Faculty of Engineering

Department of Textile Engineering

A Thesis on

COMPARATIVE ANALYSIS OF DENIM GARMENT TESTING STANDARD ACROSS MAJOR GLOBAL BUYERS

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A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Textile Engineering.

DECLARATION

I here with declare that the project that is being submitted during this thesis entitled, ‘‘**Comparative analysis of denim garment testing standard across major global buyers**” has been done beneath the supervisor of **Dr. Md. Mahbubul Haque**, Professor & Program Director, M.Sc. Department of Textile Engineering, Daffodil International University. I conjointly declare that, neither this project nor any a part of this project has been submitted elsewhere for award of any degree or diploma.

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LETTER OF APPROVAL

This is to certify that the thesis entitled:

"Comparative analysis of denim garment testing standard across major global buyers"

This thesis report prepared by Tohidul Haque (ID: 193-32-406) is approved in Partial Fulfillment of the Requirement for the Degree of Master Of Science In Textile Engineering. The said student has completed his thesis work under my supervision. During the research period, I found him sincere, hardworking, and enthusiastic.

I hereby approve the thesis as fulfilling the research requirements and allow it to be submitted for final evaluation.

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Abstract

The global denim industry is highly competitive, with brands and retailers imposing rigorous quality control measures to meet diverse consumer expectations. This thesis, titled **"Comparative Analysis of Denim Garment Testing Standards Across Major Global Buyers,"** explores the variances in testing protocols and quality standards required by key international denim buyers, like Anazon, Kik, Primark, Newlook. Each buyer has distinct testing requirements, influenced by factors such as product durability, sustainability initiatives, and regional market demands.

The study shows the core denim testing parameters—**durability** (e.g., tensile strength, tear strength, abrasion resistance), **colorfastness** (to washing, rubbing, water), **shrinkage** (dimensional stability), and **chemical compliance** (e.g., restricted substances lists for azo dyes, phthalates, formaldehyde)—and highlights the differences in these testing standards across brands such as **KiK, Primark (EU Market), New Look (UK Market), and Amazon (USA Market).**

Methodologically, this research collects data through a combination of buyer-provided testing protocols, Analysis and compare buyerwise requirement.

In conclusion, this thesis provides a comprehensive comparative analysis that will benefit both manufacturers and buyers by offering insights into optimizing denim garment testing protocols to meet diverse global market demands, while also addressing the sustainability concerns shaping the future of the industry.

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Chapter 1: Introduction

1.1 Background of Denim Garment Testing:

Denim, a sturdy cotton twill fabric, has been a staple in the global textile and apparel industry for over a century. Originating in the late 19th century as workwear due to its durability and practicality, denim has evolved into a fashion icon, becoming one of the most versatile and widely worn fabrics worldwide. Its enduring popularity stems from its unique characteristics, such as its rugged texture, ability to age beautifully, and adaptability to various garment styles, from jeans and jackets to skirts and accessories.

As the demand for denim garments has grown, so has the complexity of ensuring their quality. **Denim garment testing** has become a critical component in maintaining consistency, performance, and consumer satisfaction. This testing is essential to verify that denim products meet the required standards of buyers and consumers regarding appearance, durability, and sustainability. With the rise of globalization, fast fashion, and heightened environmental awareness, testing has become not only a measure of quality but also a tool for ensuring that denim products comply with evolving industry regulations and ethical standards.

1.2 Evolution of Denim Testing

Historically, denim garments were evaluated primarily for their durability, particularly their resistance to wear and tear. Early testing focused on key parameters such as tensile strength, abrasion resistance, and shrinkage, which were critical for garments like work overalls and jeans used in rugged environments. As denim transitioned from

workwear to mainstream fashion, the range of tests expanded to include factors such as colorfastness, stretch recovery, and seam strength, ensuring that garments maintained their appearance and fit over time..

1.3 Globalization and Varying Buyer Requirements

The globalization of the textile industry has led to the development of diverse testing standards, tailored to the specific needs of international buyers and regions. Major buyers like kik, Primark, Newlook & Amazon have established their own rigorous protocols to ensure that denim garments meet their brand standards. These protocols cover a wide range of testing areas, including:

- **1.3.1 Physical Performance**: Testing for strength, abrasion resistance, tear resistance, and dimensional stability (shrinkage and stretch recovery) to ensure denim garments withstand repeated use and washing.
- **1.3.2 Colorfastness**: Tests for the resistance of dyed denim to fading from exposure to washing, rubbing, perspiration, and light. As denim is often subject to various washing and distressing treatments, colorfastness is a crucial performance measure.
- **1.3.3 Chemical Compliance**: With increased focus on environmental sustainability and consumer safety, brands have imposed strict chemical testing requirements. This includes monitoring for hazardous substances like formaldehyde, azo dyes, and heavy metals under regulations such as **REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals)** in the EU and **California Proposition 65** in the U.S.

1.4 Environmental and Ethical Considerations

As consumer awareness of environmental and ethical issues has grown, the denim industry has responded with new testing standards that prioritize sustainability. Traditional denim production involves intensive water usage, energy consumption, and chemical treatments, particularly during the dyeing and finishing stages. Some Brands have pioneered initiatives to reduce the environmental impact of denim, implementing standards for **waterless production techniques**, **reduced energy consumption**, and **the use of eco-friendly chemicals**.

Testing for compliance with these initiatives has become a core focus for many buyers. For instance, eco-friendly standards now include testing for **organic cotton** certification, the use of **biodegradable dyes**, and compliance with **Zero Discharge of Hazardous Chemicals (ZDHC)** guidelines. These sustainability-driven protocols ensure that denim garments not only meet performance and aesthetic criteria but also align with the growing demand for environmentally conscious fashion.

1.5 Importance of Testing in Denim Apparel

Testing in denim apparel is essential because denim is known for its durability, distinctive appearance, and comfort. Consumers expect their denim garments to maintain these qualities throughout their lifecycle, despite heavy usage and frequent washing. Brands and manufacturers must ensure that their denim products not only look good but also perform well under real-world conditions. This is where testing becomes critical, as it verifies that the garments meet specific performance and quality benchmarks.

Here are the key reasons why testing is so important in denim apparel:

1.5.1 Ensuring Durability and Longevity

Denim garments, particularly jeans, are often worn for extended periods and subjected to significant stress. Consumers expect their denim to be resistant to tears, abrasion, and general wear-and-tear, particularly in high-stress areas like the knees and pockets. Testing for **tensile strength**, **tear resistance**, and **abrasion resistance** helps ensure that the fabric can withstand the daily rigors of use without deteriorating prematurely. This is especially important for brands like which are known for producing long-lasting denim products.

1.5.2 Maintaining Aesthetic Quality (Colorfastness)

Denim's aesthetic appeal often lies in its indigo-dyed, faded look. However, consumers expect their denim garments to maintain a consistent color and appearance over time.

Colorfastness testing ensures that the fabric does not fade excessively or transfer dye onto other garments and surfaces. This is especially important as many denim treatments, such as stone washing and enzyme washing, affect the garment's dye. Tests for **colorfastness to washing, rubbing, perspiration, and light** ensure that the product retains its color throughout its lifespan.

1.5.3 Verifying Fit and Comfort (Shrinkage and Stretch Recovery)

One of the key expectations for denim is that it fits well, even after repeated washing and wearing. **Shrinkage testing** ensures that the garment retains its size and shape after washing, preventing issues such as excessive shrinking that could lead to discomfort or dissatisfaction. Additionally, with the increasing popularity of **stretch denim**, testing for **stretchability** and **recovery** is critical to ensure that the fabric maintains its elasticity over time without bagging or sagging. Stretch recovery testing measures how well the fabric returns to its original shape after being stretched, which is crucial for garments designed to move with the wearer.

1.5.4 Ensuring Consumer Safety (Chemical Compliance)

With growing awareness of health and environmental issues, chemical testing has become an integral part of denim testing. Many countries have strict regulations regarding the use of hazardous chemicals in textiles, such as **azo dyes, formaldehyde, phthalates**, **lead, cadmium,** and **heavy metals**. Brands must ensure that their denim garments meet these safety standards to protect consumers from harmful chemicals. For example, the European Union's **REACH (Registration,**

Evaluation, Authorisation, and Restriction of Chemicals) regulation requires testing to ensure that restricted substances are not present in harmful concentrations. Compliance with these regulations is crucial for ensuring product safety and protecting brand reputation.

1.5.5 Meeting Brand-Specific Standards and Consumer Expectations

Different global buyers have their own unique testing standards to ensure that their denim products meet brand-specific requirements. These buyers prioritize various aspects of denim quality depending on their target market, positioning, and sustainability goals. For example, Some buyers emphasis on **sustainability** and chemical restrictions, while fast fashion brands focus on **quick turnaround times** and rapid testing cycles to meet the demands of their production schedules.

Chapter-2: Literature Review

This chapter reviews the key denim testing standards required by major global buyers, focusing on variations in performance, chemical, and appearance requirements across regions. The analysis highlights the differences in regulatory frameworks and consumer preferences in the USA, EU & UK markets, which impact testing protocols and denim garment quality.

2.1 Overview of Key Denim Testing Standards Across Global Buyers

The following are some of the common testing standards that denim apparel manufacturers need to meet, depending on buyer requirements:

2.1.1 Physical Performance Testing:

- **Dimensional Stability (Shrinkage/Stretch Recovery)**: Buyers require tests like AATCC 135 (for the US market) or ISO 3759 (for EU markets) to determine the shrinkage or growth of denim after washing.
- **Tensile Strength and Tear Strength**: Ensures fabric durability, often tested through standards like ASTM D5034 or ISO 13934-1.
- **Abrasion Resistance**: Evaluates the wear and tear performance of denim, typically using methods like Martindale or ASTM D4966.
- **Seam Strength**: Standards such as ISO 13935-1 ensure that seam quality is maintained under strain.

2.1.2 Colorfastness Testing:

Colorfastness to Washing, Light, and Rubbing: Important to maintain denim's color after laundering, exposure to light. Tests like AATCC 61, ISO 105-C06 (washing), ISO 105-B02 (light), and ISO 105-X12 (rubbing) are common. Crocking this measures the tendency of indigo dye to transfer to other surfaces and is tested using standards such as AATCC 8 or ISO 105-X12.

2.1.3 Chemical Testing:

Restricted Substance Lists (RSL): Buyers have specific chemical testing requirements to check compliance with RSLs for banned substances (e.g., azo dyes, heavy metals, formaldehyde, pH, allergenic dyes)..

2.2. Regional Variations in Testing Standards

United States (US):

- Buyers in the US often follow standards set by the American Association of Textile Chemists and Colorists (AATCC) and ASTM International.
- There is a strong emphasis on colorfastness, seam strength, and chemical safety, as compliance with the Consumer Product Safety Improvement Act (CPSIA) is required.

European Union (EU):

- Buyers in the EU focus on standards set by the International Organization for Standardization (ISO) and the European Committee for Standardization (EN).
- EU buyers are particularly concerned about chemical testing due to strict REACH (Registration, Evaluation, Authorisation, and Restriction of Chemicals) regulations.

2.3 Comparative Denim Testing Standards: USA vs. EU Markets

USA and EU markets have distinct regulatory and consumer expectations when it comes to denim garment quality. These differences stem from varying regulatory frameworks, consumer preferences, and market demands. Here are the **key differences** in denim garment quality between the USA and EU markets:

2.3.1 Chemical Safety Regulations:

- **USA**:
  - Denim garments sold in the USA must comply with regulations such as the **CPSIA (Consumer Product Safety Improvement Act)**, which is particularly strict for children's garments. The USA also has **California Proposition 65**, which requires businesses to warn consumers about exposure to chemicals that can cause cancer or reproductive harm.
  - The **CPSC (Consumer Product Safety Commission)** enforces standards for hazardous chemicals, including lead, phthalates, and formaldehyde.
- **EU**:
  - The EU has a stricter regulatory framework for chemical safety under **REACH (Registration, Evaluation, Authorisation, and Restriction of Chemicals)**. REACH restricts the use of more than 1000 hazardous chemicals in textile products, including azo dyes, heavy metals, and formaldehyde.

- The **OEKO-TEX® Standard 100**, although voluntary, is widely recognized in the EU market for ensuring textiles, including denim, are free from harmful substances.

Key Difference: The EU's REACH regulation is more comprehensive than the USA's CPSIA and Proposition 65, as it covers a wider range of chemicals, making denim garments sold in the EU market more rigorously tested for chemical safety.

2.3.2 Sustainability and Environmental Concerns:

- **USA**:
  - While sustainability is increasingly important in the USA market, regulations are less stringent compared to the EU. However, brands like Levi's are adopting voluntary standards like the **Better Cotton Initiative (BCI)** and their **Water<Less** techniques to reduce environmental impact.
  - American consumers are gradually prioritizing sustainability, but not at the same regulatory level as in the EU.
- **EU**:
  - The EU places a greater emphasis on sustainability and eco-friendly production. The **European Green Deal** and other environmental initiatives push for reducing the environmental footprint of textiles, including denim.
  - EU buyers prioritize sustainable sourcing and production, as seen in their **Join Life** and **Conscious Collection** lines, respectively. These initiatives demand compliance with sustainable practices and stricter environmental standards, such as reduced water use and lower chemical pollution.

Key Difference: The EU market places more emphasis on sustainability, with stricter regulations and greater consumer demand for eco-friendly denim, while the USA market is catching up but remains more flexible in this area.

2.3.3 Durability and Performance Testing:

- **USA**:
  - Durability is a critical factor in denim garments for the USA market, especially for workwear brands. **ASTM standards** (e.g., ASTM D5034 for tensile strength and ASTM D4966 for abrasion resistance) are widely used to ensure denim can withstand wear and tear.
  - American consumers often prioritize durability, ruggedness, and comfort, especially in casual and workwear denim, leading brands to focus on high tensile strength and abrasion resistance.
- **EU**:
  - In the EU, durability is also important, but there is more emphasis on balance between comfort, style, and environmental impact. **ISO standards** (e.g., ISO 13934-1 for tensile strength and ISO 12947-2 for abrasion resistance) are used, but they are often coupled with stricter eco-friendly practices.
  - EU consumers may prioritize a balance of style, softness, and sustainability over extreme durability, especially for fashion denim.

Key Difference: While both markets require high durability standards, the USA tends to prioritize toughness and workwear durability, whereas the EU focuses more on a balance of durability, comfort, and sustainability.

2.3.4 Labeling and Transparency:

- **USA**:
  - In the USA, denim garments must comply with the **FTC's Textile Fiber Products Identification Act**, which mandates proper labeling of fiber content, care instructions, and country of origin. Care labels follow **ASTM and AATCC guidelines**.
  - Labeling for chemical safety is less stringent compared to the EU, although California's Proposition 65 may require additional warnings.
- **EU**:
  - The **Textile Regulation (EU 1007/2011)** requires denim garments to be labeled accurately with fiber composition, care instructions, and country of origin. In addition, more transparency is demanded regarding the environmental impact and production methods of denim.
  - The EU market often looks for certifications like **OEKO-TEX®**, **GOTS (Global Organic Textile Standard)**, and other eco-labels that demonstrate sustainability and safety compliance.

Key Difference: The EU market demands greater transparency in labeling, particularly around environmental and chemical safety, while the USA market focuses on basic fiber content, care instructions, and general product safety.

2.3.5 Fashion Trends and Consumer Preferences:

- **USA**:
  - Denim in the USA is often associated with casual wear and workwear, reflecting a rugged, practical style. Classic cuts like straight-leg, bootcut, and relaxed fit are popular.
  - American consumers prefer sturdy, long-lasting denim that holds up well to frequent wear and washing.

- **EU**:
    - European consumers, especially in fashion-forward markets like France and Italy, tend to prioritize style and fit over extreme durability. Skinny jeans, tapered cuts, and high-fashion denim trends are more prevalent in the EU.
    - There is also a growing demand for softer, more comfortable denim fabrics that blend stretch fibers like elastane for added flexibility and comfort.

Key Difference: In the USA, denim garments are often geared toward ruggedness and casual utility, while the EU market leans more toward fashion trends, fit, and comfort.

2.4 Denim quality key differences for EU & USA market

Focus Area	European Market	American Market
Sustainability	High focus on sustainability, eco-friendly production, circular economy	Growing interest but less central than price and trends
Price Sensitivity	Willing to pay more for quality and sustainability	More price-sensitive, fast fashion
Durability	Prioritized, especially for longevity and resistance to wear	Important, but balanced with comfort and price
Comfort & Fit	Style, fit, and comfort are key, with a preference for tailored fits	Comfort-driven, with a focus on soft, stretchy denim
Chemical Compliance	Strict REACH compliance and eco-certifications required	Focused on CPSC regulations, with growing attention to Proposition 65
Brand & Trend Focus	Consumers seek timeless and durable styles	Trend-driven, with fast-changing fashion demands

Chapter-3: Methodology

This section outlines the approach for selecting and analyzing denim buyer manuals from different locations, focusing on physical tests, chemical tests, and color tests, as well as the specific requirements outlined by various buyers. The buyer manuals will be sourced from third-party testing laboratories.

3.1. Selection of Buyer

Buyer from major global denim buyers—such as Primark, Kik from European buyer, Newlook from UK, Amazon from USA . The selection will prioritize:

- **Geographical Representation**: Manuals from buyers across different locations (regions like America, Europe, UK) will be chosen to analyze how testing standards might vary by region.
- **Reputation of Buyers**: Buyers with significant global market presence and influence in the denim industry will be selected.
- **Availability of Testing Protocols**: Manuals will be sourced based on the completeness and accessibility of their testing protocols, ensuring a comprehensive comparison of physical, chemical, and color testing requirements.

3.2. Data Collection: Buyer Manuals from Third-Party Testing Labs

The primary data for this analysis will be gathered from third-party textile testing laboratories. These labs serve as key intermediaries between buyers and manufacturers, performing standardized tests based on buyer-specific protocols. The following steps will be taken for data collection:

- **Partnership with Third-Party Testing Labs**: Collaborations will be established with third-party testing laboratories to obtain authorized copies of buyer testing manuals. This will include reviewing Non-Disclosure Agreements (NDAs) and ensuring ethical access to proprietary information.
- **Manual Extraction**: Buyer manuals will be obtained from laboratory archives, focusing on denim-related testing protocols. The manuals will be reviewed to extract information on physical tests (e.g., strength, abrasion), chemical tests (e.g., hazardous substances, compliance with REACH), and color tests (e.g., colorfastness to light, wash, and rubbing).

Chapter-4: Analysis of Testing Requirements

The buyer manuals will be categorized based on the three major testing areas—physical, chemical, and color tests. The specific requirements for each test will be documented and analyzed as follows:

4.1. Color Fastness Tests Requirement of Different Market:

4.1.1 Buyer: Primark, Origin: Ireland, EU

Test	Standard	Results/Requirements	Remarks
Colour Fastness to Washing	BS EN ISO 105 - C06	- Change: 3-4 - Staining: 2-3 - Stay Black/Blue Claim: Change: 4, Staining: 2-3	As received
Colour Fastness to Water	BS EN ISO 105 - E01	- Change: 3-4 - Staining: 2-3 - Stay Black/Blue Claim: Change: 4, Staining: 2-3	As received Required for all colour ways, except white/cream fabrics
Colour Fastness to Rubbing	BS EN ISO 105 - X12	- Dry: 3-4 - Wet: 2 - Stay Black/Blue Claim: Dry: 3-4, Wet: 2	As received Required for all colour ways, except white/cream fabrics, only tested on indigo finishes, on the lightest part of the garment

4.1.2 Buyer: Kik, Origin: Germany, EU

Test	Standard	ResultsRequirements	Remarks
Colour Fastness to Washing	DIN EN ISO 105 - C06	- Change: 3-4 - Staining: 3-4, If Contrast Color Staining: 4-5	Denim dark blue, black denim, overdyed, special wash- No need Test
Colour Fastness to Water	DIN EN ISO 105 - E01	- Change: 3-4 - Staining: 3-4, If Contrast Color Staining: 4-5	Denim dark blue, black denim, overdyed, special wash- No need Test
Colour Fastness to Rubbing	DIN EN ISO 105 - X12	- Dry: 2-3 - Wet: 2	Denim dark blue, black denim, overdyed

4.1.3 Buyer: Newlook, Origin: UK

Test	Standard	Results/Requirements	Remarks
Colour Fastness to Washing	N/A	To be assessed during Garment Appearance After Wash Test	
Colour Fastness to Rubbing	BS EN ISO 105: X12	Dry: 3-4, Wet: N/A	Not applicable for non-dyed, bleached, whites, creams, or ivory
Colour Fastness to Water	BS EN ISO 105: E01	- Change: 4 - Staining: 4 - Cross-staining: 4-5	Not required on white or cream components
Colour Fastness to Perspiration	ISO 105 E04	- Change: 4 - Staining: 4 - Cross-staining: 4-5	Not required on white or cream components

4.1.4 Buyer: Amazon, Origin: USA

Test	Standard	Results/Requirements	Remarks
Colour Fastness to Washing	BS EN ISO 105-C06, A2S @ 40 Deg C	Color Change: Grade 3-4 Color Staining: Grade 3 Self-StainingGrade 4-5 No Stretch Denim: Color Change: Grade 3 Color Staining: Grade 2-3 Self-Staining: Grade 4-5	Not applicable to white/off white/blench white/snow white/bright white/cream colors, unless printed with a darker color.
Colour Fastness to Rubbing	BS EN ISO 105: X12	Washed Denim: Dry: Grade 3; Wet: Grade 2 No Stretch Denim: Dry: Grade 2-3; Wet: Grade 1-2	Not applicable to white/off white/blench white/snow white/bright white/cream colors If rubbing fails, test after one home laundering: report data only.
Colour Fastness to Water	BS EN ISO 105: E01	Color Change: Grade 3-4 Color Staining: Grade 3 Self-Staining: Grade 4-5	Not applicable to white/off white/blench white/snow white/bright white/cream colors, unless printed with a darkercolor
Colour Fastness to Ozone	ISO 105 G03	After 1 cycle Color Change: Grade 3-4	Applicable to all denim products

4.1.5 Comparison

Test	Primark (Ireland, EU)	KiK (Germany, EU)	New Look (UK)	Amazon (USA)
Colour Fastness to Washing	- Change: 3-4 - Staining: 2-3 - Stay Black/Blue Claim: Change: 4, Staining: 2-3	- Change: 3-4 - Staining: 3-4 - Contrast Color Staining: 4-5 (No need test for dark blue/black denim, overdyed, special wash)	N/A Assessed during Garment Appearance After Wash Test	- Change: 3-4 - Staining: 3 - Self-Staining: 4-5 (No Stretch Denim: Change: 3, Staining: 2-3, Self-Staining: 4-5)
Colour Fastness to Water	- Change: 3-4 - Staining: 2-3 - Stay Black/Blue Claim: Change: 4, Staining: 2-3	- Change: 3-4 - Staining: 3-4 - Contrast Color Staining: 4-5 (No need test for dark blue/black denim, overdyed, special wash)	- Change: 4 - Staining: 4 - Cross-staining: 4-5 (Not required on white/cream components)	- Change: 3-4 - Staining: 3 - Self-Staining: 4-5
Colour Fastness to Rubbing	- Dry: 3-4 - Wet: 2 - Stay Black/Blue Claim: Dry: 3-4, Wet: 2	- Dry: 2-3 - Wet: 2 (No need test for dark blue/black denim, overdyed)	- Dry: 3-4 - Wet: N/A (Not applicable for non-dyed, bleached, whites, creams, ivory)	- Dry: 3, Wet: 2 (No Stretch Denim: Dry: 2-3, Wet: 1-2)
Colour Fastness to Perspiration	N/A	N/A	- Change: 4 - Staining: 4 - Cross-staining: 4-5 (Not required on white/cream components)	N/A
Colour Fastness to Ozone	N/A	N/A	N/A	- Change: 3-4 (Applicable to all denim

Test	Primark (Ireland, EU)	KiK (Germany, EU)	New Look (UK)	Amazon (USA)
				products)

This table highlights the differences between **Primark**, **KiK (EU)**, **New Look (UK)**, and **Amazon (USA)** denim chemical testing standards across various categories, making it easier to compare them side by side.

4.1.6 Summary of Key Differences:

EU Market (Primark & KiK)

- **Key Focus Areas:**
  - **Appearance and Durability:** Focus on color change and staining after wash, with Primark highlighting "Stay Black/Blue" claims.
  - **Specific Exemptions:** KiK excludes testing for dark blue, black denim, overdyed, and special wash garments, reducing testing scope for these finishes.
  - **Contrast Color Staining:** KiK requires stricter performance on contrast color staining (Grade 4-5), especially on multicolor garments.

UK Market (New Look)

- **Key Focus Areas:**
  - **Visual Appearance:** Washing fastness is indirectly assessed through garment appearance after washing, rather than a specific washing test.
  - **Fabric-Specific Focus:** Excludes non-dyed, bleached, white, cream, and ivory fabrics from rubbing and water fastness tests.

- **Cross-Staining:** More attention on cross-staining for colored fabrics, with requirements of Grade 4-5 for better durability in multicolor garments.

USA Market (Amazon)

- **Key Focus Areas:**
  - **Denim-Specific Testing:** Differentiates between washed and no-stretch denim, with unique performance targets for each category (e.g., lower rubbing fastness for no-stretch denim).
  - **Environmental Durability:** Includes an additional ozone fastness test to assess color change after exposure to environmental factors, a requirement not found in EU or UK markets.
  - **Comprehensive Testing Scope:** Includes fastness tests across various factors (washing, rubbing, water, and ozone), with distinct requirements for different fabric types, making the testing process more rigorous and detailed.

4.2. Physical Performance Tests Requirement of Different Market:

4.2.1 Buyer: Primark, Origin: Ireland, EU

Test Name	Test Standard	Requirements	Comments
Print / Motif / Flock Durability	PM02	Change: 4 Cross Stain: 4-5 Slight loss of print adhesion acceptable Slight delamination of print acceptable Slight print cracking acceptable Slight loss of flocking acceptable	15 minutes @ 40°C Dry as per Care Label Only required on Print/Motif/Flock product being tested to BS EN ISO 6330: 2012 Appearance after wash (1 and 5 washes) All functional internal printing on garments to be assessed for observational changes only.
Tear Strength	BS EN 13937 - 1	< 6 oz/yd² (warp: 12N, weft: 10N) 6-7.9 oz/yd² (warp: 18N, weft: 15N) 8-11.5 oz/yd² (warp: 24N, weft: 20N) > 11.5 oz/yd² (warp: 30N, weft: 30N)	For Woven Fabrics Only.
Tensile Force (Strength)	BS EN ISO 13934 - 2	100N for all weights	For Woven Fabrics Only Test in non-stretch direction only for Cellulosics & Cellulosic blends.
Seam Strength	BS EN ISO 13935 - 2	< 6 oz/yd² (warp: 100N, weft: 140N) 6-7.9 oz/yd² (warp: 180N, weft: 200N) 8-11.5 oz/yd² (warp: 220N, weft: 260N) > 11.5 oz/yd² (warp: 260N, weft:	For Woven Fabrics Only Test in non-stretch direction.

Test Name	Test Standard	Requirements	Comments
		300N)	

Test Name	Test Standard	Requirements	Comments
Seam Slippage	BS EN ISO 13936 - 1	< 6 oz/yd² (90N, max. 6mm) 6-7.9 oz/yd² (110N, max. 6mm) 8-11.5 oz/yd² (120N, max. 6mm) > 11.5 oz/yd² (140N, max. 6mm)	For Woven Fabrics Only.
Martindale Abrasion	BS EN ISO 12947 - 2	< 6 oz/yd² (10,000 rubs) 6-7.9 oz/yd² (15,000 rubs) 8-11.5 oz/yd² (18,000 rubs) > 11.5 oz/yd² (20,000 rubs)	For Woven Fabrics Only 9 kPa weight.
Dimensional Stability	PM01	-3% to +2%	Wash as per Care label using the number of washes prescribed by Primark.
Spirality	PM01	≤ 3%	Wash as per Care label.
Appearance	PM01	Satisfactory ○ 1 Wash: Change 3-4, Staining: 2-3 ○ 5 Washes: Change 3-4, Staining: 2-3 ○ 23 Washes: Change 3, Staining: 3	Machine wash product: Care labels set at 30°C test at 3N/3M/3G as required Care labels set at 40°C test at 4N/4M/4G as required (following care labelling).

4.2.2 Buyer: Kik, Origin: Germany, EU

Test Name	Test Method	Requirement
Appearance After Washing	DIN EN ISO 5077, DIN EN ISO 6330	Color Change: Grade 3-4 Contrast: Grade 4-5 Pilling/Fuzzing: Grade 4-5 Other Changes: Not accepted
Dimensional Stability to Washing	DIN EN ISO 5077, DIN EN ISO 6330	Woven Fabric & Denim: ±5%
Seam Spirality After Laundering	ISO 16322-3	Woven Fabric (Children up to size 164 & Adults): ±3% / 3 cm
Fabric Weight	ISO 3801	Woven Fabric & Denim: ±5%

4.2.3 Buyer: Newlook, Origin: UK

Test Name	Test Method	Requirement
Fabric Weight	BS EN 12127	±5% of stated weight
Seam Slippage	BS EN ISO 13936-1 (Fixed Opening)	@ 6mm opening, requirement minimum 12kg
Seam Slippage (Woven Stretch Fabrics)	BS EN ISO 13936-2 (Fixed Load)	<6mm @ 12kg
Seam Strength	BS EN ISO 13935-2	15kg
Tensile Strength	BS EN ISO 13934-2	20kg
Tear Strength	BS EN ISO 13937-1	1800g (Not required for 100% filament nylon or polyester except microfibre)
Abrasion Resistance	BS EN ISO 12947-2	19,000 rubs (Shade change required on black only) Shade change 3-4 @ 6,000 rubs
Stretch & Recovery	BS EN ISO 20932-1:2020 (3kg load)	90% recovery after 1 min & after 30 mins
Appearance After Wash	NL IHTM 01	New Look In-House Test Method & Format: Pass

4.2.4 Buyer: Amazon, Origin: USA

Test Item	Test Method	Special Instructions	Criteria/Requirements
Fabric Weight	ASTM D3776	Report actual weight. If fails, include % variation from claim.	±5%
Tensile Strength	BS EN ISO 13934-2	Test after 5 washes/3 DC cycles per care instructions	9kg - 24kg based on fabric weight
Tear Strength	BS EN ISO 13937-1	Test on production garment or pre-production panels	750g - 1600g based on fabric weight
Dimensional Stability to Washing	AATCC 135/150	Assess after 5 wash cycles	Length & Width: +1% to -3.5%
Pilling Resistance	BS EN ISO 12945-2	Assess after 1 wash/1 DC cycle	Min. Grade 3 (General), Min. Grade 2-3 (Raised Surface Fabrics)
Shedding Propensity	AMZN-MTD 003	Test even if raised surface is on fabric backside	Min. Grade 3.5
Seam Strength	ASTM D 1683	Test after 5 washes/3 DC cycles	9kg - 18kg based on fabric weight
Care Instruction Verification	Amazon Care Guideline	No additional test needed, verification only	Rate Pass/Fail based on worst-case results
Dimensional Stability to Washing	AATCC 135 (3) III (5)	Measure & report both results. Pass/Fail to be based on after final results.	Length & Width: ±3.5%
Dimensional Stability to Commercial Dry Cleaning	AATCC 158		Length & Width: ±3.5%
Dimensional Stability to Hand Wash	AATCC 150 (Modified for wash)		Length & Width: ±3.5%
Appearance Evaluation	AMZN-MTM-001	Measure Wash/Hand Wash: Assess after 3 cycles. Dry Cleaning: Assess after 3 cycles.	Refer to Appearance Assessment Table
Seam Appearance (Change	AATCC 179 (Method 1, option 1)	Measure Wash/Hand Wash: Assess after 3 cycles. Dry Cleaning: Assess after 3	Grade ≥ 3

Test Item	Test Method	Special Instructions	Criteria/Requirements
after Wash/Dry Cleaning)		cycles.	
Stretch Properties of Fabric (Woven Stretch Items)	ASTM D3107		Stretch: ≥30% Growth: ≤10% Recovery (2 hours): ≥95%
Pilling Resistance (Martindale)	BS EN ISO 12945-2		Min. Grade after 2,000 rubs: 3-4
Tear Strength (Elmendorf)	BS EN ISO 13937-2	Test to be done on panel/mocking form	Warp & Weft Minimum Grades: Medium Weight: Warp 1,200g/Weft 1,000g Heavy Weight: Warp 1,500g/Weft 1,400g
Fabric Weight	ASTM D3776	Report result in oz/yd² & g/m².	±5%

4.2.5 Comparison

Here's a comparison of the physical performance testing requirements for denim from different buyers (Primark, KiK, New Look, Amazon):

Test Name	Primark (Ireland, EU)	KiK (Germany, EU)	New Look (UK)	Amazon (USA)
Print/Motif/Flock Durability	PM02, Change: 4, Cross Stain: 4-5	N/A	N/A	N/A
Tear Strength	BS EN 13937-1: < 6 oz/yd² (12N warp, 10N weft), 6-7.9 oz/yd² (18N warp, 15N weft), 8-11.5 oz/yd² (24N warp, 20N weft), > 11.5 oz/yd² (30N warp, 30N weft)	N/A	BS EN ISO 13937-1: 1800g	BS EN ISO 13937-1: 750g - 1600g
Tensile Strength	BS EN ISO 13934-2: 100N for all weights	N/A	BS EN ISO 13934-2: 20kg	BS EN ISO 13934-2: 9kg - 24kg
Seam Strength	BS EN ISO 13935-2: < 6 oz/yd² (100N warp, 140N weft), 6-7.9 oz/yd² (180N warp, 200N weft), 8-11.5 oz/yd² (220N warp, 260N weft), > 11.5 oz/yd² (260N warp, 300N weft)	N/A	BS EN ISO 13935-2: 15kg	ASTM D1683: 9kg - 18kg
Seam Slippage	BS EN ISO 13936-1: < 6 oz/yd² (90N max 6mm), 6-7.9	N/A	BS EN ISO 13936-1: @ 6mm opening	N/A

Test Name	Primark (Ireland, EU)	KiK (Germany, EU)	New Look (UK)	Amazon (USA)
	oz/yd² (110N max 6mm), 8-11.5 oz/yd² (120N max 6mm), > 11.5 oz/yd² (140N max 6mm)		minimum 12kg, BS EN ISO 13936-2: <6mm @ 12kg (Woven Stretch Fabrics)	
Abrasion Resistance	BS EN ISO 12947-2: < 6 oz/yd² (10,000 rubs), 6-7.9 oz/yd² (15,000 rubs), 8-11.5 oz/yd² (18,000 rubs), > 11.5 oz/yd² (20,000 rubs), 9kPa weight	N/A	BS EN ISO 12947-2: 19,000 rubs, shade change 3-4 at 6,000 rubs	BS EN ISO 12945-2: Pilling Resistance, Min. Grade 3 (General), Min. Grade 2-3 (Raised Surface Fabrics)
Dimensional Stability	PM01: -3% to +2%, Wash as per Care label	DIN EN ISO 5077/6330: ±5%	N/A	AATCC 135/150: Length & Width: +1% to -3.5%, Commercial Dry Cleaning: ±3.5%, Hand Wash: ±3.5%
Spirality	PM01: ≤ 3%	ISO 16322-3: ±3% / 3 cm	N/A	N/A
Appearance After Washing	PM01: Satisfactory (1 Wash: Change 3-4, Staining: 2-3, 5 Washes: Change 3-4, Staining: 2-	DIN EN ISO 5077/6330: Color Change Grade 3-4, Contrast Grade 4-5, Pilling/Fuzzing	NL IHTM 01: Pass	AMZN-MTM-001: Refer to Appearance Assessment Table

Test Name	Primark (Ireland, EU)	KiK (Germany, EU)	New Look (UK)	Amazon (USA)
	3, 23 Washes: Change 3, Staining: 3)	Grade 4-5		
Fabric Weight	N/A	ISO 3801: ±5%	BS EN 12127: ±5% of stated weight	ASTM D3776: Report actual weight, ±5%, if fail, include % variation from claim
Pilling Resistance	N/A	N/A	N/A	BS EN ISO 12945-2 (Martindale): Min. Grade after 2,000 rubs: 3-4
Stretch & Recovery	N/A	N/A	BS EN ISO 20932-1:2020: 90% recovery after 1 min & after 30 mins	ASTM D3107: Stretch: ≥30%, Growth: ≤10%, Recovery (2 hours): ≥95%
Seam Appearance (after Wash)	N/A	N/A	N/A	AATCC 179 (Method 1, option 1): Grade ≥ 3
Shedding Propensity	N/A	N/A	N/A	AMZN-MTD 003: Min. Grade 3.5

4.2.6 Summary of Key Differences:

EU Market (Primark & Kik)

- **Key Focus Areas:**
  - **Appearance and Durability:** Emphasis on print/motif/flock durability, color change, and staining after wash.
  - **Dimensional Stability:** Tight tolerances (around ±5%) for woven fabrics and denim.
  - **Mechanical Properties:** Requirements for tear strength, tensile strength, seam strength/slippage, and abrasion resistance, with performance thresholds varying based on fabric weight.

UK Market (Newlook)

- **Key Focus Areas:**
  - **Seam and Fabric Performance:** Detailed tests on seam slippage, seam strength, and tensile strength.
  - **Stretch & Recovery:** Specific tests (BS EN ISO 20932-1:2020) to ensure that stretch fabrics recover at least 90% after both short and longer resting periods.
  - **Appearance After Washing:** Clear in-house criteria to judge changes in appearance after wash cycles.

USA Market (Amazon)

- **Key Focus Areas:**
  - **Comprehensive Testing:** A broader range of tests covering fabric weight, tensile and tear strength, pilling resistance, seam strength, and even shedding propensity.
  - **Detailed Wash Cycle Protocols:** Specific requirements after multiple wash cycles, with separate tests for hand wash and dry cleaning, reflecting the diversity of consumer use.
  - **Appearance & Care Verification:** Incorporates verification of care instructions and seam appearance after laundering, emphasizing both functional performance and aesthetic presentation.

4.3 Chemical Performance Tests Requirement of Different Market:

4.3.1 Buyer: Primark, Origin: Ireland, EU

Test Name	Test Method	Requirement
Azo Dyes	EN ISO 14362-1 &-3 for Textiles	20 mg/kg
Aniline	EN ISO 14362-1 &-3 for Textiles	30 mg/kg after reductive cleavage for textiles and leather
Allergenic and Carcinogenic Dyes/Quinoline	DIN 54231 or DIN EN ISO 16373-2	50 mg/kg
Polycyclic Aromatic Hydrocarbons (PAH)	AFPS GS 2014, LC-MS or GC-MS	General Consumer items: <1 mg/kg, Toys: <0.5 mg/kg
Cadmium	BS EN 1122:2001 Method B, AAS/ICP	100 mg/kg
Lead	Microwave Digestion followed by ICP/OES	500 mg/kg for plastics and metals
Formaldehyde	ISO 14184-1 (Textile), ISO 17226-2 (Leather)	≤75 mg/kg for direct skin contact; ≤300 mg/kg for indirect skin contact
Phthalates	EN ISO 14389, LC-MS or GC-MS	1000 mg/kg
Extractable Heavy Metals (Cadmium, Chromium VI, Lead)	EN 16711-2	1 mg/kg for textiles, including clothing and accessories, and footwear

4.3.2 Buyer: Kik, Origin: Germany, EU

Test Name	Method	Test Criteria/Applicability	Requirement	Chemical Component Name
Dyes – Azo (incl. Aniline)	1907/2006/EC (REACh Regulation) Annex XVII No.45	Baby/children: 20 mg/kg each, Adult: 30 mg/kg each	Baby/children: 20 mg/kg each, Adult: 30 mg/kg each	Multiple, including Biphenyl-4-ylamine, Benzidine, etc.
Arylamine Salts	1907/2006/EC (REACh Regulation) Annex XVII No.72	30 mg/kg each	30 mg/kg each	4-Chloro-o-toluidinium chloride, 2-Naphthylammoniumacetate
Phthalates	1907/2006/EC (REACh Regulation) Annex XVII No.51	Various categories	1000 mg/kg (sum for all categories)	DEHP, DBP, BBP, DIBP, DINP, DIDP, DNOP
Disperse Dyes	1907/2006/EC (REACh Regulation) Annex XVII No.72	50 mg/kg	50 mg/kg	Disperse Blue 1, Disperse Red 17, etc.
Nickel Release	1907/2006/EC (REACh Regulation) Annex XVII No.27	For all metal parts with direct, longer skin contact	0.5 µg/cm²/week	Nickel
Polycyclic Aromatic Hydrocarbons (PAHs)	1907/2006/EC (REACh Regulation) Annex XVII	Categories based on skin contact	Category 1: 0.5 mg/kg, Category 2-3: 1.0	Benzo[a]pyrene, Chrysene, Naphthalene, etc.

Test Name	Method	Test Criteria/Applicability	Requirement	Chemical Component Name
			mg/kg	
Heavy Metals – Extractable	1907/2006/EC (REACh Regulation) Annex XVII No.72	For all components	1 mg/kg each for Arsenic, Lead, Cadmium, Chromium VI, etc.	Arsenic, Lead, Cadmium, Chromium VI, etc.
Chromium VI in Leather	1907/2006/EC (REACh Regulation) Annex XVII No.47	Leather components	3 mg/kg	Chromium VI
Alkylphenole/Alkylphenolethoxylate (AP/APEO)	REACh Regulation, OEKO-TEX Standard	For all washable textile articles	1000 mg/kg (sum for NP/NPEO)	Nonylphenol, Nonylphenol ethoxylates, Octylphenol, etc.
Chlorinated Paraffins	850/2004/EC Annex I Part B	For PVC, PU, and leather components	SCCP: 1500 mg/kg, MCCP: 1000 mg/kg	Short-chain chlorinated paraffins (SCCP), Medium-chain (MCCP)
Quinoline	1907/2006/EC (REACh Regulation) Annex XVII No.72	For all components	50 mg/kg	Quinoline
Formaldehyde	1907/2006/EC (REACh Regulation) Annex XVII	Jackets, coats, upholstery, baby sleep	20-300 mg/kg based on component	Formaldehyde

Test Name	Method	Test Criteria/Applicability	Requirement	Chemical Component Name
	No.72	bags	type	
Solvents	1907/2006/EC (REACh Regulation) Annex XVII No.72	For off-white and multi-color materials	3000 mg/kg each for DMF, NMP, DMAC	N,N-Dimethylformamid (DMF), N-Methyl-2-pyrrolidon (NMP), etc.
Perfluorinated and Polyfluorinated Chemicals (PFCs)	Regulation 2019/1021/EU	For textile products with anti-stain or water repellent properties	PFOA: 0.025 mg/kg, PFOS: < 1 µg/m² of the coated material	PFOA, PFOS, their salts and derivatives

4.3.3 Buyer: Newlook, Origin: UK

Test Name	Test Method	Requirement
Alkylphenols (APs) & Alkyl phenol ethoxylates (APEOs)	See New Look Chemical Management Policy for details	Total APs: 10 ppm, Total APs + APEOs: 100 ppm
Azo	See New Look Chemical Management Policy for details	20 ppm
Formaldehyde	EN ISO 14184-1, Composites permitted (up to 3 components)	75 ppm
pH Value	ISO 3071, Composite testing is not permitted	4.0 - 7.5

4.3.4 Buyer: Amazon, Origin: USA

Test Name	Test Method	Scope	Requirement
Azo-amines and Arylamine Salts	EN ISO 14362-1:2017 (Textile),	Textile and leather, skin contact materials only	Less than 20 ppm each
Cadmium	DIN EN 16711-1:2016 (Non-leather), DIN EN ISO 17072-2:2019 (Leather)	Leather, plastic, surface coating, PVC, metal	40 ppm or less
Chlorinated Paraffins	ISO 18219-1:2021 (SCCP), ISO 18219-2:2021 (MCCP)	Leather, synthetic leather, polymeric material	SCCP/MCCP: 1000 ppm or less
Chlorophenols	EN 17134-2:2023	Textile and leather, accessible materials only	TriCP, TeCP, PCP: 0.5 ppm or less
Chromium VI	EN ISO 17075-1:2017, EN ISO 17075-2:2017 (Leather and suede)	Leather and suede, skin contact materials only	3 ppm or less
Dyes (Forbidden and Disperse)	DIN 54231:2022	Synthetic and synthetic blends, skin contact materials	Less than 30 ppm each
Formaldehyde	JIS L 1041-2011 (Textiles), EN ISO 17226-1:2021 (Leather)	Textile, textile with prints, leather	75 ppm or less (20 ppm for UAE)
Nickel Release	EN 12472:2020, EN 1811:2023	Metal, direct and prolonged skin contact materials	Less than 0.5 µg/cm²/week

Phthalates	EN ISO 14389:2022 (Textiles), GC/MS (Non-textiles)	Plastic, plasticized materials and coatings	500 ppm or less (each), Total: 1000 ppm or less
Polycyclic Aromatic Hydrocarbons (PAHs)	AFPS GS 2019, EN 17132:2019, ISO 16190:2021	Rubber, EVA, PU, TPU, PVC, foams, black polymeric materials	Total: 10 ppm, 1 ppm each (specific PAHs)
Solvents and Residuals	EN 17131:2019 (Textiles), ISO 16189:2021 (Others)	PU coatings, synthetic leather, accessible materials	DMFa: 500 ppm, DMAC: 1000 ppm, NMP: 1000 ppm
Total Lead and Mercury in Substrates	CPSC-CH-E1002-08.3 (Non-metal), CPSC-CH-E1001-08.3 (Metal)	Test accessible materials only	Lead: 90 ppm or less (30 ppm for PVC/neoprene), Mercury: 0.5 ppm or less
Total Lead and Mercury in Surface Coatings	CPSC-CH-E1003-09.1	Test accessible materials only	Lead: 90 ppm or less (30 ppm for PVC/neoprene), Mercury: 0.5 ppm or less

4.3.5. Comparison

Here's the **comparison** of key denim chemical test requirements for the **EU (Primark and KiK)**, **UK (New Look)**, and **USA (Amazon)** markets:

Test	Primark (EU)	KiK (EU)	New Look (UK)	Amazon (USA)
Azo Dyes	max 20 mg/kg	20 mg/kg (baby), 30 mg/kg (adult)	20 ppm	less than 20 ppm for skin-contact materials
Aniline	30 mg/kg after reductive cleavage	Included under Azo test (30 mg/kg)	Not specified	Not specified
Polycyclic Aromatic Hydrocarbons (PAH)	General: <1 mg/kg, Toys: <0.5 mg/kg	REACh Annex XVII, Category 1: 0.5 mg/kg, Categories 2-3: 1 mg/kg	Not specified	Total: 10 ppm, Specific PAHs: 1 ppm
Nickel Release	Not specified	max 0.5 µg/cm²/week	Not specified	less than 0.5 µg/cm²/week
Formaldehyde	≤75 mg/kg (skin contact), ≤300 mg/kg (indirect)	20-300 mg/kg based on component type	75 ppm, composites allowed	75 ppm or less for textiles
Phthalates	Not specified	1000 mg/kg (sum for all categories)	Not specified	500 ppm or less (each phthalate), total 1000 ppm
Heavy Metals (Cadmium, Lead, Chromium VI)	Cadmium: 100 mg/kg, Lead: 500 mg/kg,	1 mg/kg for all metals (Arsenic, Lead, Cadmium,	Not specified	Cadmium: 40 ppm, Lead: 90 ppm (surface), 40

Test	Primark (EU)	KiK (EU)	New Look (UK)	Amazon (USA)
	Chromium VI: 3 mg/kg (Leather)	Chromium VI)		ppm (leather), Chromium VI: 3 mg/kg (leather)
Chlorinated Paraffins (SCCP, MCCP)	Not specified	SCCP: 1500 mg/kg, MCCP: 1000 mg/kg	Not specified	SCCP and MCCP: 1000 ppm or less
Alkylphenols (APs) & Alkylphenol Ethoxylates (APEOs)	Not specified	APs: 10 ppm, APEOs: 1000 mg/kg	Total APs: 10 ppm, APs + APEOs: 100 ppm	Not specified

This table highlights the differences between **Primark**, **KiK**, **New Look**, and **Amazon** denim chemical testing standards across various categories, making it easier to compare them side by side.

4.3.6. Summary of Key Differences:

Azo Dyes and Aniline:

- Different limits for baby vs adult garments (KiK).
- Some buyers include aniline under the azo test, while others don't specify (Primark vs New Look and Amazon).
- Ensure clarity on limits for skin-contact materials (Amazon).

Polycyclic Aromatic Hydrocarbons (PAH):

- Detailed requirements for specific categories in KiK (REACh Annex XVII) vs the general limit for Primark.
- Amazon has stricter total and specific PAH limits.

Nickel Release:

- Only KiK and Amazon specify this test, with a similar limit (max 0.5 µg/cm²/week). This is crucial for metal accessories like buttons or zippers.

Formaldehyde:

- Buyers have varied limits based on skin contact and component types, with Primark and KiK allowing different thresholds for direct and indirect contact.
- All other buyers (New Look, Amazon) allow composites, which could impact the scope of testing.

Phthalates:

- Phthalates are critical due to their use in plastic components like labels or coatings. Focus on KiK and Amazon, which have clear limits, with Amazon specifying individual phthalate limits.

Heavy Metals:

- KiK is the strictest with 1 mg/kg for all metals.
- Amazon specifies lower limits for cadmium, lead, and chromium VI compared to Primark, which could be a key focus for compliance.

Chlorinated Paraffins (SCCP, MCCP):

- SCCP and MCCP limits are specified only by KiK and Amazon, with a focus on similar thresholds (1000 ppm).

Alkylphenols (APs) & Alkylphenol Ethoxylates (APEOs):

- Only KiK and New Look specify limits, with KiK allowing higher APEOs.
- This area is important due to their environmental impact and widespread use in textile processing.

Chapter-5: Results Discussion

5.1 Durability Comparison:

KiK (Germany, EU):

- **Tear Strength (ISO 13937-1)**: KiK focuses on tear strength, specifying different thresholds for denim fabrics based on fabric weight. KiK's standards are focused on ensuring that denim maintains its structural integrity.
- **Tensile Strength (ISO 13934-2)**: Durability is further highlighted by testing tensile strength to verify that garments can withstand pulling forces in real-world usage.
- **Abrasion Resistance (ISO 12947-2)**: For woven fabrics, KiK sets thresholds for rub resistance, ensuring denim remains resilient to wear and tear.

Primark (Ireland, EU):

- **Tear Strength (ISO 13937-1)**: Primark provides detailed tear strength values based on fabric weight, ensuring that both lightweight and heavyweight denim offer durability for extended use.
- **Seam Strength (ISO 13935-2)**: Primark pays particular attention to seam strength, a critical factor for the longevity of denim garments, to ensure that seams hold even after multiple washes.
- **Martindale Abrasion (ISO 12947-2)**: Primark's abrasion test requirements align with other EU buyers, requiring high rub resistance for denim to maintain its look and feel after extensive wear.

Amazon (USA):

- **Tensile Strength (ISO 13934-2)**: Amazon ensures durability by requiring a range of tensile strengths based on fabric weight, tested after multiple wash cycles.

- **Tear Strength (ISO 13937-1)**: Amazon's requirements also cover different fabric weights to ensure robust tear resistance, adding a practical layer of durability for its denim.
- **Pilling Resistance (ISO 12945-2)**: With a focus on appearance and durability, Amazon incorporates pilling tests, ensuring that raised surface fabrics can withstand friction without excessive pilling.

New Look (UK):

- **Tensile Strength (ISO 13934-2)**: New Look demands a high tensile strength, ensuring that denim maintains its structural integrity under tension.
- **Seam Slippage (ISO 13936-1)**: For seam integrity, New Look tests both woven and stretch fabrics for slippage under pressure, ensuring long-lasting seams.
- **Abrasion Resistance (ISO 12947-2)**: For abrasion resistance, New Look emphasizes testing across different weights, ensuring denim resists fabric thinning and tearing through everyday use.

5.2. Colorfastness Comparison:

KiK (Germany, EU):

- **Color Fastness to Washing (ISO 105-C06)**: KiK focuses on color change and staining, requiring stringent testing for both regular and contrast color staining.
- **Color Fastness to Rubbing (ISO 105-X12)**: KiK also places importance on dry and wet rubbing, albeit with more lenient standards for dark blue and black denim.
- **Color Fastness to Water (ISO 105-E01)**: KiK's standards for water resistance are consistent with general EU requirements, ensuring denim holds up well against water exposure.

Primark (Ireland, EU):

- **Color Fastness to Washing (ISO 105-C06)**: Primark requires assessments for color change and staining after washing, ensuring denim retains its color vibrancy even after several washes.
- **Color Fastness to Water (ISO 105-E01)**: As with most EU buyers, Primark tests water exposure, ensuring that denim fabrics resist water-based color transfer and fading.
- **Color Fastness to Rubbing (ISO 105-X12)**: Primark emphasizes dry and wet rubbing, ensuring that denim finishes resist color loss through friction, a critical aspect of long-lasting wear.

Amazon (USA):

- **Color Fastness to Washing (ISO 105-C06)**: Amazon follows practical guidelines for washing tests, with specific requirements based on denim types (e.g., no-stretch vs. washed denim). The emphasis is on maintaining a high grade for color change and self-staining.
- **Color Fastness to Rubbing (ISO 105-X12)**: Amazon incorporates realistic approaches, allowing retesting after home laundering if initial rubbing tests fail, acknowledging the consumer's real-world washing practices.
- **Color Fastness to Water (ISO 105-E01)**: Amazon's requirements ensure that denim can withstand water exposure, maintaining color integrity even when faced with moisture.

New Look (UK):

- **Color Fastness to Rubbing (ISO 105-X12)**: New Look sets high standards for dry rubbing but does not require wet rubbing tests, reflecting a more focused approach.
- **Color Fastness to Water (ISO 105-E01)**: The UK buyer emphasizes water fastness, with stricter requirements for staining and cross-staining.

- **Color Fastness to Perspiration (ISO 105 E04)**: New Look also introduces tests for perspiration, ensuring denim resists discoloration due to sweat, a test not emphasized by the other buyers.

5.3. Shrinkage Comparison:

KiK (Germany, EU):

- **Dimensional Stability to Washing (ISO 5077)**: KiK requires shrinkage tests after multiple washes, ensuring that denim garments retain their size and shape with limited variation (±5%).

Primark (Ireland, EU):

- **Dimensional Stability (Primark Method)**: Primark emphasizes tight tolerances for shrinkage, testing both fabric length and width to ensure garments maintain their size across washes.
- **Spirality (Primark Method)**: To avoid twisting and skewing, Primark includes spirality tests with clear limits for post-wash appearance.

Amazon (USA):

- **Dimensional Stability to Washing (AATCC 135/150)**: Amazon requires dimensional stability assessments after multiple washes, setting clear guidelines for acceptable shrinkage ranges (+1% to -3.5%).
- **Dimensional Stability to Dry Cleaning (AATCC 158)**: Amazon extends shrinkage tests to include dry cleaning scenarios, covering more care possibilities for the consumer.

New Look (UK):

- **Dimensional Stability to Washing (New Look IHTM 01)**: New Look's requirements mirror those of other buyers but also place emphasis on stretch and recovery properties, ensuring shrinkage control even in stretch fabrics.
- **Stretch and Recovery (ISO 20932-1)**: Specifically for stretch fabrics, New Look includes tests for both short- and long-term recovery, ensuring garments retain their shape and fit after repeated wear.

5.4 Chemical Compliance Comparison:

KiK (Germany, EU):

- **Restricted Substances (REACH)**: KiK enforces strict chemical compliance based on REACh regulations, covering azo dyes, phthalates, and formaldehyde, ensuring consumer safety and eco-friendliness.

Primark (Ireland, EU):

- **Chemical Testing (Primark RSL)**: Primark adheres to EU chemical regulations, setting stringent limits on formaldehyde, heavy metals, and restricted azo dyes to ensure compliance with environmental and safety standards.

Amazon (USA):

- **Restricted Substances (Amazon RSL)**: Amazon implements **stricter** thresholds for heavy metals such as cadmium, alongside other chemicals like phthalates and azo dyes, reflecting higher safety measures for consumer protection.

New Look (UK):

- **Chemical Testing (New Look RSL)**: New Look follows stringent chemical compliance, including **low limits** on azo dyes, alkylphenols, and phthalates, reinforcing its commitment to eco-friendly practices.

When comparing the denim testing standards across **Amazon (USA)**, **Primark (EU)**, **KiK (EU)**, and **New Look (UK)**, we observe significant differences in the depth of testing and focus areas based on regional preferences and brand priorities.

5.5. Amazon (USA Market) Focus Area:

- **Amazon** stands out as the buyer with the **most extensive and thorough testing** across both **physical performance and chemical compliance**. Their broader testing scope emphasizes **all-around durability**, ensuring denim products meet high performance across various washing methods and care conditions.

5.6. Primark (EU Market) Focus Area:

- **Primark** balances **physical performance** and **chemical safety**, but their testing protocol is **less diverse and rigorous** compared to **Amazon**. While their standards ensure denim holds up in typical wear, they **don't go beyond standard European testing** for chemical safety, focusing more on durability under EU care conditions.

5.7. KiK (EU Market, Germany) Focus Area:

- **KiK** provides **practical durability** at **affordable costs**, ensuring denim withstands regular use while meeting basic chemical safety standards. However, **their testing is less demanding** when compared to **Amazon** and is more focused on standard EU requirements without additional layers of testing complexity.

5.8. New Look (UK Market) Focus Area:

- **New Look** focuses heavily on **structural durability** and **fit**, especially for stretch denim, aligning with the UK market's demands for fashionable and durable garments. While their physical performance standards are robust, **their chemical testing remains in line with basic EU regulations**, without the added rigor seen in **Amazon's** protocols.

5.9. Most Stringent Market for Denim Testing Standards

- **Amazon** leads with the **most stringent testing requirements**, offering a broader range of tests that include multiple care methods, durability, and in-depth chemical testing. Their **higher thresholds** for chemical safety (e.g., cadmium, phthalates) and the inclusion of tests like **shedding propensity** and **seam appearance after home laundering** make Amazon's standards **harder** to meet overall.

5.10 Markets with the Most Durable Performance Requirements

- **Amazon** and **New Look** both prioritize **long-lasting performance**, but in different ways. **Amazon** uses a comprehensive set of tests to ensure garments survive **varied care routines** and maintain structural integrity. **New Look** focuses more on **construction durability** (e.g., seam strength and stretch recovery), especially in **fashion denim**, ensuring garments maintain their fit and appearance after wear and washing.

5.11 Chemical Safety vs. Durability: Emphasis in Global Denim Testing

- **Amazon** places an **equal emphasis** on both **chemical safety** and **durability**, while **KiK** and **Primark** focus more on **physical durability** and maintain standard EU chemical testing requirements. **New Look** provides strong **durability and structural integrity** tests but does not push chemical compliance beyond standard UK and EU regulations.

Chapter-6: Conclusion

This research aimed to conduct a comparative analysis of denim garment testing standards across major global buyers, focusing on Amazon (USA), KiK (Germany), Primark (Ireland), and New Look (UK). The study systematically evaluated variations in testing protocols related to durability, color fastness, shrinkage, and chemical compliance.

Key findings highlight significant differences in buyer requirements influenced by regional regulations, sustainability goals, and market expectations. For example, EU-based buyers such as KiK and Primark emphasize chemical safety and environmental compliance, while Amazon incorporates broader performance tests and consumer-centric criteria. New Look's standards lean toward visual appearance and fit consistency.

This comparative insight contributes to a better understanding of global quality expectations and underscores the importance of aligning production and testing protocols with specific buyer requirements. Manufacturers and suppliers can use this analysis to optimize product quality and compliance while navigating diverse international markets.

Overall, this thesis provides a foundational reference for enhancing global testing strategies in the denim apparel sector, supporting both commercial and sustainability objectives.

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