Final Assignment

QA & QC of a Denim Fabrics
And
Quality Manual

(Abrasion of Denim)

TXSC 4630

Quality Assurance Systems

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Date of Submission : July 14, 2019

Introduction: Denim fabrics are generally made from staple-fiber yarns where the weft passes under two or more warp fibers, producing the familiar diagonal ribbing identifiable on the reverse of the fabric. Indigo is the most common denim, where the warp thread is dyed, while the weft thread is left white. Because of the warp-faced twill weaving, one side of the denim fabric is dominated by the blue warp threads and the other side is white weft threads (Telli and Babaarslan 2016). The denim fabric has the following properties :

- strong and durable.
- feeling hard during wearing.
- Long term used.
- Higher tears, snags and abrasion resistance.

Quality Parameters: Quality is the important parameters of a product where essential characteristics, superiority, excellence, or perceived level of value is the key issue. At glance, quality contains all characteristics that define an object or a service. Also, quality is an important tool for manufacturers, retailers, and marketers to distinguish their products from other competitors(Caroline Nilsson y Elisabeth and Lindstam 2012).

The main factor of the quality of the product is to satisfies customers expectations by either meeting or exceeding them. Quality is defined within a cost framework determined by manufacturers, buyers, and consumers. The meaning of quality varies among consumers and manufacturers, and it may change from time to time based on desired features the product possesses. The actual quality of a denim product cannot be determined by measuring one property because it is a combination of the results from different assessments in a variety of units. Quality parameters have also been considered into the seven factors such as performance, compliance, garment care, appearance, construction /workmanship, and style/fashion (Farashahi 2016).

- Performance is the key quality which is the combination of product and user-based approaches.
- Durability of an apparel can be distinct the total length of uses.
- Serviceability is the competence, speed, and courtesy of repair, in textile products refers to their clean-ability and ease of care.
- Aesthetics is highly subjective and depends on personal preferences and it's totally user-based element of quality where it's relies on persons judgments about the garments .

Production Process :

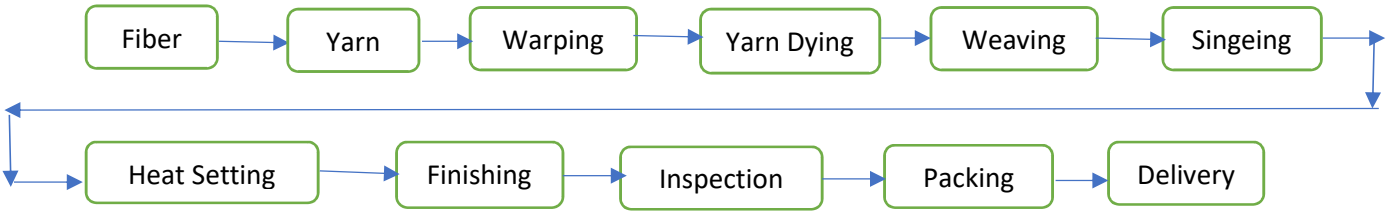

Figure 1 : Production Process (Fiber to Fabrics) (Islam 2012)

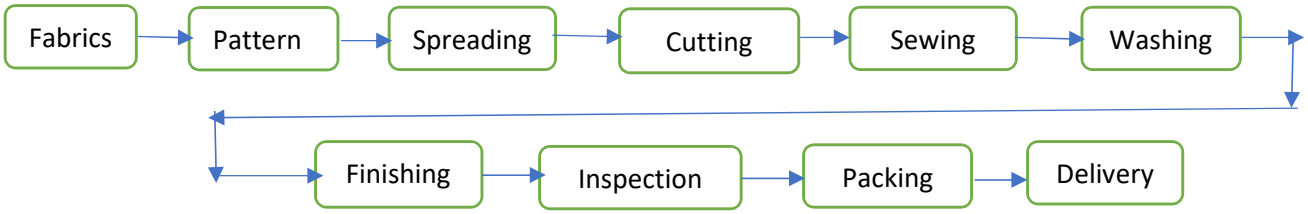

Figure 2 : Production Process (Fabrics to Product) (Islam 2012)

Fiber to Yarn: Cotton fiber is widely used for denim manufacturing, where quality of fiber and staple length are of crucial importance. cotton fibre needs to series of operations to be yarns (Raju Tex 2015).

Warping: is the first step of manufacturing process where transferring multiple yarns from individual yarn packages onto a single package assembly (Raju Tex 2015) .

Yarn Dying: Most denim fabric is yarn dyed. The warp yarns are dyed with indigo, and the filling yarns are left undyed (Raju Tex 2015).

Weaving: Interlacement of warp and weft threads are called weaving, where warp yarns are indigo dyed. there is a wide range of looms being used, right from the simplest handloom to the most sophisticated loom (Raju Tex 2015).

Singeing is a finishing process that burns off any loose fibers protruding from the fabric's surface by passing the material over a gas flame (Raju Tex 2015).

Heat setting is the thermal process where The effect of the process gives fibers, yarns or fabric dimensional stability as well as other desirable attributes like higher volume, wrinkle resistance or temperature resistance (Raju Tex 2015).

Finishing process is essential for the performance and the appearance of denim fabric. The quality of a final garment depends on the quality of a fabric when it is received as a roll. Normally, 10% of the rolls received are inspected and evaluated based on a four-point system. After that it's go for packing then delivery (Raju Tex 2015).

After fabrics manufacturing done then it's process for garment manufacturing, where garment production consists of sequential processes such as laying, marking, cutting, stitching, checking, finishing, pressing and packaging.

Quality Assurance Model: Quality assurance (QA) is the methodical process to determine a product or service whether it meets the definite requirements. QA establishes and maintain a set of requirements to develop a reliable product. A quality assurance system is meant to increase customer confidence with company's credibility, while also improving work processes and

efficiency. Find below the free hand sketch quality assurance model for denim Pant (Farashahi 2016).

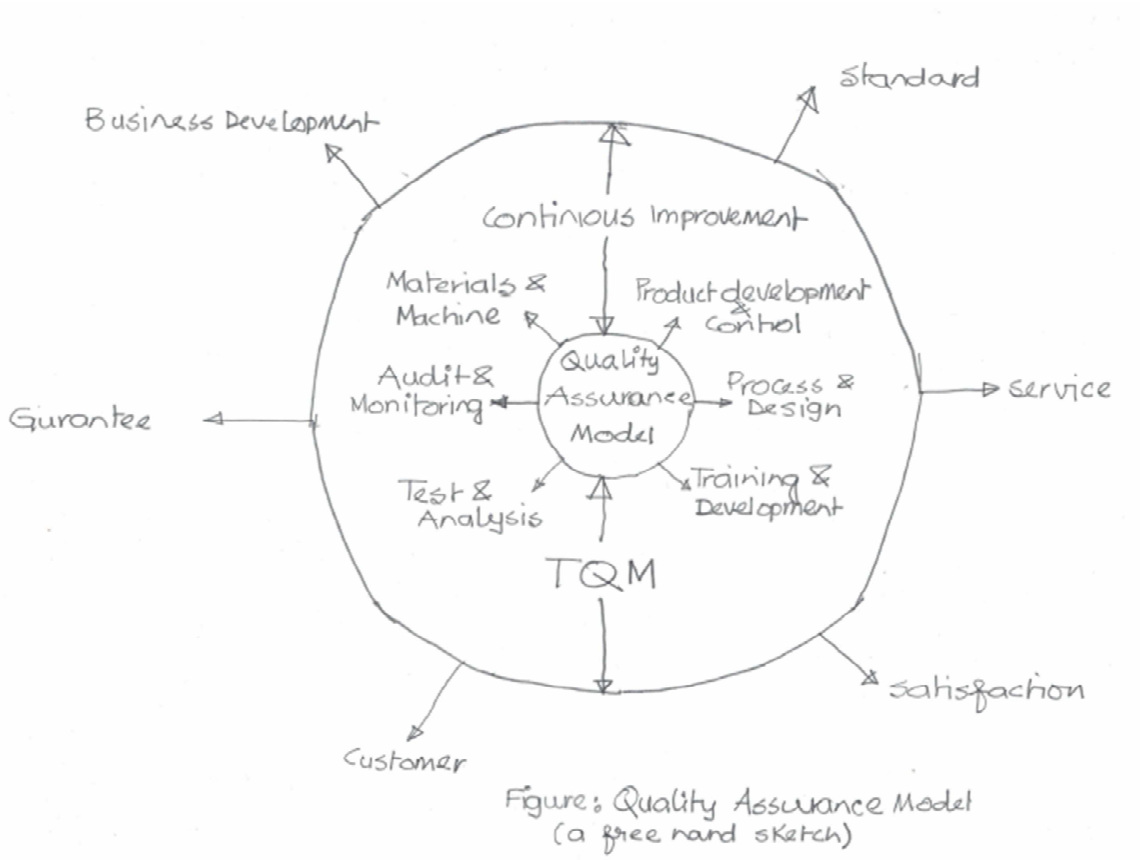

Figure 3: Quality Assurance Model (QAM)

Quality in the apparel industry focuses on multiple variables and involves establishing requirements, standards and specifications, for products according to customer needs. These requirements include the physical components that make-up the garment, such as materials, product development, process design, analysis, audit & monitoring. Ideally, quality in apparel production should be built into the product, and continually addressed throughout the manufacturing process beginning with the design of the garment and continuing until the garment reaches the retail shop floor (Rahman et al. 2009).

The quality of garments standards and specifications is measured & develop during the time of manufacturing. Garment appearance and performance key quality which influence the customer satisfaction. The elements of quality depend on the evaluation of apparel are performance, durability, serviceability, aesthetics, and conformance. The appearance quality of garments is related to the mechanical and physical properties of fabric and quality as well as the sewing quality during the manufacturing process . Although the buyers and sellers are responsible for determining quality of apparel based on ASTM . Each standardized test method is used for measuring a performance attribute of apparel, and the results will help to identify the cause of a problem. (Rashid and Taibb 2016).

Quality Assurance Data : The concept of the quality can be divided into five elements of performance, durability, serviceability, conformance, and aesthetics. In another way apparel quality has also been categorized into the seven factors of performance, compliance, garment care, appearance, construction /workmanship, and style/fashion.

Performance: Performance is a combination of product and user-based approaches of quality and emphasizes the measurable product characteristics. Clothing's are directly related to performance, and they consist of the properties of fibers, fabric finishes, yarns structure, seam construction. Performance always controls the quality of a product, and it is often evaluated by consumers (Farashahi 2016).

Durability : Durability has both technical and economic dimensions. In the economic dimension, durability is the amount of uses before a product breaks down or physically deteriorated (Farashahi 2016).

Serviceability: Serviceability is the capability and speed where serviceability in textile products refers to their clean-ability and ease of care. Dimensional change, wrinkling, and soil-release can also be considered serviceability of garments (Farashahi 2016).

Conformance: To meet the predetermined standards of product quality & design is conformance. Conformance is also related to consumer-based approach of quality to achieve the desired quality level, garments should conform to the product specifications which include garment and material components as well as design and assembly (Farashahi 2016).

Aesthetics: Aesthetics is the user-based element of quality, highly subjective and depends on personal preferences. Aesthetic relies on individuals' judgments about the garments' comfort, appearance, smell, and sound .The combination of structural integrity and aesthetic presence increases that value of a garment (Farashahi 2016).

Quality Assurance (**QA**) is a way of preventing mistakes and defects in manufactured products and avoiding problems when delivering products or services to customers.

List of Tools & Techniques :

.1 Total Quality Management

.2 Quality Control System

.3 Documentation

.4 Validation

.5 Six sigma methodology

Total quality management is a structured approach to overall organizational management. The focus of the process is to improve the quality of an organization's outputs and services through continuous improvement of internal practices. The standards the TQM can reflect in both internal priorities and industry standards. Based on the ISO standard there are eight TQM standard which is below (Dassanayake 2014) :

• Customer focus – Organizations must be understanding current and future customer requirements and attempt to achieve the customer expectations all the times.

• Leadership – Leadership plays a vital role in organizations to ensure the development of an effective internal environment.

• Involvement of people – Involvement of employees at all levels is the essential part of the company and each persons of the company's abilities can be used for the entire organization's benefit.

• Process approach – is management strategy where resources and tasks are managed as a process within the company.

• System approach to management – it is essential to identify, understand and manage interrelated processes for a specific objective to increase the organization's efficiency and abilities.

• Continual improvement –should be a primary objective of any organization to consistently perform tasks and duties at the highest level of efficiency.

• Factual approach to decision making – to ensure that all decisions are made fairly and effectively based on the analysis of data and information rather than an emotional level.

• Mutually beneficial supplier relationships –is mutually dependent a favourable relationship with both supplier and company to create a value and quality management within the workplace (Dassanayake 2014).

Quality control system Objectives: The key objective to maximize the production within the specified tolerances correctly in first time. The Quality System Requirements are based on the principle of PDCA Cycle (Islam 2011).

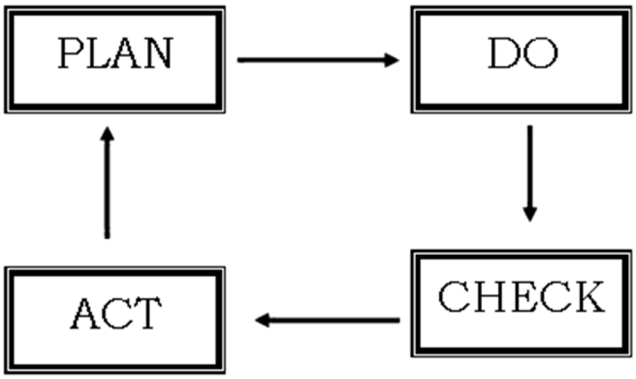

Figure 4 : Process Cycle (Islam 2011)

1. Understanding the customers' quality requirements.
2. Organizing & training quality control department.
3. Ensuring proper flow of quality requirements to the QC and production .
4. Establishing quality plans, parameters, inspection systems, and sampling techniques, etc.

5. Inspection, testing, measurements as per plan and record all the deviations.
6. Feedback to production department and plan for further improvement.

Documentation : The documents management must be formal way in QMS where processes, procedures, and responsibilities are key objective to achieve quality . A QMS helps to coordinate and direct an organization's activities to meet customer and regulatory requirements and continually improve its effectiveness and efficiency (Real Regulatory 2017).

A well-designed documented system ensures quality standards, minimizes the potential error, reduces interruption when deviations occur due to being able to quickly access relevant data and allows for easy monitoring of the processes and appropriate adjustments are made to ensure the quality (Real Regulatory 2017).

Process validation plays an important role to control and maintain the quality of final product. Validation is the key process which involves during the life cycle of products. It also involves in planning and procedure as well as maintain the working standard. Effective process valuation contributes significantly to assuring product quality (Kumar, A & Upadhay 2019).

Quality Manual

1. Introduction:

This Quality Manual demonstrates – Quality control of Abrasion in denim fabrics and maintaining a high-level customer service that has safety as a priority and continuous improvement in production.

2. Conformance and Compliance Standards :

The Quality Manual is intended to demonstrate conformance to current editions of the following (ASTM Tester D4966 1998):

- ISO/IEC 17025 General requirements for the competence of testing and calibration laboratories

3. Purpose of this Manual :

The key purpose of the manual - overall assurance to quality in work practice, customer service and support to production processes (Pignatell 2011).

- by demonstrating the ability, provide quality service to the customer consistency.
- by addressing customer satisfaction through the effective application of the system as well as continuous process improvement and the prevention of nonconformity,
- through employee empowerment, continual improvement of the technical skill and capability (Pignatell 2011).

4. Responsibility :

The Management team is responsible to maintain the QMS is documented, implemented, maintained and continually improved (Pignatell 2011) .

5. Quality Management System :

The Quality Management System will meet the following requirements/clause to maintain the ISO Certification.

5.1. Personnel of the Laboratory: Ensures the authority and interrelationship of personnel who manage, perform, and verify work affecting the quality is defined and documented, particularly for personnel who need the organizational freedom and authority to (Pignatell 2011) (ISO/IEC 17025 2015):

- Initiate action to prevent the occurrence of any nonconformance relating to production, process, and customer service,
- Initiate, recommend, or provide solutions through designated channels and verify the implementation of solutions,
- Control further processing, delivery or installation of nonconforming product until the deficiency or unsatisfactory condition has been corrected.

5.2. Document changes: are always encourage to improvements of organization and changes to documents and data are reviewed and approved by the same function/organizations and all kind of changes is recorded. A documented procedure alwyas maintained that defines the controls needed (Traynor 2018) (ISO/IEC 17025 2015):

1) to approve documents for adequacy prior to issue and review it and update as necessary.

3) to ensure that changes and the current revision status of documents are identified.

4) to ensure documents remain legible and readily identifiable.

5) to prevent the accidental use of obsolete documents and to apply suitable identification to them if they are retained for any purpose.

6) ensuring coordination of any document changes with the appropriate customer(s) and/or regulatory authorities in compliance with contract and/or regulatory requirements (Traynor 2018).

5.3. Control of nonconforming testing and/or calibration work: to ensure the nonconforming of test & calibration work, it's important implements the monitoring, measurement, analysis, and improvement processes needed (Pignatell 2011) (ISO/IEC 17025 2015):

1) to demonstrate the conformity of the product and ensure conformity of the quality management system.

2) to continually improve the effectiveness of the quality management system.

This includes the determination of applicable methods, including statistical techniques and the extent of their use.

5.3.1 Test Methods: There are two different methods commonly used to test abrasion, referred to as Wyzenbeek and Martindale.

ASTM D4157-07 Wyzenbeek (Oscillatory Cylinder): The ASTM D4157-07 is a test of the American Society of Testing and Materials (Association for Contract Textiles 2010).

ASTM D4966-98 Martindale: The ASTM D4966-98 is a test method of the American Society of Testing and Materials (Association for Contract Textiles 2010) .

Both methods test flat abrasion resistance of a textile. This test method does not evaluate edge abrasion or any of the other diverse factors that would determine the overall durability of upholstery as used in a variety of seating designs (Association for Contract Textiles 2010).

5.3.2 Test procedure & Standard :

.1 Standard atmosphere for testing is 70 6 2°F (21 6 1°C) and 65 6 2 % relative humidity (ASTM D 4157 1998).

.2 Based on the end use application, select the abradant value from the table

End Use Application	Abradant	Head Pressure, N (lbf)	Specimen Tension, N (lbf)
Upholstery General Contract	#10 Cotton Duck	13.4 N (3 lbf)	17.8 N (4 lbf)
Upholstery Heavy Duty	#10 Cotton Duck	13.4 N (3 lbf)	17.8 N (4 lbf)
Olefin Upholstery	Steel Screen	13.4 N (3 lbf)	17.8 N (3 lbf)

Table 1 : Abradants, Pressures, and Tension (ASTM D 4157 1998)

.3 It's very important to use a new piece of duck and it must be mounted on the machine with the short direction & cut parallel to the warp direction.

5.3.2. Probable Non-conformity: Abrasion testing does not consistently indicate the future extended appearance of a textile, but the results can be a useful predictor of performance when considered with other durability factors (Association for Contract Textiles 2010) (ISO/IEC 17025 2015).

- Results of abrasion testing can vary on the same test sample.
- Abrasion results can be affected by many things such as coatings, finishes, novelty yarns, pile constructions, patterns with long floats or repeat patterns that have large areas of different surface textures (Association for Contract Textiles 2010).
- The variability of abrasion testing increases significantly above 50,000 double-rubs / cycles.

- Higher abrasion resistance does not necessarily indicate a significant extension of the service life of the fabric (Association for Contract Textiles 2010).

5.4 Test and calibration methods and method validation :

Calibration processes directly affect quality and processes must be done under controlled conditions. The process plan is may be modified depend on new customer requirements. Controlled conditions include the following (ASTM Tester D4966 1998) (ISO/IEC 17025 2015):

- The availability of information about the product/calibration characteristics.
- Must be used documented work instructions defining the manner of calibration.
- Equipment must be suitable in a work environment and compliance with reference standards.
- Monitoring and control is important for process parameters
- Suitable maintenance of equipment to ensure continuing process capability.

5.4.1 Procedure of Calibration of Test Apparatus & Maintenance (Oscillatory Cylinder) :

1) Check and validate the rubber pads of the holders (ASTM D 4157 1998).

2) Check and validate the entire lower surface of the rubber pad which is contact with the cylinder and re-arrange the lower pad surface if any spaces observed (ASTM D 4157 1998).

3) Clean with the nylon brush, if the wire screen abradant is used. Clean cylinder and make sure, remove the pressure from the pad and lock the specimen holding arm in position and run the tester in 50 cycle increments(ASTM D 4157 1998).

4) Clean the surface of the cylinder section and the steel screen by brushing a weekly basis(ASTM D 4157 1998).

Validation: The ability of the processes to achieve accurate results and validation including the following, as applicable (Pignatell 2011) (ISO/IEC 17025 2015):

- qualification of processes;
- qualification of equipment and personnel;
- use of defined methodologies and procedures;
- requirements for records & re-validation.

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