

FACT SHEET TEXTILE FINISHING AND CLEANING TESTING

TexTrace® Woven RFID Brand Label

Introduction

This report describes a comprehensive study of passive UHF RFID (ultra-high frequency radio frequency identification) woven RFID brand labels from TexTrace. We describe each of the tests and illustrate the data to enable end users to make informed decisions about the true capability of the product.

As RFID adoption in the fashion industry continues to progress rapidly, fashion brands and retailers are seeking to reap more benefits from this versatile technology, going beyond logistics and well-known basic retail store applications such as inventory management. In order to enable these extended applications such as brand protection, production steering and electronic article surveillance (EAS), new requirements arise for software, hardware and, most importantly, RFID tags.

Going beyond – both upstream and downstream – means RFID tagging happens in early production stages, and the use of RFID does not end with the consumer’s purchase of a tagged product. Consequently, RFID tags must be able to withstand the textile finishing processes that are employed in garment manufacturing, as well as the cleaning processes occurring after point of sale. Also key is the reliability and security of RFID tag attachment, for instance with respect to return handling, anti-theft and product authentication.

The TexTrace® Woven RFID Brand Label was especially developed to enable the use of RFID from production until after sales. It is a truly textile RFID tag, where RFID is integrated in the brand’s woven brand label in a seamless way. This means neither the brand image nor the look and feel of the item are compromised by RFID. The TexTrace woven RFID brand label is an ideal source tagging solution, sewn onto the fashion item already during manufacturing, not only afterwards. This provides each item in a collection a unique identity that can be reliably and efficiently traced from production on to the display shelf and beyond, for the life of the product.



Textile Finishing and Cleaning Process Overview

In the manifold finishing processes that apparel items undergo, the parameters applied vary from brand to brand and are well-guarded company secrets. Among the chemicals and additives used, apart from water, are enzymes, bleach (e.g. chloride, ozone, peroxide) and pumice stones. The items are washed in large industrial washing drums (approximately 1.5 m in diameter), where the amount of liquid used ranges from very little water for

stone washing to lots of water for garment dyeing (high liquor ratio). Upon washing or dyeing, apparel items usually face a tumble drying. In order to fix resins and achieve 3D effects such as wrinkles, bleaching and curing in the oven at temperatures up to 160°C/ 320°F for roughly 20 minutes also may occur in between process steps or after the finishing process. Once the items are sold to the consumer, they will undergo cleaning processes such as domestic washings and dry cleanings.

The TexTrace woven RFID brand label, as integral part of the fashion item, hence faces a challenging environment in terms of mechanical stress, chemistry and temperature. In this fact sheet, we summarize the test results from various apparel finishing and cleaning processes conducted with fashion brands, garment manufacturers, cleaners and industrial labs.

Test Conclusion

In this paper, there are a number of standard tests to evaluate the performance of TexTrace’s woven RFID brand labels. The passive UHF RFID brand labels underwent extensive testing, ranging from finishing tests at clothing manufacturing facilities to post-sale garment cleaning tests. The tests focus on factors relevant to apparel brand owners to help them determine the right tag for the job by measuring performance with application read ranges, durability and temperature tolerances.

It was found that the TexTrace woven RFID brand label resists all of the common processes utilized in textile finishing and cleaning as referenced in this document. The variance in tag look and feel and performance of the RFID label was insignificant in the various processes representing real-world conditions. The results verified that TexTrace woven RFID brand labels not only have the original brand look and feel, they also resist stone and enzyme washes, as well as domestic washing and dry cleaning. Brand labels with built-in RFID are therefore applicable for a broad range of use cases in the fashion value chain, starting with production steering, through to inventory counting, electronic article surveillance (EAS) and guest experience until return handling and product authentication after sales.

Get in touch with us for further information on the performance or test settings and watch the TexTrace Woven RFID tag in action in our illustrative movie at:

www.youtube.com/watch?v=5cchVzmP7HA



1 Stone Washing

Stone washing gives a garment a worn-out appearance and helps to increase the softness and flexibility of otherwise stiff and rigid fabrics such as denim. The process uses pumice stones in a large industrial clothes washer to roughen up the fabric. As the wash cylinder rotates, the cloth fibers are repeatedly pounded and beaten as the tumbling stones ride up the paddles inside the drum and fall back down onto the fabric.

Test Parameters (conducted at customer's)

T	t	pH
40°C/ 140°F	60 min	n.a.
Additives: Pumice, a.o.		
Items: Jeans		

Look & Feel

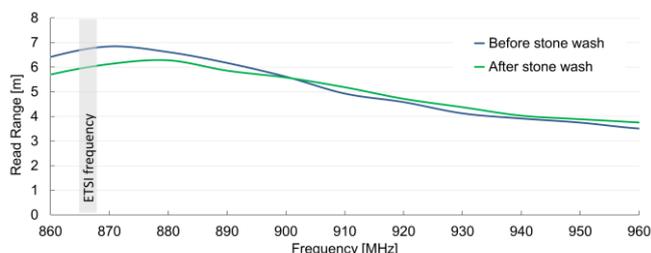
before stone wash:

after stone wash:



Sewn on jeans, position: underside of waistband. The picture to the right shows the tag after the process, removed from the item.

Performance



Number of test labels (ETSI-tuned): 50

Conclusion Stone Washing

The look and feel of the woven RFID label was not significantly altered by the stone wash process. The average RFID tag performance took a slight shift in the lower frequencies, which however bears no limitation in use from a practical perspective.

2 Enzyme Washing

Enzyme washing uses enzymes to finish fabric such as denim to give it a worn, aged look and to render the material softer and suppler. These effects are mainly achieved by chemically attacking the blue indigo dye, degrading cotton's cellulose and hydrolyzing starches. Enzyme washing was originally developed as a more environmentally friendly alternative to stone washing. Once the desired effect is achieved, the temperature or alkalinity of the bath can be changed to stop the enzymes. Because it does not physically abrade the fibers, enzyme washing does not weaken the denim.

Test Parameters (conducted at customer's)

T	t	pH
60°C/ 140°F	60 min	4 to 11
Chemicals: Enzymes, H ₂ O ₂ , chlorine, Silicon (not for denim)		
Items: Jeans		

Look & Feel

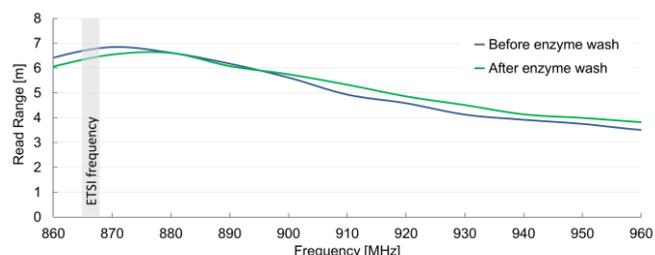
before enzyme wash:

after enzyme wash:



Sewn on jeans, position: underside of waistband. The picture to the right shows the tag after the process, removed from the item. Please note, the white thread remainders are not damage to the label and just show the thread used to sew on the label.

Performance



Number of test labels (ETSI-tuned): 50

Conclusion Enzyme Washing

The look and feel of the woven RFID label was not significantly altered by the enzyme wash process. The average RFID tag performance took a slight shift, which is insignificant from a practical use perspective and in line with the tag performance variation prior to the washing.

3 Garment Dyeing

Garment dyeing is the process of dyeing fully fashioned garments subsequent to manufacturing, as opposed to the conventional method of manufacturing garments from pre-dyed fabrics. The dyeing process usually uses a high liquor ratio and is therefore minimally abrasive.

Test Parameters (conducted at customer's)

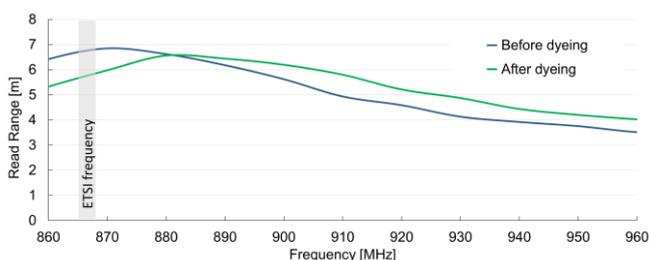
T	t	pH
90°C/ 194°F	3h	n.a.
Chemicals: Dyes, a.o.		
Items: Jeans		

Look & Feel



Sewn on jeans, position: underside of waistband. The picture to the right shows the tag after the process, removed from the item. Please note, the white thread remainders are not damage to the label and just show the thread used to sew on the label.

Performance



Number of test labels (ETSI-tuned): 50

Conclusion Garment Dyeing

The look and feel of the woven RFID label appeared slightly altered by the three-hour dyeing process, as is to be expected after a long, high-temperature treatment. The average RFID tag performance also took a visible shift. From a practical perspective, the impact of this performance shift is however minor and will not limit the applicability of the tags for a variety of use cases.

4 Domestic Washing

Domestic washing is the conventional cleaning process for clothing in private households. It uses a washing machine, water and detergent and is often followed by a tumble drying process.

Test Parameters (conducted at industrial lab)

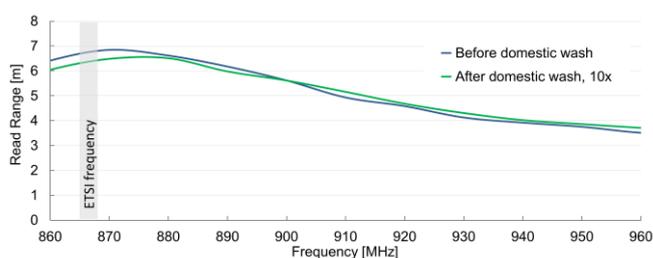
T	t	pH
Wash: 60°C/ 140°F	Wash: 70 min	n.a.
Tumble: ≤ 90°C/ 194°F	Tumble: 25 min	n.a.
Cycles: 10 x washing followed by tumble drying		
Chemicals: Reference detergent (IEC-A, perborate, TAED)		
Items: Trousers, jeans, shirts		

Look & Feel



Sewn on trouser, position: underside of waistband

Performance



Number of test labels (ETSI-tuned): 200

Conclusion Domestic Washing

The look and feel of the woven RFID label was not changed by the 10 washing and drying cycles. The average RFID tag performance took a minor shift in part of the global UHF frequency range, which is negligible from a practical use perspective.

5 Dry Cleaning

Dry cleaning is any cleaning process for clothing and textiles using a chemical solvent other than water. The solvent used is typically tetrachloroethylene (perchloroethylene), which the industry calls "PERC". It is used to clean delicate fabrics that cannot withstand the rough and tumble of a washing machine and clothes dryer; it is also an alternative to labor-intensive hand washing.

Test Parameters (conducted at cleaner's)

T	t	pH
Wash: 25°C/ 77°F	60 min	n.a.
Tumble: ≤ 80°C/ 176°F		n.a.
Cycles: 10 x washing followed by tumble drying		
Chemicals: PERC		
Items: Trousers, shirts		

Look & Feel

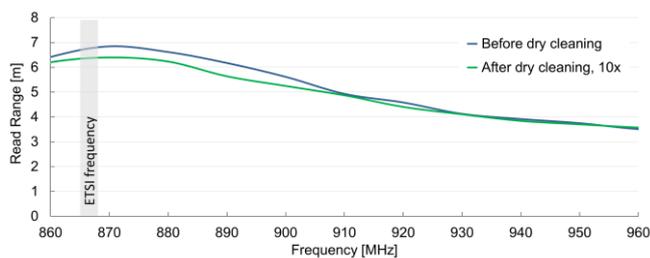
before dry cleaning:

after dry cleanings:



Sewn on shirt, position: neck

Performance



Number of test labels (ETSI-tuned): 100

Conclusion Dry Cleaning

The look and feel of the woven RFID label was not altered by the 10 dry cleanings. The average RFID tag performance took only a slight shift in part of the global UHF frequency range, which is insignificant from a practical use perspective and in line with the tag performance variation prior to the cleanings.