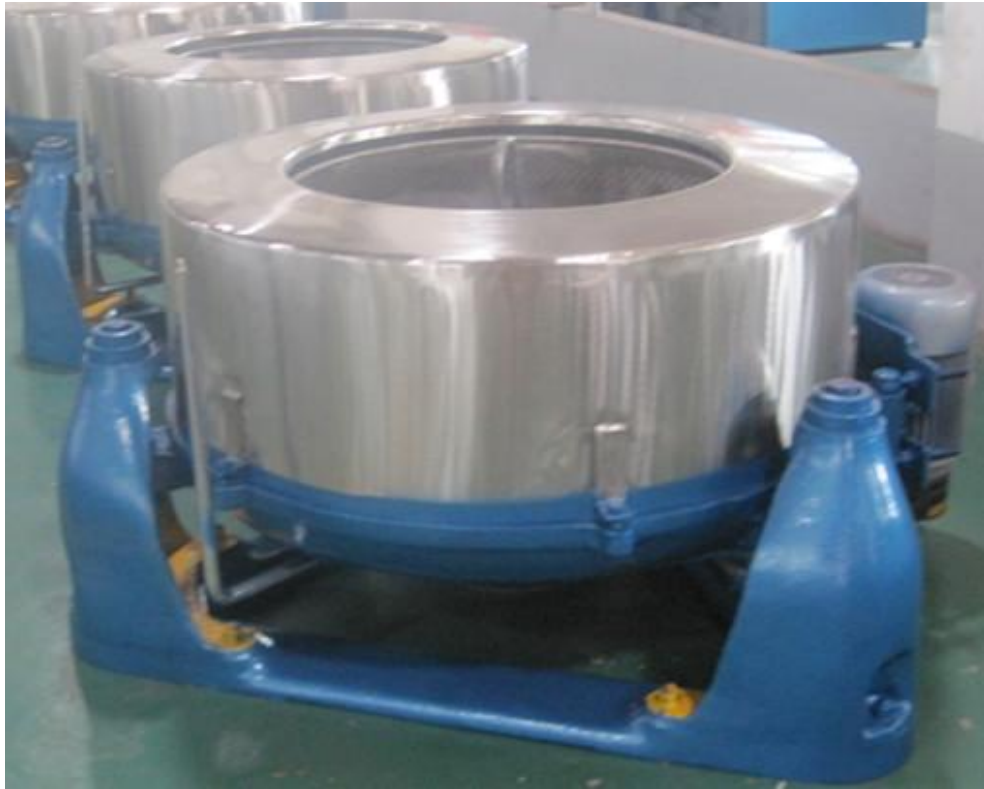


Fig: Hydro extractor machine.

2.12 Dimensional stability

2.13 Definition of Dimensional stability:

Dimensional stability refers to the change indicators of the fabric size after the washing and drying and it is one of the most important fabric wear ability. The strength of dimensional stability has a great influence on the garment or other textile products specifications. Dimensional stability is the vital characteristics of a fabric. It is required to confirm about the dimensional stability of a dyed fabric. If you think that, you buy a t-shirt from the market as your required size but after first

Wash its size becomes small or large than your required size then you will be upset. So, it required to know about the dimensional stability.

2.14 Several Factors Affecting the Fabric Shrinkage:

The several following major factors can affect the fabric shrinkage.

2.15 Fiber Components of Fabric:

Compared with synthetic fibers (polyester, acrylic), natural plant fibers (such as cotton, linen) and plant regeneration fibers (viscose) are easily hygroscopic and expand, therefore the dimensional stability is larger. While the scale structure of wool easily affects its dimensional stability stability.

2.16 The Structure of Fabric:

Under normal circumstances, the dimensional stability stability of the woven fabric is superior to the knitted fabric; the dimensional stability stability of the high-density fabric is superior to a low density, such as the stability of denim fabric is higher. In the dryer fabric, the dimensional stability of the general plain weave fabric is smaller than a flannel fabric; knitted fabric the plain stitch dimensional stability is smaller than rib fabric.

2.17 Production Process of Fabric:

In dyeing, printing and finishing process, fabrics is inevitably stretched by machine and the tension exists in the fabric. While fabric easily relieves tension when encounter with water, so we find that the fabric has shrunk in the wash after. In the actual process, we generally use pre-shrunk to solve this problem.

2.18 The Process of Washing and Maintaining:

Wash care includes washing, drying and ironing, and every step of the three steps will affect the fabric shrinking. E.g. the dimensional stability of the hand wash sample is superior to the samples of the machine wash and the washing temperature will also affect the dimensional stability. Generally, the higher the temperature is, the worse the stability is. The drying of the sample on the fabric impacts the dimensional stability lot.

There are four common ways of drying:

Drip-drying method, metal mesh tiling method, hang dry drying and drum drying method.

The drip-drying method has the minimum impact on the fabric, and the drum drying method has greatest impact on the size of the fabric. In addition, selecting an appropriate ironing temperature Based on the composition of the fabric can also improve the fabric shrinking. For example, cotton and linen fabrics can improve its size dimensional stability by hot iron. But not the higher the temperature, the better for synthetic fibers, because high temperature ironing cannot improve its shrinkage, but its performance will have destruction, such as the fabric stiff crisp. Therefore reasonable care label is very important to wash their clothes.



2.19 Grey scale:

Grayscale is a range of shades of **gray** without apparent color. The darkest possible shade is black, which is the total absence of transmitted or reflected light. The lightest possible shade is white, the total transmission or reflection of light at all visible wavelengths.

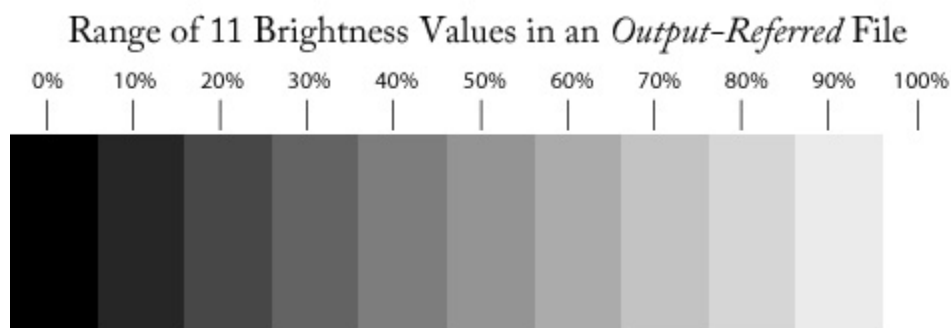


Fig: Image of gray scale.

2.20 Fastness

2.20.1 Definition of Fastness:

Fastness is a term used in the dyeing of textile materials, meaning resistance of the material's color to fading or running.

Color Fastness is a resisting property of textile materials. To resist the color loosing or reducing from the textile material surface during different mechanical, physical and chemical treatment is called color fastness

2.20.2 Different types of fastness testing:

- Color fastness to wash.
- Color fastness to light.
- Color fastness to rubbing. 1. wet 2. dry
- Color fastness to perspiration (acidic and alkaline).
- Strength to color produced color.
- Colorimetric values of produced color.
- Color fastness to chlorine.
- Color fastness to acids.
- Color fastness to alkalis.
- Color fastness to sea water.
- Color fastness to weathering.
- Color fastness to bleaching agents

2.21 Testing available in textile industries

- ☐ Color fastness to wash
- ☐ Color fastness to Rubbing
- ☐ Color Fastness to Perspiration

2.22 Color fastness to wash:

Color fastness to washing means, a specimen of the textile, in contact with one or two specified adjacent fabrics, is mechanically agitated under described conditions of time and temperature in a soap solution, then rinsed and dried. The change in color of the specimen and the staining of the adjacent fabric are assessed with the grey scales.

Color fastness is usually assessed separately with respect to:

1. Changes in the color of the specimen being tested, that is color fading;
2. Staining of undyed material which is in contact with the specimen during the test that is bleeding of color.

In my personal experience, in case of fastness test color fastness to washing is the first and most important requirements of buyers. There are a number of ISO test for color fastness to washing.

Color fastness to wash is very important for Lab-dip. There are varieties if tasting procedure, because –

- Washing conditions may vary from one country to another.
- The methods depend on the use of dyed goods.
- Evaluate the repeated washing accelerated test Methods are used.

There are different test methods to check the color fastness to washing which is standardized by ISO.

Test	Temp(°C)	Time (mins)	Steel balls	Chemicals
ISO-105-CO1	40	30	0	Soap(5 g/l)
ISO-105-CO2	50	45	0	Soap(5 g/l)
ISO-105-CO3	60	30	0	Soap(5g/l) +soda (2 g/l)
ISO-105-CO4	95	30	10	Soap(5g/l)+soda (2 g/l)
ISO-105-CO5	95	240	10	Soap(5g/l)+soda (2 g/l)

2.23 Rubbing fastness:

A fastness is a place, such as a castle, which is considered safe because it is difficult to reach or easy to defend against attack. This test is designed to determine the degree of color which may be transferred from the surface of a colored fabric to a specify test cloth for rubbing (which could be dry and Wet).

Rubbing fastness measurement is important one to know the ability of the dyed fabrics against the rubbing or staining. This type of test shows the fixation of the dyes with the fabric. If the color fastness to rubbing is good then it's other properties like washing fastness and durability etc. improves automatically because the rubbing is a method to check the fixation of the color on the fabric. So if the fixation is good it's washing properties will be good. The rubbing

fastness properties of the textile material are measured by comparing the tested fabrics with the grey scale and staining scale.

2.23.1 Purpose:

To determine a chlorate materials resentence to rubbing.



Fig: Crock meter For Rubbing Test

2.24 Color Fastness to perspiration:

The garments a\which come into contact with the body where perspiration is heavy may suffer serious local discoloration. This test is intended to determine the resistance of color of dyed textile to the action of acidic and alkaline perspiration.

2.24.1 Purpose of Perspiration Testing:

To determine the resentence of the color of textiles to the action of artificial human sweat.

2.25 Dimensional stability Test:

Dimensional stability is the process in which a fabric becomes smaller than its original size,

usually through the process of laundry. Cotton fabric suffers from two main disadvantages of shrinking and creasing during subsequent washing.

There are two types of dimensional stability occurs during washing.

- 1) Length wise
- 2) Width wise

Cause:

Due to high tension during preparation of fabric which result in excess stretch in yarn. This type of dimensional stability is known as London shrinkage. Due to swelling of fibers for fiber structure.

Dimensional stability stability test is an off line quality assurance system. By this test, we can be confirming about the dimensional stability and spiraled properties of a fabric. After washing operation; dimensional stability stability test is carried out. Dimensional stability properties can be changed by stinting, compacting or by treating the fabric with finishing chemicals.



Fig: Template Used in Dimensional stability Test

2.26 Purpose Of Saliva Testing:

To determine the resentence of the color of textiles to the Saliva according to GB/T 18886. The secretion of salivary glands, consisting of a clear usually slightly acid aqueous fluid of variable composition. It moistens the oral cavity, prepares food for swallowing, and initiates the process of digestion.

2.27 GSM

The GSM of fabric is one kind of specification of fabric which is very important for a textile engineer for Understanding and production of fabric. 'GSM' means 'Gram per square meter' that is the weight o fabric in gram per one square meter. By this we can compare the fabrics in unit area which is heavier and which is lighter

GSM of woven fabric means 'Gram per square meter' that is the weight of fabric in gram per one square meter. By this we can compare the fabrics in unit area which is heavier and which is lighter. from the Table and Figure; we were seen that some variation of GSM of by GSM Cutter and GSM from Construction. Here GSM from Construction are always greater from by GSM Cutter. In case of by GSM Cutter; the highest GSM is 284 of Bedford cord and the lowest GSM is 123 of Plain. Also in case of GSM from Construction; the highest GSM is 321 of Bedford cord and the lowest GSM is 130 of Plain. But GSM from Construction and by GSM Cutter is almost close to each other.

2.28 Color Fastness to pilling: (Pilling)

Purpose of pilling test: Pilling is a fabric surface characterized by little pills of entangled fiber clinging to the cloth surface and giving the garment unsightly appearance. The pills are formed during wear and washing by the entanglement of loose fibers which protrude from the fabric surface.

Under the influence of the rubbing action these loose fibers develop into small spherical bundles anchored to the fabric by a few unbroken fibers.

Great each specimen in accordance with EMPA photo scans as well as the grading scheme given below:-

Grade	Description
5	No change
4	Slide surface fizzing and partially format pills.
3	Moderate surface fizzing or moderate pilling, Pills of varying size and density partially covering the specimen surface.
2	Distinct surface fizzing or distinct pilling Pills of varying size and density partially covering the large portion of the specimen surface.
1	Dense surface fizzing or sever pilling Pills of varying size and density partially covering the hole of the specimen surface.



Fig: pilling box

3. Experimental details:

3.1 Washing Process of Normal Wash:

The process of 1 pcs of knit garments washing is given below:

3.1.1 - 1st step:

1. At first attach a multitier with the garments.
2. Load the garments on washing machine.
3. Add water: 65L
4. Machine running.
5. Add Detergent-10gm/litre
6. Temperature-Cold or 40°cto 60°c.
7. Time-40mts.
8. Drop the liquor.
9. Unload the garments.

3.1.2 - 2nd steps:

Remove excess water from the garments by using hydro extractor machine.

3.1.3 – Dryer:

Dry the garments in normal temperature.

3.1.4 - Shade checking:

Measure the shade changing of the garments with the help of gray scale.



Acetate

Cotton

Nylon

Polyester

Acrylic

Wool

Fig: Multi-fiber

3.2. Dimensional stability

3.2.1 Procedure of Dimensional stability Test (Dimensional stability test)

In following the procedure of dimensional stability test is given in details-

Sample: Two piece of 60.6 cm x 49.1 cm fabric is taken for test.

Procedure:

- Conditioning: Put the sample in the table for 4 hours for conditioning before starting test.
- Cut the sample 60.6*49.1cm & benchmark should be 35 x 35 cm. Stitch the sample (3 sides) by over lock sewing machine.
- Put sample in washing machine and run according to buyer's choice.
- Drying: All Buyers' requirement is tumble dry.

Dimensional stability calculation:

Dimensional stability% = (before wash-after wash)/before wash.

3.3 Rubbing Fastness:

3.3.1 Rubbing Fastness depends on:

- ☐ Nature of the Color
- ☐ Depth of the Shade

3.3.2 Equipments:

Crock meter, Cotton rubbing cloth(5cm×5cm),light box with light source D65,gray scale for assuming staining (ISO105-A03),Distilled water(grade 3),Pipette.

3.3.3 Method of Dry Rubbing:

1. Place the test specimen lengthwise into the testing device and make sure that the surface is not creased.
2. Place the rubbing cloth in the testing device.
3. Rub ten times in an even pace approx one cycle per second.
4. Remove the rubbing cloth and the specimen.

3.3.4 Method of Wet Rubbing:

- Following the procedure for a dry rubbing but at one drop of water with the pipette to the rubbing cloth before placing in the crock meter.
- Dry the rubbing cloth before evaluation.

Fabric Sample: Rib s/j

Date: 04-03-2015

Supplier Name: Aboni Knitwear (Babylon group)

Buyer Name: Tesco

Sample: Production Sample.

Model: Tank Top

Composition: 95% cotton + 5% Lycra.

Color: Royal Blue / Blue Klein.

3.4 GSM

3.4.1 Apparatus:

1. GSM cutter
2. Electric balance.

3.4.2 Working Procedure of Measuring GSM of a Fabric:

1. For Measuring GSM, fabric sample is cut by GSM cutter
2. Now weight is taken by electric balance.
3. By this way we get the weight in gram per one square meter fabric.
4. Here GSM of the fabrics by the GSM cutter is obtained by the multiplying the sample weight with 100.

Normally the GSM of grey fabric remains lower than the finished fabric. After knitting when we washed the fabric the GSM increase and come to near as our requirement. This incensement of GSM depends on fabric construction and some knitting variables.



Fig: GSM cutter

3.5. Perspiration

3.5.1 Equipment for Fastness Measurement (Perspiration)

1. Perspiration tester
2. Oven, Maintained at 37 ± 2 Degree centigrade
3. Multi-fiber test fabric
4. Grey scale
5. Color matching chamber
6. Acidic and Alkaline solution
7. Glass or Acrylic plate
8. Weight.
8. PH meter.

Sample size will be $10 \text{ CM} \times 4 \text{ CM}$

3.5.2 Test Procedure:

1. Wet the test sample in mentioned alkaline or acidic solution at room Temperature. The Material ration will be 1:50 and leave for 30 minutes.
2. Pour off excess solution and place the composite sample between two glass plate or acrylic plate under a pressure of 4.5 KG and place in a oven for 4 hours at 37 ± 2 degree centigrade temperature.
3. Remove the specimen and hang to dry in warn air not exceeding 60 Degree centigrade.

3.5.3 Evaluation

Evaluation is done by Grey scale in a dyed color matching cabinet and rate from 1 to 5.

3.5.4 Preparation of Solution:

pH regulator

0.1 Mol/l NaOH-4.0gNaOH per liter distilled water.

Alkaline solution

- 0.5g of L-histamine monohydrochloride monohydrate. ($\text{C}_6\text{H}_9\text{O}_2\text{N}_3 \cdot \text{HCL} \cdot \text{H}_2\text{O}$)
 - 0.5gNaCl.
- PH should be maintain $8(\pm 0.2)$ with 0.1mol/L NaOH solution.

Acid Solution

1. L-Histamine Monohydrochloride monohydrate 0.5g/L
 - 2.5g NaCl.
 3. Sodium dehydrogenates Orthophosphate Dehydrate 2.2g/l.
- PH should be maintain 5.5(\pm 2) with 0.1mol/L NaOH solution.

3.6 Color Fastness to Saliva: (Saliva)

3.6.1 EQUIPMENT:

- Perspirarometer
- 11 acrylic-resin or glass plates
- Flat-bottomed dishes
- Oven, maintained at (37 ± 2)°C
- Light box with light source D65
- Gray scale for assessing change in color (ISO105-A02)
- Multifibre adjacent fabric, type DW(ISO105-F10)
- Gray scale for assessing staining (ISO105-A03)
- Chemicals for the saliva solution (see preparation of solution)
- Distilled water, grade 3
- Scale

3.6.2 PREPARATION FOR SOLUTION:

Saliva solution, freshly prepared, containing per litre distilled water

3.0g Lactic acid ($\text{CH}_3\text{-CH}(\text{OH})\text{-COOH}$)

0.2g Carbamide ($\text{H}_2\text{N-CO-NH}_2$)

4.5g sodium chloride (NaCl)

0.3g Potassium Chloride (KCl)

0.3g Sodium Sulphate (Na_2SO_4)

0.4g Ammonium Chloride (NH_4Cl)

No need to bring the saliva solution to specific pH.

3.6.3 TEST SPECIMEN

Two specimens for each color and material measuring 4cm×10 cm.

Details such as labels, badges and drawstring also need to be tested .if the product is multi-color all colors tested. More test specimens could be required, if product is printed striped or include colors.

If details (including prints)are in contrast color these need to be tested both against multi-fiber among and the fabric of which the details is attached .if not in contrast color , they need to be tested on the multifibre adjacent fabric.

METHOD

1. Cut specimens measuring 4cm × 10 cm.
2. Attach a specimen to multifibre adjacent fabric of the same size, by sewing along on of the sides. the multifibre adjacent fabric should be next to the face side of the fabric
3. Switch on oven and preheat the test device (perspirometer) for 30 min
4. Place the specimen in individual flat-bottomed dishes and cover with the saliva solution at liquor ratio of 50:1.
5. Thoroughly wet the specimens and allow it to remain in the solution at room temperature for 30 min. press and move the specimen from time to time to ensure good and uniform penetration of the liquor.
6. Pour of the solution.
7. Place each specimen between two glass or acrylic plates and place them in the perspirometer .each perspirometer can hold maximum 10 samples .if less, all 11 plates still have to be placed in the perspirometer ,put a pressure of 12.5 kPa on the perspirometer using the load ,lock it and then removed the load .
8. Place the perspirometer in the oven for 4 hours at (37±2)°C in upright position
9. Take out the specimens from the oven and perspirometer .open out each specimen and dry then in room temperature, not exceeding 60°C ,with the specimen only being in contact at the point of the stitching.

3.7 Color Fastness to pilling: (Pilling)

3.7.1 Purpose of pilling test:

To determine the pilling resistance of textiles according to ISO 12945-1.

Equipment:

- Pilling Box
- Sewing machine
- Polyuratheline Tape (For Per Test)
- Self adhesive PVC tape 19mm weight
- Mounting jig , used to mount specimen on tube
- Stencil for cutting specimen
- Vacuum cleaner

3.7.2 TEST SPECIMENT

Re-treatment such as laundering or dry clean is not to be carried out prior to testing .Different construction occurs in the product all of them need to be tested. Such as require five specimens. Four specimens are tested and one specimen is saved. The specimen is to be taken randomly, from the sample without having common widthwise forms. The specimen side shell runs parallel to the fabric edges.

Specimen Preparation:

- Cut five specimen from the sample ,each 125mm×125mm
- Four specimens are to be sewn into tubes; one specimen should be saving for the assessment.
- Turn each specimen inside out.
- Mount each specimen on each polyurethane tube by using the mountain jig. The specimen should be equal distance from the ends of the tube.

Apply self-adhesive tape around both cut ends of each specimen, so that the tape fixed on the tube and leaves 6mm of the tube exposed. The length of the tape shell not excess circumference of the tube.

3.7.3 Method:

1. Ensure that the pilling box is clean inside; if not vacuum clean the pilling chambers.
2. Place the four specimens in the same pilling box. Close the lid and secure it by closing the clasps.
3. Tumble the number of revolution tested in specimen.
4. Remove the tubes from the box, remove the tape and cut the seams.

Washing of Normal Wash

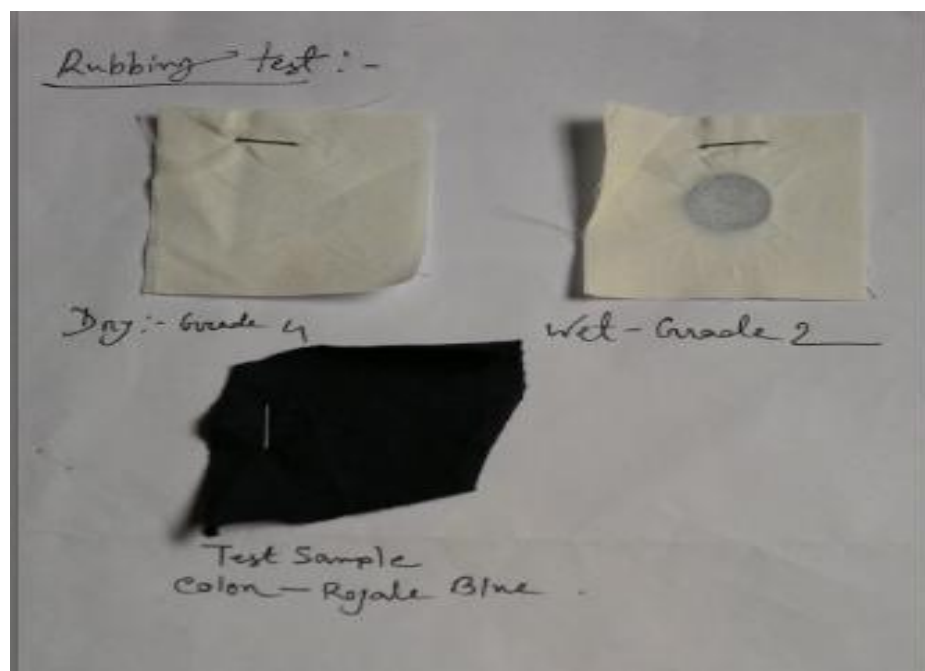
2. Colour Fastness to household laundering	
Staining :	4.5
Change in Colour :	4.5
Cross Staining :	-

Dimensional stability

1. Dimensional Stability to washing
(ISO 5077 / ISO 6330 / ISO 3759)

Length				
	Before wash (cm)	After wash (cm)	Diff. in cm	Diff. in %
1	60.6	60.1	-0.5	-0.8
2	49.1	48.2	-0.9	-1.8
Width				
1	39.6	38.4	-1.2	-3.0
2	39.2	38.1	-1.1	-2.8

Rubbing



GSM



Fig: GSM before wash



Fig: GSM after wash

Perspiration

Global Product Compliance Department
valid for all brands in H&M group
October 2014

Colour fastness to Perspiration
According to EN ISO 105 E04 or Chinese standard GB/T 3922-1995

Order number/Product dev no: 601141/5767
Buyer: H&M
Colour: Blue Dark (76-220)
Composition: 100% Cotton
Placement: Multifibre

Test result:

Colour staining - Acid

Acetate	4-5
Cotton	4-5
Polyamide	4-5
Polyester	4-5
Acrylic	4-5
Wool	4-5

Colour staining - Alkaline

Acetate	4-5
Cotton	4-5
Polyamide	4-5
Polyester	4-5
Acrylic	4-5
Wool	4-5

Change in colour

Acid	4-5
Alkaline	4-5

Cross staining

Acid	-
Alkaline	-

Pass: ☒ Fail: ☐

Performed by: [Signature]
Date: 11.02.15

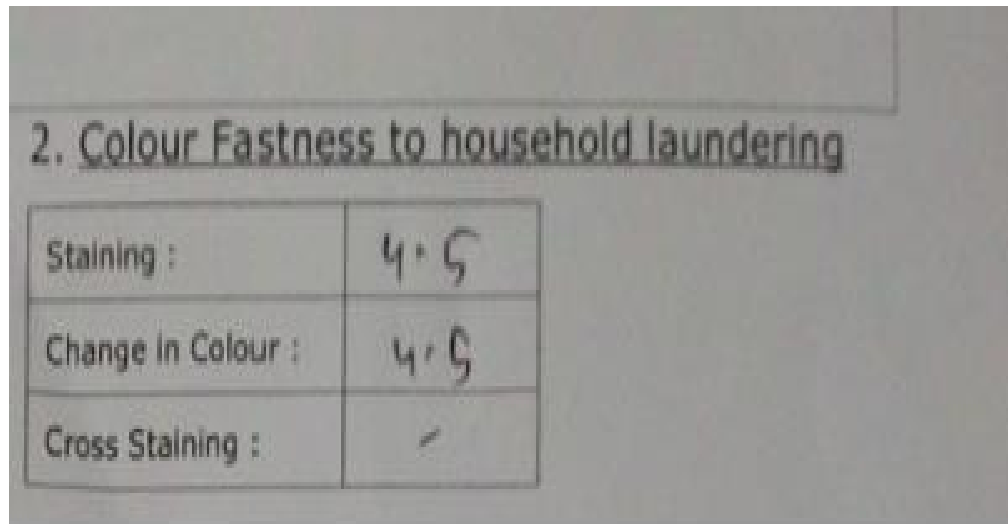
Test report template for H&M approved supplier lab

4. Results & Discussion:

4.1 Result: (washing Of Normal Wash)

Color fastness to house hold laundering is given below:

Staining	4.5
Changes in color	4.5



A photograph of a handwritten table on a piece of paper. The table is titled '2. Colour Fastness to household laundering'. It has three rows and two columns. The first row is 'Staining : 4.5', the second row is 'Change in Colour : 4.5', and the third row is 'Cross Staining : /'. The handwriting is in black ink.

2. Colour Fastness to household laundering	
Staining :	4.5
Change in Colour :	4.5
Cross Staining :	/

Fig: Color fastness of knit garments due to washing.

4.2 Dimensional stability

Length

	Before Wash (cm)	After wash (cm)	Diff.in (cm)	Diff. in (cm)
1	60.6	60.1	-0.5	-0.8
2	49.1	48.2	-0.9	-1.8

Width

			Diff.in (cm)	Diff. in (cm)
1	39.6	38.4	-1.2	-3.0
2	39.2	38.1	-1.2	-2.8

1. Dimensional Stability to washing
(ISO 5077 / ISO 6330 / ISO 3759)

Length

	Before wash (cm)	After wash (cm)	Diff. in cm	Diff. in %
1	60.6	60.1	-0.5	-0.8
2	49.1	48.2	-0.9	-1.8

Width

1	39.6	38.4	-1.2	-3.0
2	39.2	38.1	-1.1	-2.8

5. 1. Length wise after wash of dimensional stability is decrease.
6. 2. Width wise after wash of dimensional stability is decrease.

4.3 (Rubbing)

Color fastness to rubbing according to ISO 105×12:

DRY	Before Wash	4
	After Wash	4
WET	Before Wash	2
	After Wash	2

Rubbing Test Results

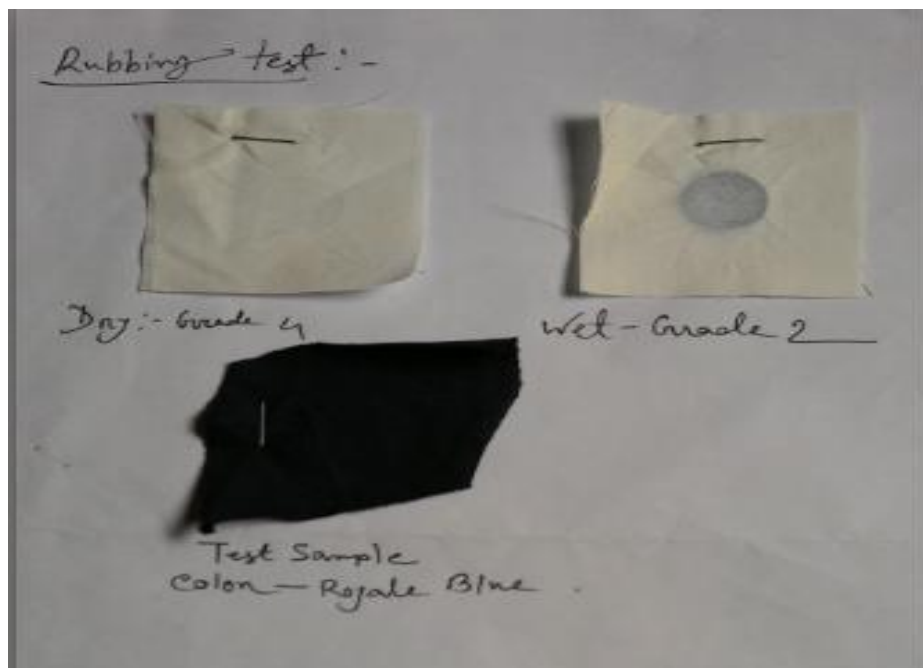


FIG: Color fastness to rubbing

4.4. Test result of GSM: (GSM)

Before wash: 109

After wash: 108



Fig: GSM before wash



Fig: GSM after wash

4.5 Test result: (Perspiration)

Staining	Acid	Alkaline
Acetate	4.5	4.5
Cotton	4.5	4.5
Polyamide	4.5	4.5
Polyester	4.5	4.5
Acrylic	4.5	4.5
Wool	4.5	4.5

Global Product Compliance Department
valid for all brands in H&M group
October 2014

Colour fastness to Perspiration
According to EN ISO 105 E04 or Chinese standard GB/T 3922-1995

Order number/Product dev no: 601141 / 5767
 Buyer: H&M
 Colour: Blue Dark (76-220)
 Composition: 100% Cotton
 Placement: Multifibre

Test result:

Colour staining - Acid	
Acetate	4-5
Cotton	4-5
Polyamide	4-5
Polyester	4-5
Acrylic	4-5
Wool	4-5

Colour staining - Alkaline	
Acetate	4-5
Cotton	4-5
Polyamide	4-5
Polyester	4-5
Acrylic	4-5
Wool	4-5

Change in colour	
Acid	4-5
Alkaline	4-5

Cross staining	
Acid	-
Alkaline	-

Pass: ☒ Fail: ☐

Performed by: [Signature]
 Date: 11.02.15

Test report template for H&M approved supplier lab

Fig: Test Report on Color Fastness to Perspiration

4.6. RESULTS (Saliva)

Assess cross staining, change in color and staining .See chapter introduction “Assessment of color fastness”.

Test result:

Colour staining Adjacent fibre 1	4-5
Colour staining Adjacent fibre 2	✓
Change in colour:	4-5
Cross staining:	✓

Fig: Saliva test result

4.7. Result: (pilling)

Place the tested specimen as well as the untested specimen in the pilling viewing cabinet. The tested specimen is assorting against the untested specimen.



Fig: Test sample

5. Conclusion

The project has come to a termination finally after lots of thinking, discussion and our continuous trying. We really have worked hard to complete this project well ahead. We wished to make it as a replica of changes on knit garments washing. So that it provides a complete knowledge about investigation on changes on knit garments washing between before and after wash. Though there were some limitations like shortage of time that compelled us to complete the thesis as soon as possible, even then we have tried to give our best. In this paper, we can see that dimensional stability in length wise is increased and width wise is decreased. Bursting strength is decreased and GSM increased after wash. Color fastness to wash is good. Color fastness to rubbing in dry state and wet state remain unchanged.

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