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# Quality Control and Test Standards

A buying and product development team assessing a knitted fabric supplier asks about measurable quality before price: how consistent is the colour, how much does the fabric shrink in the wash, after how many cycles does the surface fuzz and pill, how many defects occur per roll. This guide ties fastness, dimensional stability, pilling/abrasion, four-point inspection and lab-dip approval to ISO 105 and AATCC standards, turning the ΔE<1 claim into an observable commitment.

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## Which quality and test topics should you ask about when selecting a supplier?

> A robust assessment rests on five axes: colour and rubbing fastness, dimensional change after washing, surface durability (pilling/abrasion), inspection based on defect counting, and colour approval via lab-dip. When each can be tied to a defined ISO or AATCC method and a numerical acceptance criterion, "good fabric" turns from a subjective claim into a measurable contractual term.

In B2B textile sourcing, most disputes arise not from aesthetic preference but from unmeasured expectations. Complaints such as "the colour bleeds", "it shrank in the wash" or "it pilled on first wear" can all be agreed in advance through a test method and a tolerance value. For this reason a mature integrated facility clarifies, before closing the sale, which standards, which specimen and which acceptance threshold will be used.

In the table below we have gathered the five topics buyers ask about most often, the question each answers and the standard family each rests on. These five topics also form the skeleton of the five sub-guides beneath this pillar page.

| Quality topic | Question it answers | Principal standard family |
|---|---|---|
| Fastness | Does the colour stay stable in washing, perspiration, rubbing and light? | ISO 105 series / AATCC |
| Dimensional stability | How much do width and length change after wash and dry? | ISO 6330 + ISO 5077 / AATCC 135 |
| Pilling and abrasion | After how many cycles does the surface fuzz, pill or abrade? | ISO 12945 / ISO 12947 (Martindale) |
| Four-point inspection | How many defects, and of what size, occur per unit area? | Four-point system (compliant with ASTM D5430) |
| Lab-dip approval | How close is the production colour to the approved standard? | ISO 105-J03 / AATCC EE / CMC and CIEDE2000 |

## What do fastness tests measure and which standards do they rest on?

> Fastness is the resistance of a colour to staying in place against external influences: washing, perspiration, rubbing (crocking) and light. For each influence there is a separate ISO 105 sub-method, and the result is reported on a 1-5 (1-8 for light) grey/blue scale grade. The pass grade is set according to the fabric's end use; expectations differ for light and dark shades.

Colour fastness shows how well the dye is fixed on the fibre and where it may migrate in use. Wash fastness assesses colour bleeding and staining of an adjacent light ground; perspiration fastness assesses fading under acidic/alkaline perspiration conditions; rubbing (crocking) fastness assesses colour transfer in dry and wet rubbing; light fastness assesses fading under UV exposure. While reactive dyeing typically achieves high wet fastness on cellulosic fibres, in pigment and some garment-dye effects the rubbing fastness is managed carefully according to end use.

Using the standard numbers correctly makes the assessment objective. The table below summarises the most frequently cited ISO 105 sub-methods and their AATCC equivalents.

| Influence | ISO method | AATCC equivalent | Scale |
|---|---|---|---|
| Wash fastness | ISO 105-C06 | AATCC 61 | Grey scale 1-5 |
| Perspiration fastness | ISO 105-E04 | AATCC 15 | Grey scale 1-5 |
| Rubbing (crocking) | ISO 105-X12 | AATCC 8 / 116 | Grey scale 1-5 |
| Light fastness | ISO 105-B02 | AATCC 16 | Blue scale 1-8 |

The interpretation of grades depends on end use: in babywear and underwear the wet fastness expectation is generally held higher, while in outerwear light fastness comes to the fore. Fixing the target grades in the contract removes any later debate over "is it adequate or not"; with KARCEM we can clarify these thresholds on a product-by-product basis.

## How are shrinkage and dimensional stability measured?

> Dimensional stability is how much the fabric changes in width and length after a standard wash-and-dry cycle. The specimen is washed to ISO 6330, and the change between marked measurements is calculated as a percentage to ISO 5077. In knitted fabric, spirality (skew) is also measured; sanforising and compacting bring these values under control.

Because knitted structure is more elastic than woven, it is more prone to dimensional change; this makes the shrinkage test one of the most critical physical tests in knits. The correct method is to choose a wash programme that mimics real care conditions, mark the specimen, and measure after multiple cycles. A negative value denotes shrinkage (contraction), a positive value extension. In fabrics containing elastane, the heat-set temperature and stenter setting directly affect recovery and final dimensions.

Alongside the dimensional results, spirality should also be reported; particularly in single-jersey structures such as single jersey, seam twisting is related to this value. The table below shows the basic steps to follow for knits and the corresponding standards.

| Measured | Method | Unit / output |
|---|---|---|
| Wash-and-dry cycle | ISO 6330 | Programme + number of cycles |
| Width / length change | ISO 5077 | % change (-/+) |
| Shrinkage (AATCC route) | AATCC 135 | % change |
| Spirality (skew) | Marked-square method | % skew angle |

The acceptable range of change is set according to fabric type, weight and the final product. Rather than committing to a specific percentage, we address the target values together with your fabric structure and care instructions in the dimensional stability guide, and clarify them together in production.

## How are pilling, Martindale and abrasion resistance assessed?

> Pilling is the balling-up of fibres broken loose on the surface; Martindale is the method that measures both pilling and abrasion resistance through controlled rubbing at defined cycle counts. The pilling result is reported on a 1-5 photographic scale (5 best), and abrasion as the number of cycles at which the surface breaks through or a yarn ruptures.

Pilling is decisive for both aesthetics and perceived quality, and is seen more frequently especially in carded and open-end yarns, owing to the tendency of short fibres to rise to the surface. The use of combed and compact yarn reduces fuzzing and improves the pilling grade. Abrasion resistance comes to the fore in upholstery and heavy-use clothing; the Martindale abrasion test gives the number of cycles the surface withstands against a standard abradant.

Clarifying the test method and reporting format ties a "it pilled" complaint to a measurable criterion in advance. The table below summarises the relevant standards and the output format.

| Test | Standard | Output |
| --- | --- | --- |
| Pilling (Martindale) | ISO 12945-2 | 1-5 photographic scale |
| Pilling (box method) | ISO 12945-1 | 1-5 photographic scale |
| Abrasion resistance | ISO 12947 (Martindale) | Number of cycles |
| Pilling (AATCC route) | ASTM D4970 | 1-5 scale |

The pass grade and target cycle count vary with end use; underwear and outerwear are not assessed against the same threshold. We go deeper into product-specific targets in the pilling and abrasion guide.

## How does the four-point inspection system score fabric quality?

> The four-point system is a standard visual inspection method that assigns each defect a score of 1 to 4 according to its size. The total score is normalised per 100 m² (or 100 yd²) to produce a quality score. A lower score means cleaner fabric; the acceptance limit is agreed in advance between buyer and supplier.

Visual inspection is a step that complements laboratory tests but does not replace them: while fastness and shrinkage are measured on a specimen, four-point inspection scans the whole roll, counting surface defects such as holes, stains, missed stitches and lines. A single defect is given at most 4 points, and no more than 4 points are counted in a single metre; this prevents one area disproportionately inflating the score. When the result is assessed together with weight tolerance and width measurements, the commercial usability of the roll becomes clear.

| Defect size | Points assigned |
| --- | --- |
| 3 in (7.5 cm) and under | 1 point |

| Defect size | Points assigned |
|---|---|
| 3-6 in (7.5-15 cm) | 2 points |
| 6-9 in (15-23 cm) | 3 points |
| Over 9 in (23 cm) / hole | 4 points |

Although the scoring calculation is common across the industry, the acceptable threshold varies from product to product; printing, dark grounds or critical end uses require a tighter limit. We explain the scoring logic and a worked example step by step in the four-point inspection and tolerance guide.

## How does the lab-dip approval process make the ΔE<1 target measurable?

> The lab-dip is the small dye trial prepared before production; the approved lab-dip becomes the standard against which the production colour is compared. The colour difference is quantified with ΔE, and in modern practice the CMC or CIEDE2000 formula is used. The ΔE<1 target denotes a difference the eye can barely distinguish and turns colour consistency into a measurable commitment.

Colour management is the heart of the "registration" logic: standard, lab-dip and production batches are aligned around the same reference. The process typically proceeds as follows: the customer defines the standard, the laboratory prepares several lab-dips, the approved recipe is transferred to production, and production batches are measured against the standard with a spectrophotometer and the ΔE reported. To reduce the risk of metamerism, measurements are taken under standard light sources; consistency under different lighting is also checked separately.

The table below summarises the stages of the process and the measurable output produced at each stage.

| Stage | Action | Measurable output |
|---|---|---|
| Standard definition | The target colour is fixed physically/numerically | Reference Lab values |
| Lab-dip | The recipe is trialled in small batches | Approved recipe + ΔE |
| Production measurement | The batch is read against the standard | ΔE (CMC/CIEDE2000) |
| Batch consistency | The difference between rolls is monitored | Within-/between-batch ΔE |

The ΔE<1 target is meaningful when the light source, observer angle and formula (CMC l:c or CIEDE2000) are defined; promising a single figure on its own, without these parameters fixed, would be misleading. We go deeper into the process end to end in the lab-dip approval guide, and into the dyeing side on the colour fastness and ΔE page.

## How are these tests combined into a quality agreement?

> A mature quality agreement gathers the five axes into a single acceptance matrix: fastness grades, dimensional change range, pilling/abrasion threshold, four-point score limit and ΔE target. Each row has a standard, a specimen definition and a pass criterion. Inspection then runs not on "I liked it / I didn't" but on a shared set of measures.

Individual tests are valuable, but the real strength lies in gathering them all into a consistent specification document. In a vertically integrated structure, because the process runs under one roof from yarn to finishing, a deviation that surfaces in one test can be quickly traced back to the right stage (knitting, pre-finishing, dyeing, finishing treatment); this traceability speeds up corrective action.

The document can also cover sustainability and conformity expectations: when OEKO-TEX 100 limit values, ZDHC/MRSL chemical management and the certification chain can be tracked in the same file as the test results, audits become easier. Addressing this framework together with certificates and the dyeing/printing guide makes quality and conformity a single whole.

> **With KARCEM:** We fix your fastness, shrinkage, pilling, four-point and lab-dip targets in a single acceptance matrix tailored to your product, and trace every deviation back to the right stage in vertically integrated production. To discuss your test thresholds and colour targets, you can create a sample or quotation request.