



DuPont™ Tyvek®

BECAUSE IT MAKES THE DIFFERENCE

Introduction

This document presents information about the DuPont™ Tyvek® protective fabric in comparison to Microporous Film and Spunbound Meltblown Synthetics (SMS). Here you will find the results of standard tests carried out on the three fabrics evaluating their performance as barriers to liquids and solid particulates. You will also find assessments carried out in terms of comfort and production quality.

Overview

- 1 Fabric structure
- 2 Barrier to liquids
- 3 Barrier to solid particulates
- 4 Comfort
- 5 Seams
- 6 Quality & sustainability
- 7 Conclusion



Fabric structure

Tyvek®: a unique structure



Tyvek®: a unique structure



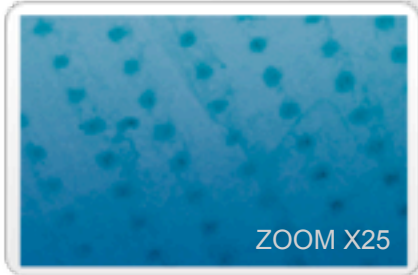
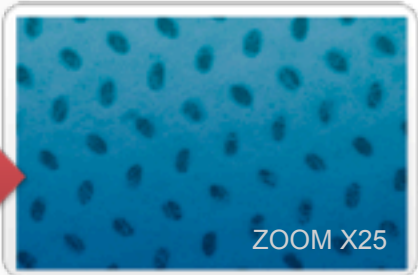
Produced with the flash-spinning method, TYVEK® fabric is made of continuous strong high density polyethylene fibers. That's why it does not shed fibers and its barrier is still effective even after abrasion.

SMS

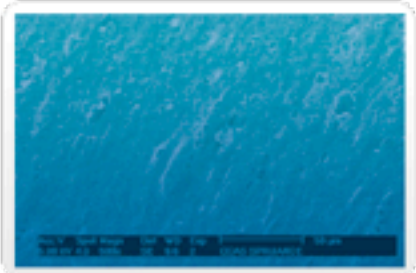
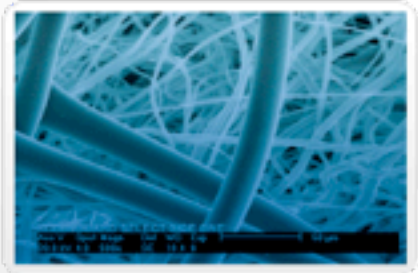
MICROPOROUS FILM

TYVEK®

AFTER 10 CYCLES OF ABRASION



TOP VIEW



Barrier to liquids

Permeation test: BEFORE ABRASION

Permeation test: AFTER ABRASION

Penetration test: BEFORE & AFTER ABRASION



Permeation test: EN ISO 6529 – Method A

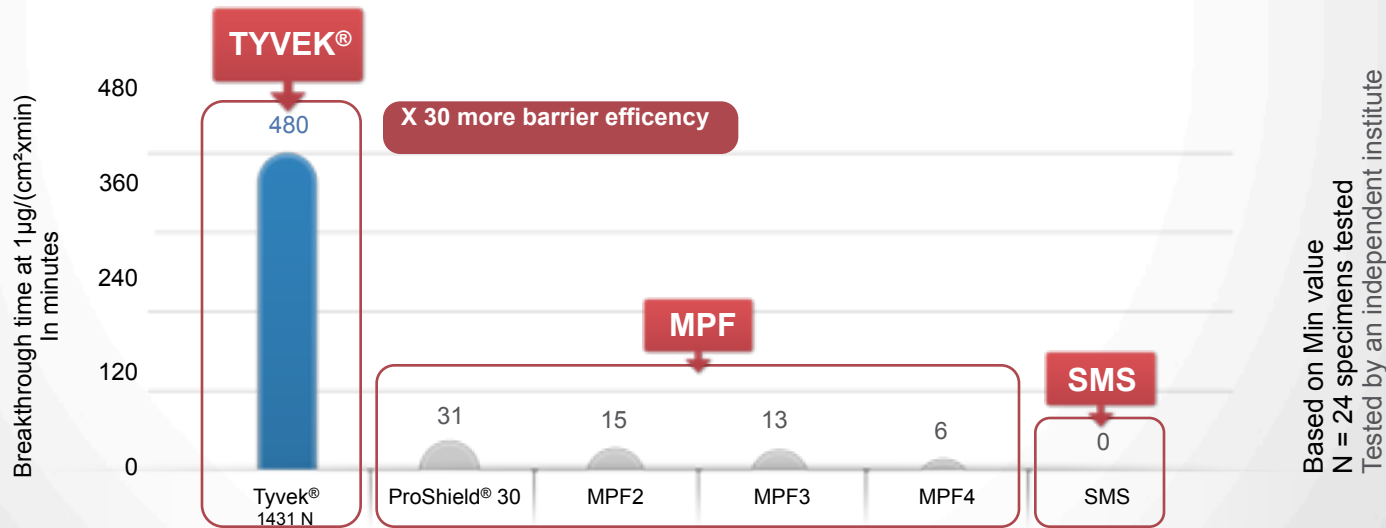
BEFORE ABRASION



Thanks to its unique structure, Tyvek® is a superior and safe barrier in terms of permeation resistance.

Tyvek® is a safe choice.
 Microporous Film may give the perception of good liquid protection because of repellency properties when in reality chemicals quickly permeate through.

PERMEATION (EN ISO 6529-Method A) Sulphuric acid 18%



Permeation = Permeation is a measure of chemical barrier performance. Permeation is invisible, but it may strike after a certain period of time if you are not sufficiently protected.

Permeation test: EN ISO 6529 – Method A

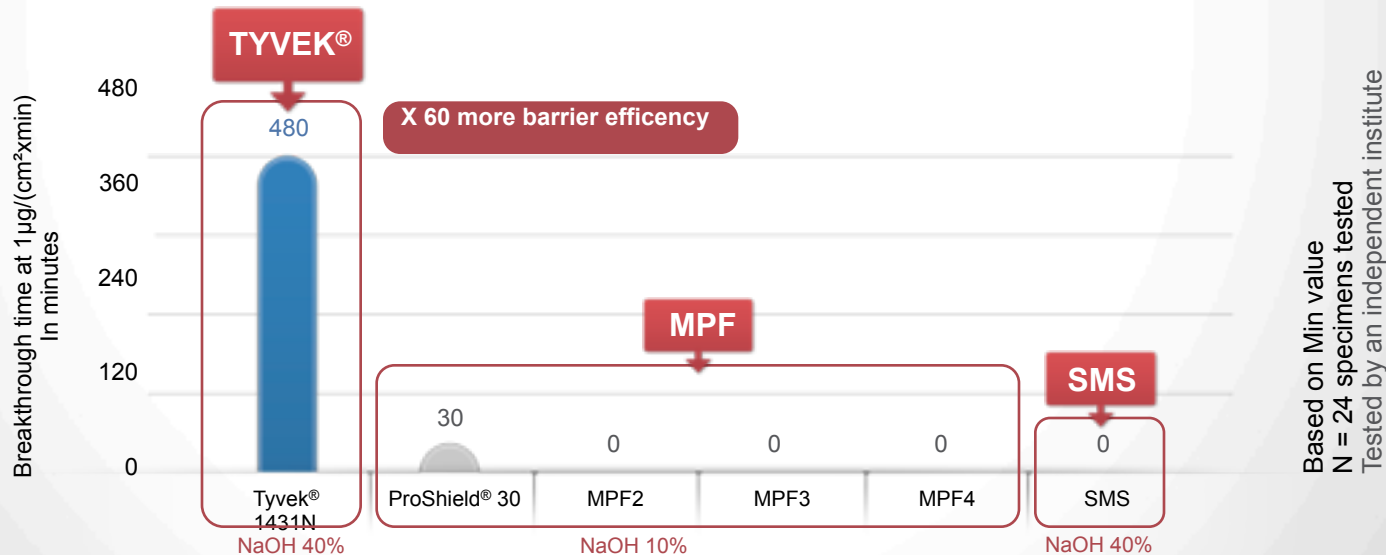
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PERMEATION (EN ISO 6529-Method A) Sodium hydroxide 40% & 10%



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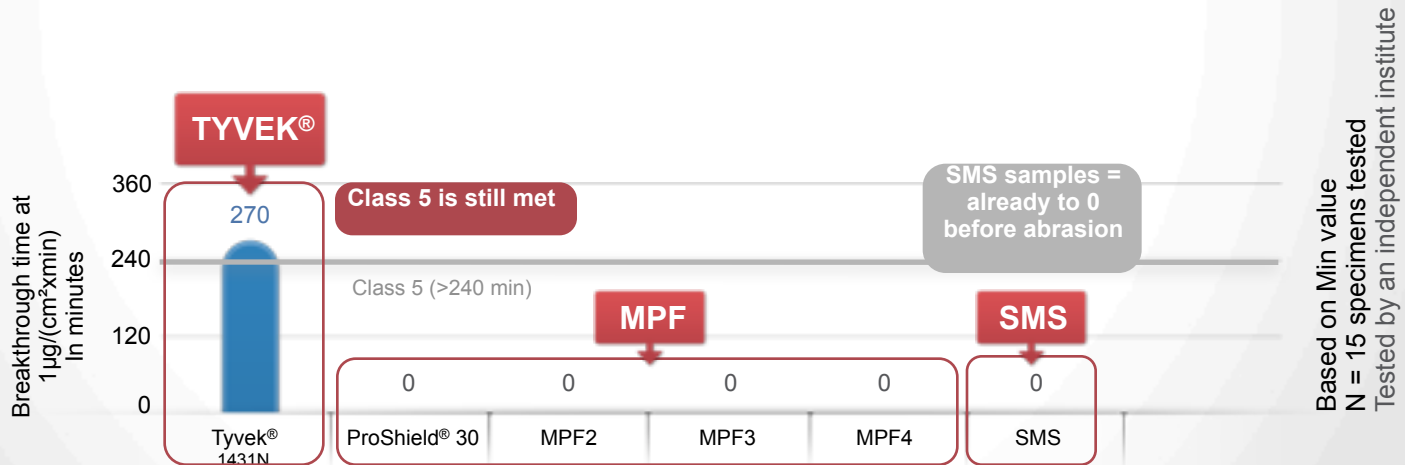
AFTER 10 CYCLES OF ABRASION: EN 530 – Method 2



After abrasion Tyvek® permeation performance remains the highest when alternative fabrics have lost all resistance to permeation.

Tyvek® reaches a permeation class of 5 (> 240 minutes) after abrasion.
 Microporous Film fabric shows an immediate breakthrough time for all samples.
 SMS fabric has an immediate breakthrough time BEFORE abrasion.

PERMEATION (EN ISO 6529-Method A) Sulphuric Acid 18%



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Permeation test: EN ISO 6529 – Method A

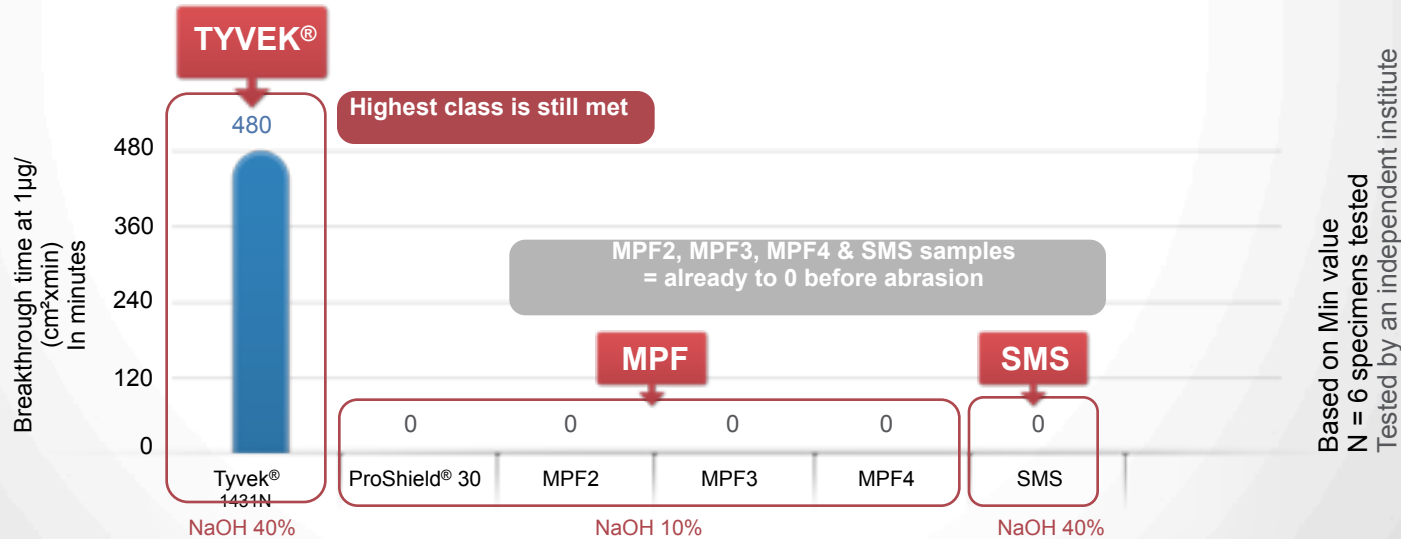
AFTER 10 CYCLES OF ABRASION: EN 530 – Method 2



After abrasion Tyvek® permeation performance remains the highest when alternative fabrics have lost all resistance to permeation.

Tyvek® barrier performance against sodium hydroxide is unaffected by abrasion, whereas Microporous Film and SMS fabrics show an immediate breakthrough time BEFORE abrasion.

PERMEATION (EN ISO 6529-Method A) Sodium hydroxide 40% & 10%



Permeation = Permeation is a measure of chemical barrier performance. Permeation is invisible, but it may strike after a certain period of time if you are not sufficiently protected.

Hydrostatic Head: EN 20811

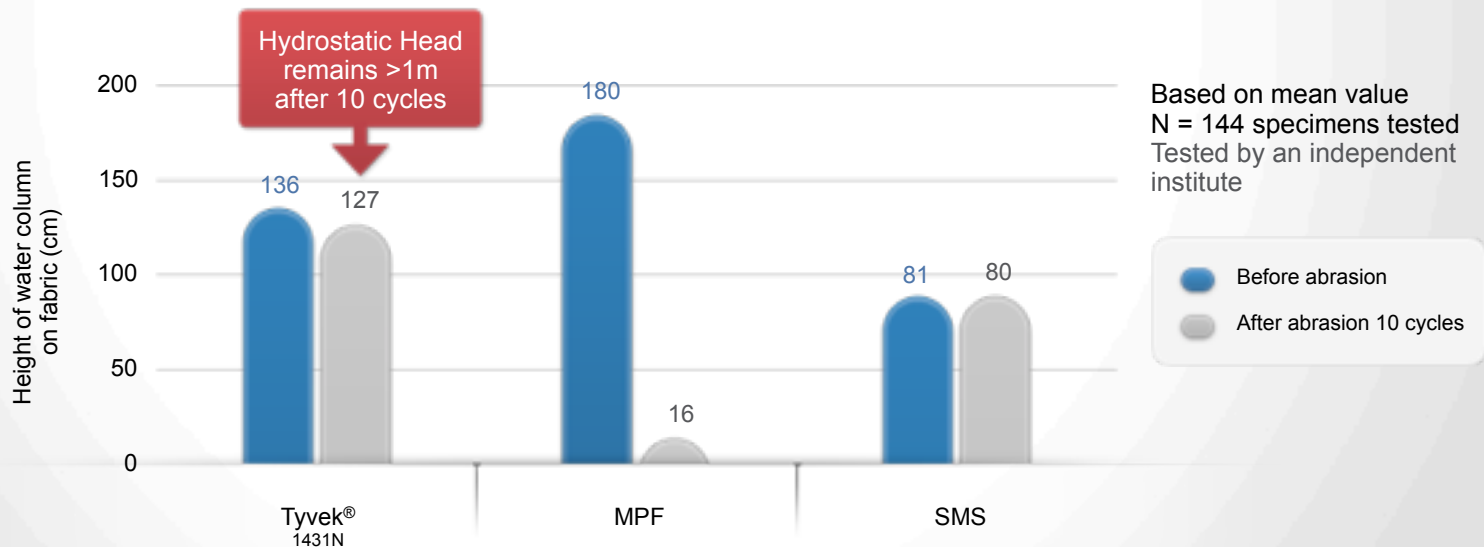
BEFORE & AFTER 10 CYCLES OF ABRASION: EN 530 – Method 2



After abrasion, Tyvek® penetration performance is the highest.

Prior to the abrasion test Microporous Film offers the best resistance to liquid pressure. But after just 10 cycles of abrasion, its performance takes a spectacular dive, while SMS is less affected but starts from a much lower performance level, and Tyvek® continues to protect.

HYDROSTATIC HEAD (EN 20811) before and after abrasion (EN 530-Method 2)



Hydrostatic Head = Hydrostatic Head determines the resistance of a fabric to water penetration under slight pressure.

Barrier to solid particulates

Protecting people inside

Protecting the processes outside



Protecting people: inside

The suit inward leakage test - EN ISO 13982 - (1&2)

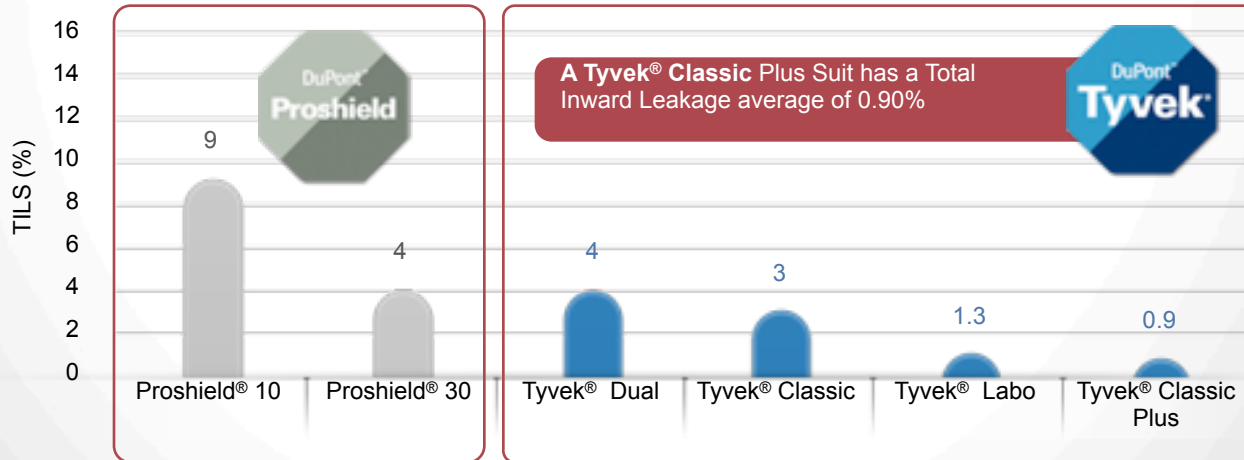


Tyvek® product range offers the highest barrier to particulates.

The type 5 test allows up to 15% inward leakage of particulates in the suits but who wants to accept this hazardous particulate environment?

- **ProShield® 30** (Microporous Film fabrics) may be easily abraded and the barrier layer can be readily worn away.
- **ProShield® 10** (SMS fabrics) tend to have quite open structures, offering low dry particle holdout performance to fine particulates.
- **Tyvek® Classic Plus** with over-taped seams offer a higher overall protection.

TOTAL INWARD LEAKAGE AVERAGE of the 10 suits & all activities EN ISO 13982-(1&2)



The tested coveralls were taped onto a full face mask, boots and gloves
Tested by an independent institute

The suit inward leakage test = This test essentially determines the barrier efficiency of the suit when challenged with sodium chloride particulates of a defined size distribution.

Protecting people: inside

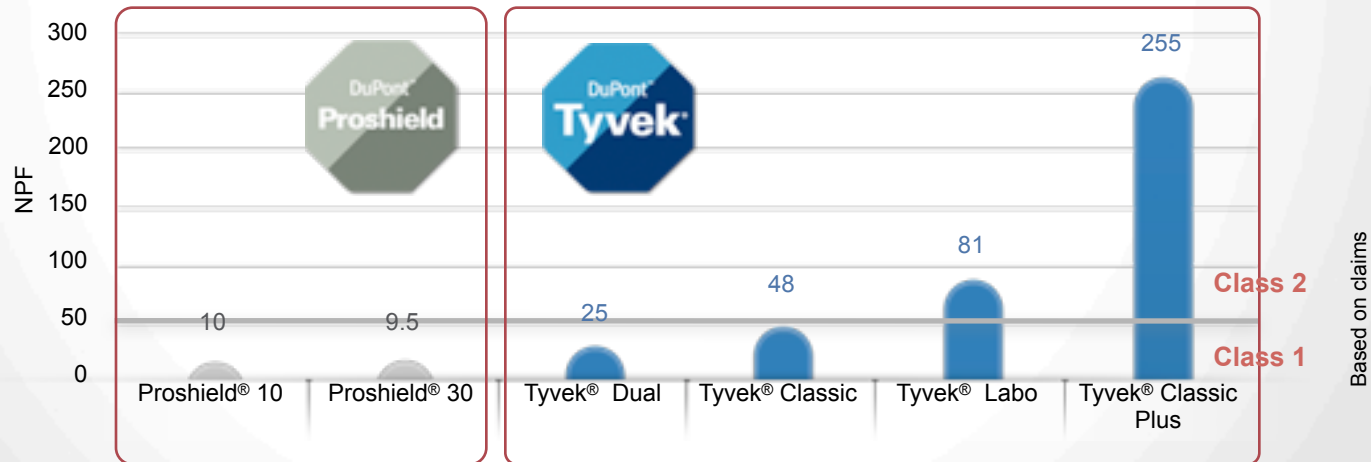
Nominal Protection Factor - EN 1073-2



Tyvek® product range offers the highest barrier to particulates.

Tyvek® Labo and Tyvek® Classic Plus meet Class 2.
The nominal protection factor is between 50 and 500.

NOMINAL PROTECTION FACTOR EN 1073-2



A suit which offers the **highest protection** to fine particulates will have **LOW inward leakage**, and thus a **HIGH nominal protection factor**.

Protecting the processes: outside

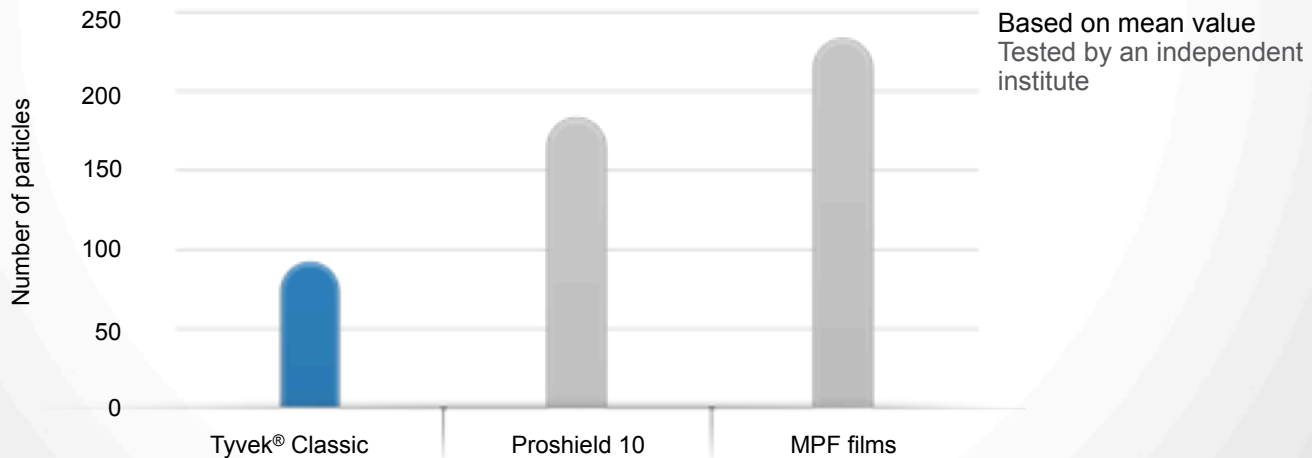
Dry linting propensity BS 6909



Tyvek® is low-linting.

Tyvek® is the ideal material for applications that require low linting (e.g: paint, pharmaceutical applications) because **its continuous, strong, high density polyethylene fibers do not shed.**

AVERAGE PARTICLE COUNT / 17 litres of air



BS 6909 = Method for generation and counting of the airborne linting propensity of fabrics in the dry state.

4 Comfort

Water vapour resistance = Ret / by product family

Humidity between underwear and garment / by product family (sweat simulation)



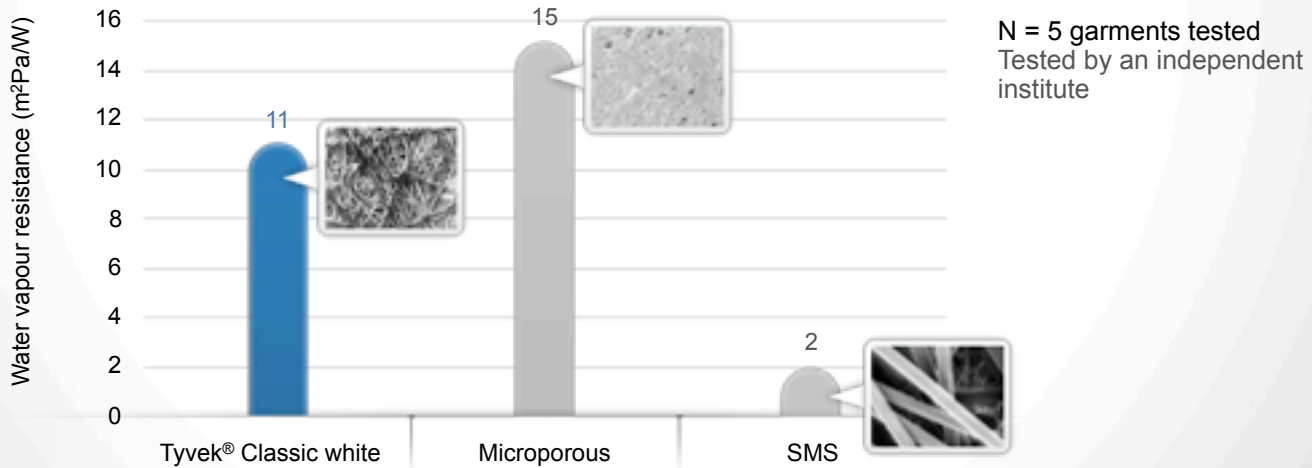
Water vapour resistance = Ret (Resistance evaporation transmission)

By product family



The lower resistance is, the higher the amount of water will be able to evaporate. SMS fabrics with their open structure show the best breathability performance but we know their protection performance is limited. **Tyvek® offers the best balance between comfort and protection.**

WATER VAPOUR RESISTANCE RET



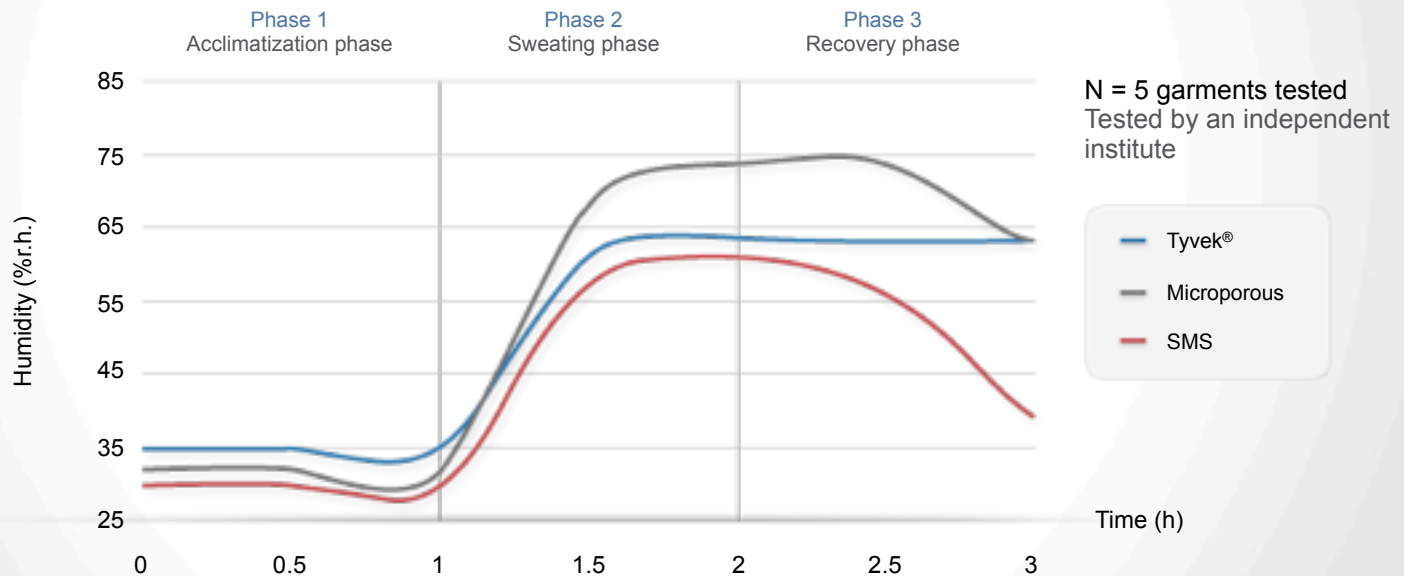
Ret = Ret is the measurement of the resistance to evaporative heat loss. The lower the Ret value, the less resistance to moisture transfer and the more breathable the fabric.

Humidity between underwear and garment (sweat simulation)

By product family



With their open structure, SMS coveralls allow the most humidity to escape and are better by far than the Microporous Film coveralls. Tyvek® offers quite a good performance during sweating and recovery phase. Microporous Film is the material that takes the longest time to remove humidity.



Test Method:
Physiological measurements with the Thermal Agile Manikin (SAM) on a protective clothing system

Seams

Tight and reliable seams – a top priority for DuPont

Are seams tight?

Hydrohead results


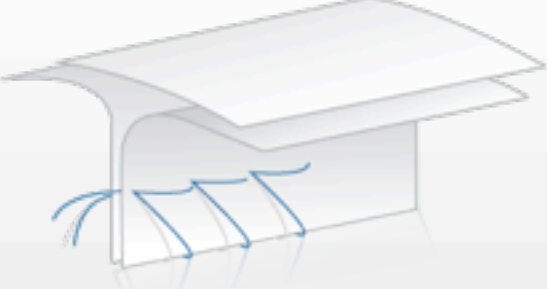
Permeation results




Tight and reliable seams: a top priority for DuPont



When selecting a garment, carefully check the quality of the seams, as they contribute to the overall protection of the garment.

<p>STITCHED Type 5/6</p>	<p>STITCHED & OVERTAPED Type 3/4</p>
	
<p>Stitching offers good balance between seam strength and seam barrier.</p>	<p>Seams can be stitched and overtaped. The tapes used for DuPont products with this type of seam offer a barrier equal to that of the fabrics.</p>

	<p>BOUND SEAMS</p>
<ul style="list-style-type: none"> • Seam construction leaves the needle holes visible. • Construction can not offer a permeation barrier equal to the fabric 	

Are seams tight?



Not all seams are tight



Definition of tight = so compact that liquids or gas cannot enter or escape



Based on permeation and hydrohead test results, we can say that:

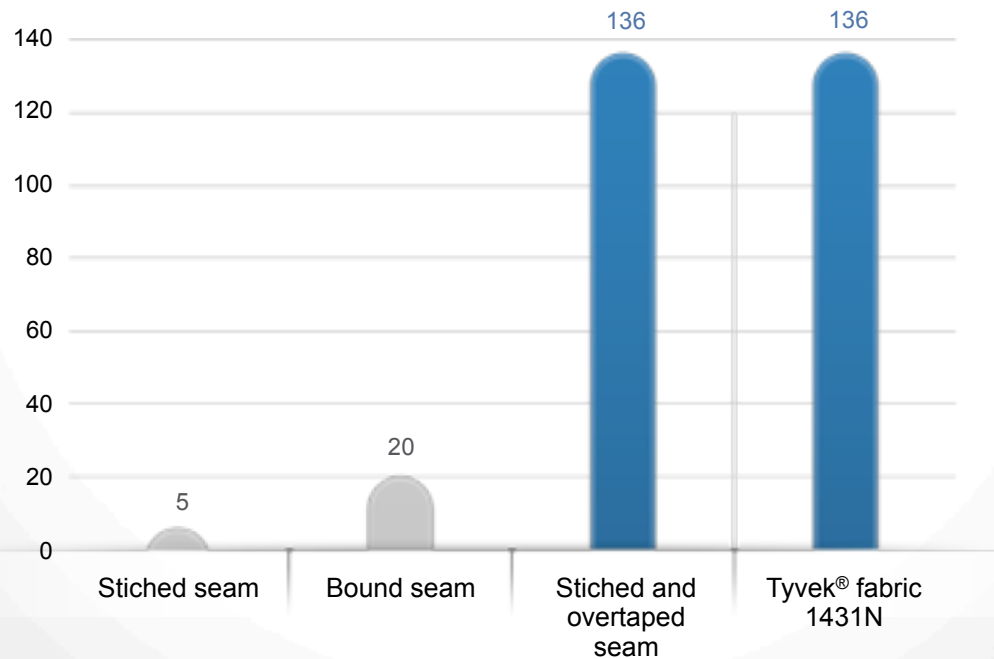
- Stitched seams are not fully tight.
- Stitched and overtaped seams are tight and offer same barrier as fabric.

Hydrohead results



Based on the water column test, stitched and overtaped seams are tight and offer same barrier as the fabric.

HYDROHEAD DIN EN 20811 (cm H₂O)



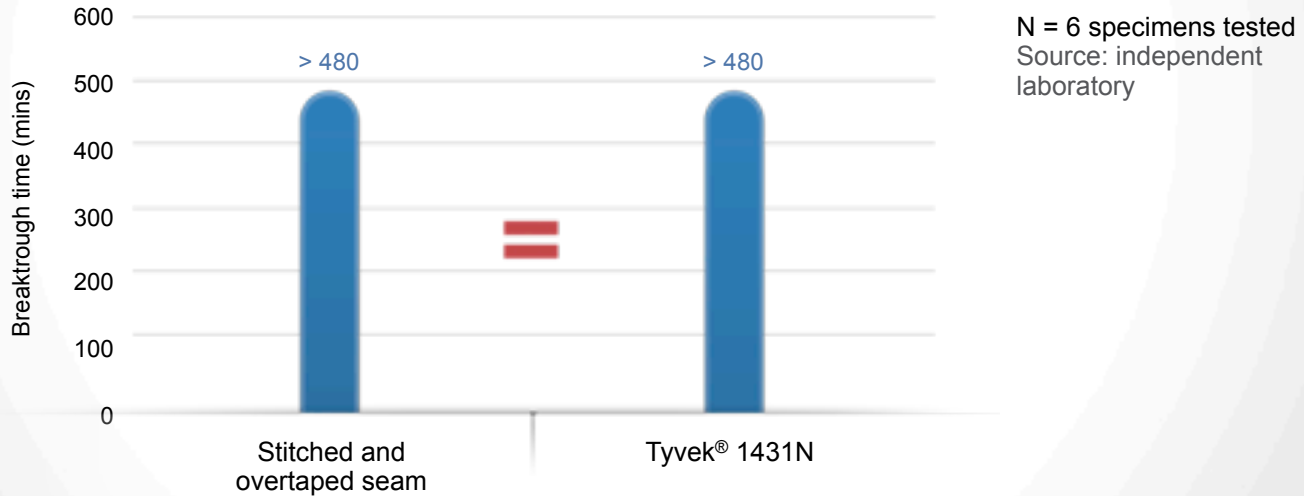
N = 16 specimens tested
Internal test

Permeation results



Based on permeation testing, stitched and overtaped seam of model Classic Plus are tight and offer the same barrier as the fabric.

PERMEATION EN ISO 6529 with NaOH 40% (BT 1.0 in min at 1.0 µg/cm²/min)



Quality & sustainability

Core values & product stewardship

Going beyond the minimum requirements of the directive 89/686/ECC



Core values & product stewardship



PRODUCT STEWARDSHIP

- // All Tyvek® products must be:
- **Safe for use**, correctly labelled to avoid misuse.
 - **Meet performance marketing claims** (supported by technical data).
 - **Composition verification** for carcinogens and do not contain REACH substances or DMF.
 - **Skin Patch (allergy) testing** conducted, latex and toxicological review
 - Minimize **environmental** footprint.
 - **Comply** with legislation.

HIGHEST ENVIRONMENTAL & ETHICAL STANDARDS

- // Rigorous policies in place to ensure the highest environmental respect & ethical standards.
- // Health, safety, quality, environmental standards are applied to our garment conversion facilities that go well beyond local requirements or legislation.

Going beyond the minimum requirements of directive 89/686/ECC



TYVEK® STRINGENT QUALITY CONTROL SYSTEM

- // Tyvek® is routinely and rigorously controlled under strict procedures.
- // Tyvek® fabric production quality control monitors more than 200 data/day.
- // Tyvek® garments are controlled at the converter location and at DuPont.

TYVEK® QUALITY CONTROL COMPLIES WITH ARTICLE 11

- // DuPont has the experience and testing facilities to implement:
 - “Non-routine” testing equipment for the fabric.
 - Type 4 & 6 test cabin (calibrated and comparable with external institute).
- // DuPont is periodically audited by a notified body to check Tyvek® conformity to the relevant requirements.

Conclusion

- Great performance
- Medium performance
- Limited performance

	Barrier to liquid				Barrier to solid particulates		Comfort
	Permeation test EN ISO 6529 Method A		Hydrostatic Head EN ISO 6529 Method A		INSIDE (protecting people) The suit inward leakage test EN ISO 13982-(1&2)	OUTSIDE (protecting the processes) Dry linting propensity BS 6909	Water vapour Resistance Ret
	Before abrasion	After abrasion*	Before abrasion	After abrasion*			
Tyvek®							
Microporous Film							
SMS							

5

1

* 10 cycles of abrasion - simulating 1-day use



Protective suits may look the same, but only from a distance. Independent testing according to normative requirements shows that the unique DuPont Tyvek® material offers superior protection in terms of permeation, comfort and durability when compared with Microporous Film and SMS.

The DuPont logo, consisting of the word "DUPONT" in white capital letters inside a red oval.A man in a white Tyvek protective suit stands in the foreground of a large industrial factory. He has his hand on his hip and is looking directly at the camera. In the background, several other workers in similar suits are visible, along with large rolls of material on a conveyor system. The lighting is dramatic, with strong highlights and deep shadows.

**ALL SUITS LOOK THE SAME, BUT ONLY ONE
SUIT MAKES THE DIFFERENCE. TYVEK®.**

Find out more differentprotection.tyvek.com

The DuPont logo, consisting of the word "DUPONT" in white capital letters inside a red oval.

Tyvek.

DISCLAIMER

This information is based upon technical data that DuPont believes to be reliable. It is subject to revision as additional knowledge and experience becomes available. DuPont does not guarantee results and assumes no obligation or liability in connection with this information.

It is the user's responsibility to determine the level of toxicity and the proper personal protective equipment needed. This information is intended for use by persons having the technical expertise to undertake evaluation under their own specific end-use conditions, at their own discretion and risk.

Anyone intending to use this information should first check that the garment selected is suitable for the intended use. The end-user should discontinue use of garment if fabric becomes torn, worn or punctured, to avoid potential chemical exposure. Since conditions of use are beyond our control, we make no warranties, expressed or implied, including but not limited to warranties of merchantability or fitness for a particular purpose and assume no liability in connection with any use of this information.

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The results for Tyvek® are based on internal and external tests performed on DuPont™ White Tyvek® 1431N (Europe). Performance of other Tyvek® styles and colors may differ.