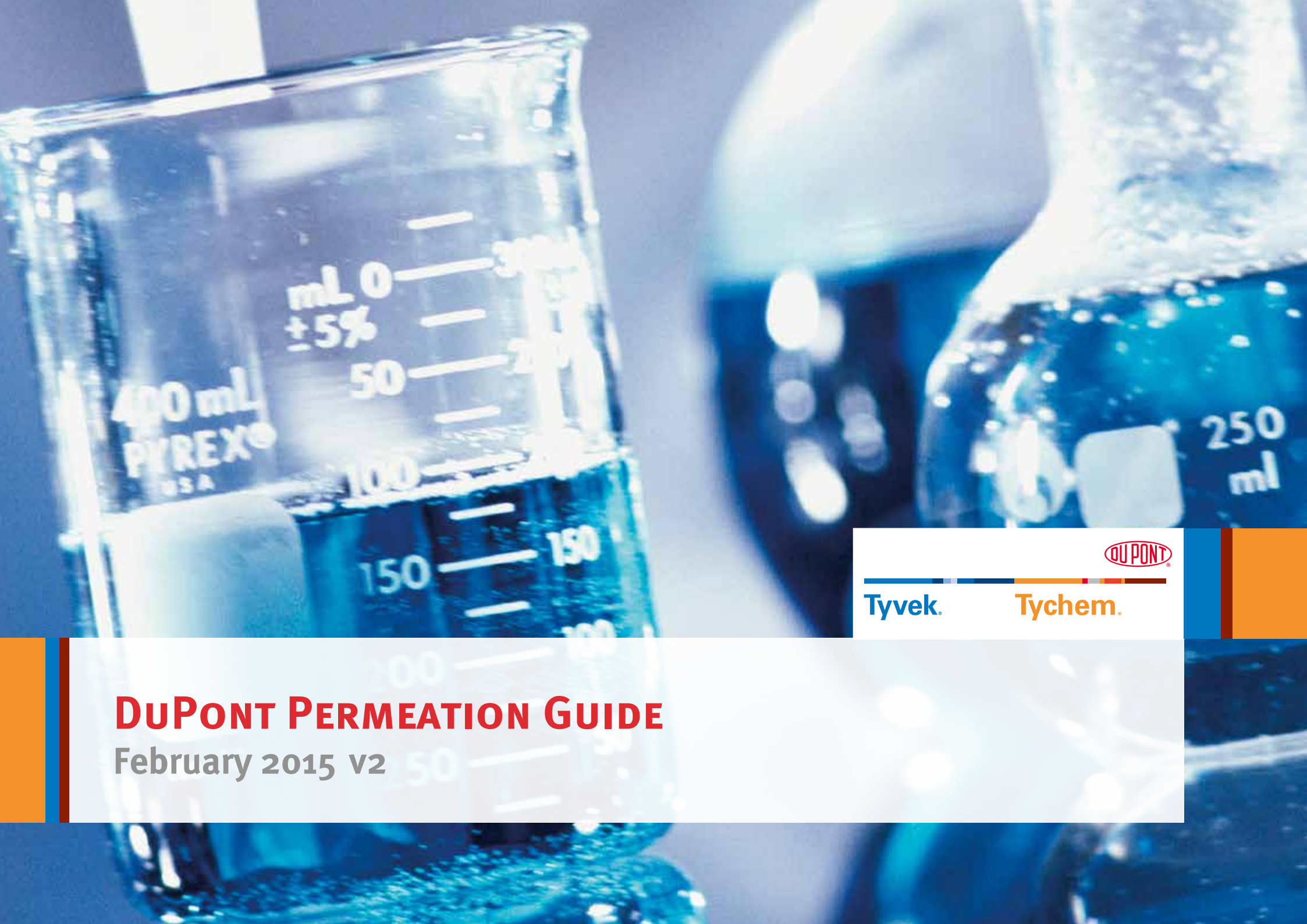


DuPont

Tyvek. Tychem.

DuPont Permeation Guide

February 2015 v2

INTRODUCTION

The DuPont Permeation Guide and DuPont™ SafeSPEC™

On the following pages you will find permeation data for the DuPont™ Tyvek® and DuPont™ Tychem® fabrics used to produce our chemical protective garments. This permeation guide has been updated with the latest test results for new chemicals and fabrics, with this current issue reflecting the available published data as of February 2015.

A new, online source for the very latest permeation data, presented in a customizable and extractable form, is provided by DuPont™ SafeSPEC™ (www.safespec.dupont.co.uk). Beyond the most recent permeation test results, SafeSPEC™ facilitates the selection and comparison of the entire DuPont chemical protective range, whether by brand, design or protective performance (Type, Standard, etc.). Once selected, further details on the specific product, including design features, performance and relevant literature, can be easily accessed within just a few clicks of the mouse.

Using the **Selector Tools**, visitors can find proposals for the most appropriate DuPont garment based on the hazard they face or by identifying the industry and task they are involved in. A further, notable feature of SafeSPEC™ is the option for the user to receive notification of any significant changes to DuPont garments, from their permeation data to packaging and references.

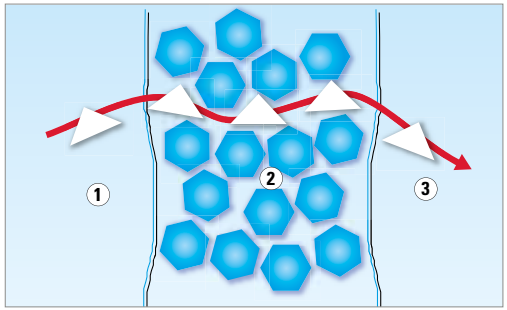
DuPont™ SafeSPEC™

www.safespec.dupont.co.uk

What is permeation?

Permeation is the process by which a potentially hazardous chemical moves through a material on a molecular level. Permeation can be represented by the following simplified diagram (Fig. 1).

Fig. 1 - Permeation



① Sorption of molecules of liquid onto the contracted (outside) surface of the fabric.

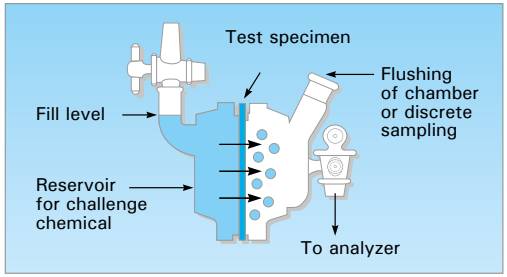
② Diffusion of the sorbed molecules across the fabric.

③ Desorption of the molecules from the opposite (inside) surface of the fabric.

Measuring permeation

The resistance of a protective clothing fabric to permeation by a chemical can be determined by testing a fabric against a challenge chemical according to EN ISO 6529 (method A and B), ASTM F739 or EN 374-3. For these methods a two-chambered test cell is used. The test specimen is positioned between the two sections of the cell.

Fig. 2 - Permeation test cell



On the challenge side of the test cell the outside fabric surface is exposed continuously to the challenge chemical. The sampling side of the test cell is analytically monitored. The normal test duration is 480 minutes.

An explanation of the parameters which describe the resistance to permeation is given below.

Permeation rate

A permeation rate indicates the mass of the chemical in micrograms, which can be transferred through one square centimeter of the fabric in one minute. The unit is µg/cm²/min.

Minimum detectable permeation rate (MDPR)

The lowest rate of permeation that is measurable is called the minimum detectable permeation rate (MDPR). The MDPR can vary depending on the sensitivity of the analytical device for the given substance. Minimum detectable permeation rates can be as low as 0.001 µg/cm²/min in certain cases.

Breakthrough detection time (Actual breakthrough time)

The breakthrough detection time or actual breakthrough time is the time elapsed between initial contact of the chemical with the outside surface of the protective clothing fabric and its detection at the inside surface. Actual breakthrough has taken place when the minimum detectable permeation rate has been reached. A breakthrough detection time of more than 480 minutes indicates that the challenge chemical did not reach the minimum detectable permeation rate during the test time of 480 minutes.

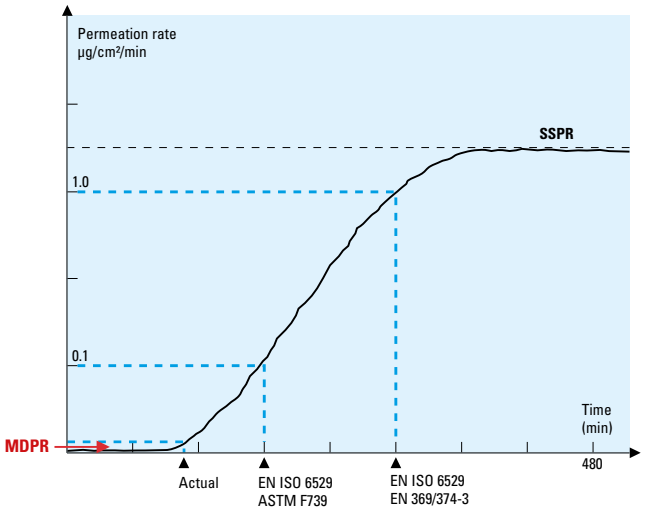
There is the possibility that a breakthrough at a lower permeation rate than the minimum detectable permeation rate has in fact taken place. To be able to assess the actual breakthrough time the minimum detectable permeation rate should be indicated.

Normalized permeation rate

To be able to compare permeation data, the breakthrough time is reported at defined permeation rates. According to ASTM F739 the normalized breakthrough detection time is reported at a permeation rate of 0.1 µg/cm²/min. According to EN 374-3 and EN 369 the normalized breakthrough detection time is reported at a rate of 1.0 µg/cm²/min.

The test method EN ISO 6529 provides the choice of two normalized permeation rates for reporting the results: 0.1 µg/cm²/min or 1.0 µg/cm²/min.

Fig. 3 - "Typical" permeation cell results



Steady state permeation rate (SSPR)

The constant permeation rate that occurs after reaching equilibrium is called the steady state permeation rate. There is the possibility that a steady state permeation rate is not reached during a measurement.

Performance classes according to EN 14325*

Chemical protective clothing is classified into six classes based on a normalized permeation rate of 1.0 µg/cm²/min.

Table 1

Normalized breakthrough time at a permeation rate of 1.0 µg/cm²/min *in minutes*	EN Class*
> 10	1
> 30	2
> 60	3
> 120	4
> 240	5
> 480	6

** EN 14325: Protective clothing against chemicals – test methods and performance classification of chemical protective clothing*

Cumulative permeation mass after 480 min (CUM)

Cumulative mass is the mass of the challenge chemicals which permeates through 1 cm² fabric during the test duration of 480 minutes. The lower the mass the better performs the fabric as a barrier to this chemical.

Time to reach cumulative permeation mass of 150 µg/cm² (TIME 150)

This is the time to reach a cumulative permeation of 150 µg/cm².

Classification according to ISO 16602*

The permeation resistance according to time to cumulative permeation of 150 µg/cm² is classified into classes.

Table 2

Time to cumulative permeation of 150.0 µg/cm²µg/(cm²·min)	Class*
≥ 10	1
≥ 30	2
≥ 60	3
≥ 120	4
≥ 240	5
≥ 480	6

** ISO 16602: Protective clothing for protection against chemicals -- Classification, labelling and performance requirements*

Permeation data table

The permeation data table for the Tychem® C, Tychem® C2, Tychem® 4000, Tychem® F , Tychem® F2 and Tychem® TK. fabrics is organized alphabetically. For each chemical the CAS-number and the physical state is listed. CAS-number is a unique numerical identifier created and assigned to a chemical substance by the Chemical Abstract Society. The physical state describes the state in which the chemical has been tested. Unless otherwise stated, the tests were performed with pure chemicals (> 95%) under laboratory conditions at room temperature and environmental pressure.

The table shows the following data for each chemical:

- Normalized breakthrough time at 0.1 µg/cm²/min in minutes
- Normalized breakthrough time at 1.0 µg/cm²/min in minutes
- Performance class according to EN 14325

* ISO 16602:2007 establishes minimum performance classification and labelling requirements for protective clothing designed to provide protection against chemicals.

The following data are available in SafeSPEC™:

- Actual Breakthrough time in minutes
- Steady State permeation rate in µg/cm²/min
- Minimum detectable permeation rate in µg/cm²/min

Interpreting permeation data

				Tychem® F/F2 Barrier to a range of organic and highly concentrated inorganic chemicals					
				Breakthrough time					
	Chemical Name	Physical State	CAS-No.	Actual	Normalized at 0.1 µg/cm²/min	Normalized at 1.0 µg/cm²/min	EN Class according to EN 14325	Steady State Permeation Rate	Minimum Detection Rate
				minutes	minutes	minutes		µg/cm²/min	µg/cm²/min
Example 1	Sulfuric acid (98%)	L	7664-93-9	> 480	> 480	> 480	6	< 0.01	0.01
Example 2	Cresol-o	L	95-48-7	124*	180	205*	4	2.7	0.001
Example 3	Dichloro-methane	L	75-09-2	imm	imm	imm	-	23.7	0.03

L: Liquid

Example 1: Sulfuric acid, CAS 7664-93-9, 98%*

Tychem® F is exposed to Sulfuric acid, 98% for a test duration of more than 480 minutes. No breakthrough has taken place at the minimum detection rate of 0.01 µg/cm²/min, the normalized breakthrough time at 0.1 µg/cm²/min and 1.0 µg/cm²/min. The breakthrough time for these permeation rates are reported with more than 480 minutes. Based on the results for the normalized breakthrough time at 1.0 µg/cm²/min the resistance to permeation is classified into class 6 according to EN 14325.

The permeation did not reach equilibrium at a measurable level. Therefore the steady state permeation rate is below the minimum detectable permeation rate.

There is the possibility that Sulfuric acid permeates the barrier, but at a lower rate than 0.01 µg/cm²/min. Based on the permeation data, Tychem® F fabric can be considered as offering a chemical barrier to

* Warning: presence of vapours must be addressed in the garment risk assessment.

liquid 98%* Sulfuric acid. The selected fabric should then be taken into the next step of the garment selection process as part of the workplace risk assessment.

Example 2: o-Cresol, CAS 95-48-7.

Tychem® F is exposed to o-Cresol, CAS 95-48-7 for a test duration of more than 480 minutes. Breakthrough has taken place at the minimum detection rate of 0.01 µg/cm²/min after 124 minutes. The normalized breakthrough time at 0.1 µg/cm²/min has been reached after 180 minutes and the normalized breakthrough time at 1.0 µg/cm²/min after 206 minutes.

Based on the results for the normalized breakthrough time at 1.0 µg/cm²/min the resistance to permeation is classified into class 4 according to EN 14325. The permeation reached equilibrium at a rate of 2.7 µg/cm²/min between 206 and 480 minutes.

Based on the permeation data, Tychem® F fabric shall be considered as offering a **limited barrier only** to o-Cresol. The end-user shall decide in a risk assessment if garments or accessories made from Tychem® F are suitable for his application. Careful attention must be paid to the working temperature, exposure time, contaminated suit area, chemical toxicity and working practices.

Example 3: Dichloromethane CAS 75-09-2.

Tychem® F has been tested against Dichloromethane CAS 75-09-2. The minimum detection rate of 0.01 µg/cm²/min and the normalized breakthrough time at 0.1 µg/cm²/min are reached immediately. The normalized breakthrough time at 1.0 µg/cm²/min has been reached after 15 minutes. The steady state permeation rate of 23.7 µg/cm²/min indicates that high quantities will permeate.

Based on the permeation data, Tychem® F fabric shall be considered as an **insufficient barrier** to Dichloromethane. For certain tasks, whereby the exposure risk is highly unlikely and the employee is trained to remove the PPE upon eventual exposure, then garments made of Tychem® F could be considered in the risk assessment. Extreme caution must be applied. If possible, identifying a fabric which offers a higher chemical permeation barrier would be a recommended safer approach.

* Warning: presence of vapours must be addressed in the garment risk assessment.

Important note: The permeation data published have been generated for DuPont by independent accredited testing laboratories according to the test method applicable at that time (EN 369, ASTM F739, EN 374-3 or EN ISO 6529 (method A and B)). The data is typically the average of three samples tested.

Cumulative permeation data have been measured or have been calculated based on steady state permeation rate.

All chemicals have been tested at a concentration of greater than 95% unless otherwise stated. The tests were performed at room temperature and environmental pressure unless otherwise stated. A different temperature may have significant influence on the breakthrough time. Permeation typically increases with temperature.

Permeation data are usually measured for single chemicals. The permeation characteristics of mixtures can often deviate considerably from the behaviour of the individual chemicals.

Breakthrough time is not the same as safe wear time. Breakthrough time alone is insufficient to determine how long a garment may be worn once the garment has been contaminated. Safe user wear time may be longer or shorter than the breakthrough time depending on the permeation behaviour of the substance, the toxicity of the substance and the exposure conditions. Breakthrough times are indicative of the barrier performance, but results can vary between the test methods and laboratories.

Please use the permeation data as part of the risk assessment to assist the selection of a protective fabric, garment or accessory suitable for your application. Working conditions, exposure conditions (e.g. temperature, pressure, concentration, physical state), and the toxicity data for the chemical need to be taken into account.

Chemical warfare agents (Lewisite, Sarin, Soman, Mustard, Tabun and VX Nerve Agent) have been tested according to MIL-STD-282 at 22°C or according to FINABEL 0.7 at 37°C.

Permeation data for Tyvek® is applicable to white Tyvek® L1431N only and is not applicable for other Tyvek® styles or colours.

The information provided herein corresponds to our knowledge on the subject at the date of its publication. This information may be subject to revision as new knowledge and experience becomes available. The data provided fall within the normal range of product properties and relate only to the specific material designated; these data may not be valid for such material used in combination with any other materials or additives or in any process, unless expressly indicated otherwise. The data provided should not be used to establish specification limits or used alone as the basis of design; they are not intended to substitute for any testing you may need to conduct to determine for yourself the suitability of a specific material for your particular purposes. Since DuPont cannot anticipate all variations in actual end-use conditions DuPont makes no warranties and assumes no liability in connection with any use of this information. Nothing in this publication is to be considered as a license to operate under or a recommendation to infringe any patent rights.

- **Need selection assistance?**
- **Need technical advice?**
- **No chemical permeation data for your chemical?**

DuPont experts can provide technical assistance with your fabric and garment selection process. Using a simple web-based questionnaire, please provide relevant information on chemicals, exposure and working conditions for a customized response.

Independent permeation testing of your specific chemical with the DuPont barrier fabrics can also be facilitated.

To check the most updated permeation data, please visit SafeSPEC™ under the following link:

DuPont™ SafeSPEC™

www.safespec.dupont.co.uk

TYCHEM® FABRICS – Permeation Data

Chemical Name	CAS	Physical State	Tychem® C/C2			Tychem® 4000			Tychem® F/F2			Tychem® TK.		
			BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN
2-(2-Butoxyethoxy) ethanol	112-34-5	Liquid							>480	>480	6			
2-(2-Ethoxyethoxy) ethanol	111-90-0	Liquid				>480	>480	6						
Acetaldehyde	75-07-0	Liquid							imm	13*	1	>480	>480	6
Acetic acid (10%)	64-19-7	Liquid	>480	>480	6									
Acetic acid (2%)	64-19-7	Liquid	>480	>480	6									
Acetic acid (>95%)	64-19-7	Liquid	imm	imm		>480	>480	6	>480	>480	6	>480	>480	6
Acetic acid 2 ethoxy ethyl ester	111-15-9	Liquid				116*	>480	6	>480	>480	6	>480	>480	6
Acetic acid 2 methoxy ethyl ester	110-49-6	Liquid				>480	>480	6	>480	>480	6	>480	>480	6
Acetic acid ethenyl ester	108-05-4	Liquid										>480	>480	6
Acetic acid ethyl ester	141-78-6	Liquid	imm	imm		imm	9*		>480	>480	6	>480	>480	6
Acetic acid pentyl ester	628-63-7	Liquid							136*	>480	6	>480	>480	6
Acetic anhydride	108-24-7	Liquid				12*	>480	6	>480	>480	6	>480	>480	6
Acetic chloride	75-36-5	Liquid				39*	>480	6	>480	>480	6	>480	>480	6
Acetone	67-64-1	Liquid	imm	nm		imm	29*	1	>480	>480	6	>480	>480	6
Acetone cyanohydrin	75-86-5	Liquid							>480	>480	6	>480	>480	6
Acetonitrile	75-05-8	Liquid	imm	imm		60	>480	6	>480	>480	6	>480	>480	6
Acetyl chloride	75-36-5	Liquid				39*	>480	6	>480	>480	6	>480	>480	6
Acroleic acid	79-10-7	Liquid	imm	imm		>480	>480	6	>480	>480	6	>480	>480	6
Acrolein	107-02-8	Liquid							48*	>480	6	>480	>480	6
Acrolein (90%)	107-02-8	Liquid				24	24	1						
Acryl amide (50%)	79-06-1	Liquid				>480	>480	6	>480	>480	6	>480	>480	6
Acrylic acid	79-10-7	Liquid	imm	imm		>480	>480	6	>480	>480	6	>480	>480	6
Acrylic acid ethyl ester	140-88-5	Liquid										>480	>480	6
Acrylic acid n-butyl ester	141-32-2	Liquid										>480	>480	6
Acrylic amide (50%)	79-06-1	Liquid				>480	>480	6	>480	>480	6	>480	>480	6
Acrylonitrile	107-13-1	Liquid	imm	imm		36*	36*	2	8	>480	6			
Acryloyl Chloride	814-68-6	Liquid				3	6		334	>480	6			
Adipic acid dinitrile	111-69-3	Liquid							>480	>480	6	>480	>480	6
Adipic acid nitrile	111-69-3	Liquid							>480	>480	6	>480	>480	6
Adiponitrile	111-69-3	Liquid							>480	>480	6	>480	>480	6
Adipyl dinitrile	111-69-3	Liquid							>480	>480	6	>480	>480	6

BT 0.1 Normalized breakthrough time at 0.1 µg/cm²/min
BT 1.0 Normalized breakthrough time at 1.0 µg/cm²/min
EN Classification according to EN 14325
CAS Chemical abstracts service registry number

mins Minutes
> Larger than
< Smaller than

imm Immediate (< 4 min)
nm Not measured
sat Saturated solution
N/A Not Applicable

***** Based on lowest single value
[8] Actual breakthrough time; normalized breakthrough time is not available

TYCHEM® FABRICS – Permeation Data

Chemical Name	CAS	Physical State	Tychem® C/C2			Tychem® 4000			Tychem® F/F2			Tychem® TK.		
			BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN
Allyl alcohol	107-18-6	Liquid				>480	>480	6	>480	>480	6	>480	>480	6
Allyl chloride	107-05-1	Liquid				imm			nm	>480	6	>480	>480	6
Amino 2-methylpropane, 2-	75-64-9	Liquid										>480	>480	6
Amino 3,4-dichlorobenzene, 1-	95-76-1	Solid										>480	>480	6
Amino 3,4-dichlorobenzene, 1- (molten at 70 °C)	95-76-1	Liquid				imm	imm					216*	nm	
Amino benzene	62-53-3	Liquid	imm	imm		>480	>480	6	>480	>480	6	>480	>480	6
Amino ethanol, 2-	141-43-5	Liquid							>480	>480	6	>480	>480	6
Amino ethylethanolamine	111-41-1	Liquid				3	>480	6	>480	>480	6	>480	>480	6
Amino ethylethanolamine (60%)	111-41-1	Liquid				>480	>480	6	>480	>480	6	>480	>480	6
Amino ethylpiperazine	140-31-8	Liquid				>480	>480	6	>480	>480	6	>480	>480	6
Amino propane, 2-	75-31-0	Liquid							>480	>480	6	>480	>480	6
Amino pyridine, 2- (sat)	504-29-0	Liquid				>480	>480	6						
Ammonia (gaseous)	7664-41-7	Vapor	imm	imm					79	>480	6	>480	>480	6
Ammonia (liquid at -70 °C)	7664-41-7	Liquid										>480	>480	6
Ammonium aqueous (2-3%)	1336-21-6	Liquid				>480	>480	6						
Ammonium aqueous (28%)	1336-21-6	Liquid	imm	imm										
Ammonium aqueous (30%)	1336-21-6	Liquid										>480	>480	6
Ammonium aqueous (32%)	1336-21-6	Liquid				>480	>480	6	>480	>480	6			
Ammonium bifluoride (sat)	1341-49-7	Liquid							>480	>480	6			
Ammonium fluoride (40%)	12125-01-8	Liquid										>480	>480	6
Ammonium hydrogendifluoride (sat)	1341-49-7	Liquid							>480	>480	6			
Ammonium hydroxide (2-3%)	1336-21-6	Liquid				>480	>480	6						
Ammonium hydroxide (28%)	1336-21-6	Liquid	imm	imm										
Ammonium hydroxide (30%)	1336-21-6	Liquid										>480	>480	6
Ammonium hydroxide (32%)	1336-21-6	Liquid				>480	>480	6	>480	>480	6			
Amyl acetate, n-	628-63-7	Liquid							136*	>480	6	>480	>480	6
Amyl alcohol	71-41-0	Liquid							>480	>480	6			
Amyl ester acetic acid	628-63-7	Liquid							136*	>480	6	>480	>480	6
Anilin, 4-Trifluoromethoxy-	461-82-5	Liquid							>480	>480	6			
Aniline	62-53-3	Liquid	imm	imm		>480	>480	6	>480	>480	6	>480	>480	6
Anthracene (sat in Toluene)	120-12-7	Liquid							>480	>480	6			

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BT 1.0 Normalized breakthrough time at 1.0 µg/cm²/min
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			BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN
Anthracin (sat in Toluene)	120-12-7	Liquid							>480	>480	6			
Antimony pentachloride	7647-18-9	Liquid				>480	>480	6	15	15	1			
Arsenic (III) chloride	7784-34-1	Liquid							32*	59*	2			
Arsenic trichloride	7784-34-1	Liquid							32*	59*	2			
Aziridine	151-56-4	Liquid										>480	>480	6
Azolidine	123-75-1	Liquid							45*	145*	4	413	nm	nm
Benzenamine	62-53-3	Liquid	imm	imm		>480	>480	6	>480	>480	6	>480	>480	6
Benzene	71-43-2	Liquid				imm	imm		>480	>480	6	>480	>480	6
Benzene carbonyl chloride	98-88-4	Liquid							>480	>480	6	>480	>480	6
Benzene sulfone chloride	98-09-9	Liquid							>480	>480	6	>480	>480	6
Benzene sulfonyl chloride	98-09-9	Liquid							>480	>480	6	>480	>480	6
Benzene thiol	108-98-5	Liquid										>480	>480	6
Benzidine (75% in Methanol)	92-87-5	Liquid										>480	>480	6
Benzo nitrile	100-47-0	Liquid							>480	>480	6	>480	>480	6
Benzol	71-43-2	Liquid				imm	imm		>480	>480	6	>480	>480	6
Benzoyl chloride	98-88-4	Liquid							>480	>480	6	>480	>480	6
Benzyl alcohol	100-51-6	Liquid				>480	>480	6	>480	>480	6			
Benzyl chloride	100-44-7	Liquid							>480	>480	6	>480	>480	6
Benzyl cyanide	140-29-4	Liquid							>390	>390	5			
Benzyl methylamine, N-	103-67-3	Liquid							>480	>480	6			
Benzyl nitrile	140-29-4	Liquid							>390	>390	5			
Biphenyl-4,4'-diamine, 1,1'- (75% in Methanol)	92-87-5	Liquid										>480	>480	6
Bis (4-(2,3-epoxypropoxy)phenyl)propane	1675-54-3	Liquid				>480	>480	6	>480	>480	6	>480	>480	6
Bis phenol A diglycidyl ether	1675-54-3	Liquid				>480	>480	6	>480	>480	6	>480	>480	6
Bis(2-ethylhexyl)phthalate	117-81-7	Liquid										>480	>480	6
Black liquor	308074-23-9	Liquid				>480	>480	6				>480	>480	6
Boron fluoride ethyl ether	109-63-7	Liquid							>480	>480	6	>480	>480	6
Boron trifluoride	7637-07-02	Vapor										>480	>480	6
Boron trifluoride diethyl etherate	109-63-7	Liquid							>480	>480	6	>480	>480	6
Boron trifluoride dimethyl etherate	353-42-4	Liquid							>480	>480	6			
Boron trifluoride etherate	109-63-7	Liquid							>480	>480	6	>480	>480	6

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Chemical Name	CAS	Physical State	Tychem® C/C2			Tychem® 4000			Tychem® F/F2			Tychem® TK.		
			BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN
Bromine (10 g/m2)	7726-95-6	Liquid										>480	>480	6
Bromine (liquid)	7726-95-6	Liquid	imm	imm					imm	nm		15	15	1
Bromine (sat vapour)	7726-95-6	Vapor										30*	30*	1
Bromo 4-fluorobenzene, 1-	460-00-4	Liquid							>480	>480	6	>480	>480	6
Bromo fluorobenzene, 4-	460-00-4	Liquid							>480	>480	6	>480	>480	6
Bromomethane	74-83-9	Vapor				>480	>480	6				>480	>480	6
But-3-en-2-one	78-94-4	Liquid							nm	>480	6			
Butadiene, 1,3- (gaseous)	106-99-0	Vapor	imm	imm		>480	>480	6	>480	>480	6	>480	>480	6
Butadiene, 1,3- (liquid at 0 °C)	106-99-0	Liquid										>180	>180	4
Butan-1-ol	71-36-3	Liquid	imm	imm		>480	>480	6	>480	>480	6	>480	>480	6
Butanal, n-	123-72-8	Liquid	imm	imm		41	>480	6				>480	>480	6
Butane dinitrile	111-69-3	Liquid							>480	>480	6	>480	>480	6
Butanol, 1-	71-36-3	Liquid	imm	imm		>480	>480	6	>480	>480	6	>480	>480	6
Butanol, n-	71-36-3	Liquid	imm	imm		>480	>480	6	>480	>480	6	>480	>480	6
Butanol, tert-	75-65-0	Liquid							37*	>480	6			
Butanone	78-93-3	Liquid				18	18	1	40*	>480	6	>480	>480	6
Butanone oxime, 2-	96-29-7	Liquid				>480	>480	6	>480	>480	6	>480	>480	6
Butenal, 2-	123-73-9	Liquid				34	34	2				>480	>480	6
Butoxy ethanol, 2-	111-76-2	Liquid				>480	>480	6	>480	>480	6			
Butyl acetate, n-	123-86-4	Liquid							>480	>480	6	>480	>480	6
Butyl acrylate, n-	141-32-2	Liquid										>480	>480	6
Butyl alcohol, n-	71-36-3	Liquid	imm	imm		>480	>480	6	>480	>480	6	>480	>480	6
Butyl amine	109-73-9	Liquid										>480	>480	6
Butyl amine, tert-	75-64-9	Liquid										>480	>480	6
Butyl ether, n-	142-96-1	Liquid							192*	>480	6	>480	>480	6
Butyl stannium trichloride	1118-46-3	Liquid							>480	>480	6			
Butyraldehyde, n-	123-72-8	Liquid	imm	imm		41	>480	6				>480	>480	6
Calomel (sat)	10112-91-1	Liquid							>480	>480	6			
Carbon disulfide	75-15-0	Liquid	imm	imm		imm	imm		>480	>480	6	>480	>480	6
Carbon monoxide	630-08-0	Vapor										330	>480	6
Carbon tetrachloride	56-23-5	Liquid							4*	>480	6	>480	>480	6

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< Smaller than

imm Immediate (< 4 min)
nm Not measured
sat Saturated solution
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TYCHEM® FABRICS – Permeation Data

Chemical Name	CAS	Physical State	Tychem® C/C2			Tychem® 4000			Tychem® F/F2			Tychem® TK.		
			BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN
Carbon tetrafluoride	75-73-0	Vapor										>480	>480	6
Carmustine (3.3 mg/ml, 10 % Ethanol)	154-93-8	Liquid	>480	>480	6				>480	>480	6			
Caustic ammonia (2-3%)	1336-21-6	Liquid				>480	>480	6						
Caustic ammonia (28%)	1336-21-6	Liquid	imm	imm										
Caustic ammonia (30%)	1336-21-6	Liquid										>480	>480	6
Caustic ammonia (32%)	1336-21-6	Liquid				>480	>480	6	>480	>480	6			
Caustic soda (42%)	1310-73-2	Liquid	>480	>480	6									
Caustic soda (50%)	1310-73-2	Liquid	>480	>480	6	>480	>480	6	>480	>480	6	>480	>480	6
Caustic soda (>95%, solid)	1310-73-2	Solid												
Chlor allylene	107-05-1	Liquid				imm			nm	>480	6	>480	>480	6
Chlor trinitromethan	76-06-2	Liquid							>480	>480	6			
Chlordane	57-74-9	Liquid										>480	>480	6
Chlorine (gaseous)	7782-50-5	Vapor	imm	imm		>480	>480	6	>480	>480	6	>480	>480	6
Chlorine (liquid at -70 °C)	7782-50-5	Liquid										>180	>180	4
Chlorine sulfide	10545-99-0	Liquid										440	>480	6
Chlorine trifluoride	7790-91-2	Vapor										45	45	2
Chloro 1,2-propanediol, 3-	96-24-2	Liquid										>480	>480	6
Chloro 1,2-propylene oxide, 3-	106-89-8	Liquid				15	15	1	372	>480	6	>480	>480	6
Chloro 1,3-butadiene, 2- (50% in Butanol)	126-99-8	Liquid							>480	>480	6			
Chloro 1-methylbenzene, 2-	95-49-8	Liquid				13	13	1	>480	>480	6	>480	>480	6
Chloro 1-propene, 3-	107-05-1	Liquid				imm			nm	>480	6	>480	>480	6
Chloro 2,3-epoxy propane, 1-	106-89-8	Liquid				15	15	1	372	>480	6	>480	>480	6
Chloro 2-nitrobenzene, 1- (35-40 °C)	88-73-3	Liquid							>480	>480	6			
Chloro 2-propene, 1-	107-05-1	Liquid				imm			nm	>480	6	>480	>480	6
Chloro acetic acid (68%)	79-11-8	Liquid							>480	>480	6			
Chloro acetic acid (80%)	79-11-8	Liquid				>480	>480	6				>480	>480	6
Chloro acetone (95%)	78-95-5	Liquid				258	258	5	>480	>480	6			
Chloro acetyl chloride	79-04-9	Liquid				120	150	4				160	170	4
Chloro acrylonitrile, 2-	920-37-6	Liquid							>480	>480	6			
Chloro aniline, p-	106-47-8	Solid										>480	>480	6
Chloro aniline, p- (molten at 70 °C)	106-47-8	Liquid				imm	imm					272*	355	5

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			BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN
Chloro benzenamine, 4-	106-47-8	Solid										>480	>480	6
Chloro benzenamine, 4- (molten at 70 °C)	106-47-8	Liquid				imm	imm					272*	355	5
Chloro benzene	108-90-7	Liquid							>480	>480	6	>480	>480	6
Chloro buta-1,3-diene, 2- (50% in Butanol)	126-99-8	Liquid							>480	>480	6			
Chloro ethanol, 2-	107-07-3	Liquid	imm	imm					>480	>480	6	>480	>480	6
Chloro ethene	75-01-4	Vapor				>480	>480	6	>480	>480	6	>480	>480	6
Chloro form	67-66-3	Liquid				imm	imm		8	8		>480	>480	6
Chloro methyl methyl ether	107-30-2	Liquid							8*	>480	6	>480	>480	6
Chloro phenol, p- (sat in Methanol)	106-48-9	Liquid										>480	>480	6
Chloro prene (50% in Butanol)	126-99-8	Liquid							>480	>480	6			
Chloro prene, 3-	107-05-1	Liquid				imm			nm	>480	6	>480	>480	6
Chloro propan-2-one, 1- (95%)	78-95-5	Liquid				258	258	5	>480	>480	6			
Chloro toluene, alpha-	100-44-7	Liquid							>480	>480	6	>480	>480	6
Chloro toluene, o-	95-49-8	Liquid				13	13	1	>480	>480	6	>480	>480	6
Chlorsulfonic acid	7790-94-5	Liquid				>480	>480	6	>480	>480	6	>480	>480	6
Chromic acid (H2SO4 x CrO3) (60%)	1333-82-0	Liquid				>480	>480	6						
Chromic acid (H2SO4 x CrO3) (80%)	1333-82-0	Liquid	>480	>480	6									
Citric acid (sat)	77-92-9	Liquid							>480	>480	6			
Creosote	8001-58-9	Liquid							>480	>480	6			
Cresol o-	95-48-7	Liquid				>480	>480	6	180	205	4			
Cresols, mixed isomers	1319-77-3	Liquid				100	90*	3				>480	>480	6
Cresylic acid	1319-77-3	Liquid				100	90*	3				>480	>480	6
Crotonaldehyde	123-73-9	Liquid				34	34	2				>480	>480	6
Crude oil, California	8002-05-09	Liquid				>480	>480	6				>480	>480	6
Cumene	98-82-8	Liquid							>480	>480	6	>480	>480	6
Cyanide chloride (20% in Toluene)	108-77-0	Liquid										>480	>480	6
Cyanobenzene	100-47-0	Liquid							>480	>480	6	>480	>480	6
Cyanoethylene	107-13-1	Liquid	imm	imm		36*	36*	2	8	>480	6			
Cyanomethane	75-05-8	Liquid	imm	imm		60	>480	6	>480	>480	6	>480	>480	6
Cyanopropan-2-ol, 2-	75-86-5	Liquid							>480	>480	6	>480	>480	6
Cyclohexane	110-82-7	Liquid							>480	>480	6	>480	>480	6

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			BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN
Cyclohexanone	108-94-1	Liquid				136	136	4	>480	>480	6	>480	>480	6
DEHP	117-81-7	Liquid										>480	>480	6
Di(ethoxycarbonyl)ethyl O,O-dimethyl phosphorodithioate 1,2- (50% in Methanol)	121-75-5	Liquid										>480	>480	6
Di(ethoxycarbonyl)ethyl O,O-dimethyl phosphorodithioate 1,2- (50%)	121-75-5	Liquid				>480	>480	6						
Diamine	302-01-2	Liquid				>480	>480	6	283	352	5			
Diaminobiphenyl, 4,4'- (75% in Methanol)	92-87-5	Liquid										>480	>480	6
Diaminodiphenyl, p- (75% in Methanol)	92-87-5	Liquid										>480	>480	6
Diaminodiphenylmethane, 4,4'-	101-77-9	Liquid										>480	>480	6
Diaminodiphenylmethane, 4,4'- (15% in Methyl Ethyl Ketone)	101-77-9	Liquid										>480	>480	6
Diaminoethane, 1,2-	107-15-3	Liquid				>480	>480	6	>480	>480	6			
Diborane (10%)	19287-45-7	Vapor										>480	>480	6
Dibromoethane, 1,2-	106-93-4	Liquid							144*	>480	6	>480	>480	6
Dibutyl 1,2-benzenedicarboxylate	84-74-2	Liquid							nm	>480	6			
Dibutylphthalate	84-74-2	Liquid							nm	>480	6			
Dibutylsebacate	109-43-3	Liquid							nm	>480	6			
Dichlorethane, 1.2.-	107-06-2	Liquid				imm	imm	0	93	109	3	>480	>480	6
Dichloro-2-propanone, 1,3- (95%, molten at 40 °C)	534-07-6	Liquid										>480	>480	6
Dichloro-2-propanone, 1,3- (molten at 45 °C)	534-07-6	Liquid							>480	>480	6			
Dichloro-4,4'-methylenedianiline, 2,2'- (sat)	101-14-4	Liquid										>480	>480	6
Dichloro-6-isopropyl-S-triazine, 2,4- (22%)	30894-74-7	Liquid										>480	>480	6
Dichloroacetone (95%, molten at 40 °C)	534-07-6	Liquid										>480	>480	6
Dichloroacetone (molten at 45 °C)	534-07-6	Liquid							>480	>480	6			
Dichloroacetyl chloride	79-36-7	Liquid							160	180	4	>480	>480	6
Dichloroaniline, 3,4-	95-76-1	Solid										>480	>480	6
Dichloroaniline, 3,4- (molten at 70 °C)	95-76-1	Liquid				imm	imm					216*	nm	
Dichloroethyl ether	111-44-4	Liquid							>480	>480	6	>480	>480	6
Dichloroethylene, 1,1-	75-35-4	Liquid							>480	>480	6	>480	>480	6
Dichloromethane	75-09-2	Liquid	imm	imm		imm	imm		imm	imm		>480	>480	6
Dichloropropene, 2,3-	78-88-6	Liquid							4*	54*	2	>480	>480	6

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			BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN
Dichlorosilane	4109-96-0	Vapor										>480	>480	6
Dicyanobutane, 1,4-	111-69-3	Liquid							>480	>480	6	>480	>480	6
Diesel automotive test fuel	N/A	Liquid	imm	imm										
Diesel fuel	68334-30-5	Liquid							>480	>480	6	>480	>480	6
Diethyl 0-(p-nitro-phenyl)-phosphorothioate, 0,0-	56-38-2	Liquid										>480	>480	6
Diethyl amine	109-89-7	Liquid	imm	imm		15	nm		>480	>480	6	>480	>480	6
Diethyl aniline, N,N-	91-66-7	Liquid				>480	>480	6				>480	>480	6
Diethyl benzene (95%)	25340-17-4	Liquid				31	42	2						
Diethyl ethanamine, N,N-	121-44-8	Liquid				12*	>480	6	>480	>480	6	>480	>480	6
Diethyl ether	60-29-7	Liquid				imm	imm		>480	>480	6	>480	>480	6
Diethyl hexyl phthalate	117-81-7	Liquid										>480	>480	6
Diethyl m-toluidine, N,N-	91-67-8	Liquid				>480	>480	6						
Diethyl sulfate	64-67-5	Liquid							>480	>480	6	>480	>480	6
Diethylene glycol monobutyl ether	112-34-5	Liquid							>480	>480	6			
Diethylene imide oxide	110-91-8	Liquid				158	>480	6				>480	>480	6
Diethylene triamine	111-40-0	Liquid				3*	>480	6	>480	>480	6	>480	>480	6
Dimethyl acetamide, N,N-	127-19-5	Liquid				96	115	3	>480	>480	6	>480	>480	6
Dimethyl amine	124-40-3	Vapor							>480	>480	6	>480	>480	6
Dimethyl aniline, N,N-	121-69-7	Liquid							>480	>480	6	>480	>480	6
Dimethyl dichlorosilane	75-78-5	Liquid				46	>480	6	>480	>480	6	>480	>480	6
Dimethyl ether	115-10-6	Vapor										>480	>480	6
Dimethyl formamide, N,N-	68-12-2	Liquid				90	>480	6	>480	>480	6	>480	>480	6
Dimethyl hydrazine, N,N-	57-14-7	Liquid				13	11*	2						
Dimethyl ketal	67-64-1	Liquid	imm	nm		imm	29*	1	>480	>480	6	>480	>480	6
Dimethyl ketone	67-64-1	Liquid	imm	nm		imm	29*	1	>480	>480	6	>480	>480	6
Dimethyl maleate	624-48-6	Liquid				>480	>480	6						
Dimethyl nitrosamine	62-75-9	Liquid							>480	>480	6			
Dimethyl phenylamine, N,N-	121-69-7	Liquid							>480	>480	6	>480	>480	6
Dimethyl sulfate	77-78-1	Liquid				>480	>480	6	>480	>480	6	>480	>480	6
Dimethyl sulfide	75-18-3	Liquid							271	452	5			
Dimethyl sulfoxide	67-68-5	Liquid							28*	114	3	>480	>480	6

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			BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN
Dinitro-o-cresol, 4,6- (sat in Methanol)	534-52-1	Liquid										>480	>480	6
Dinitrocresol (sat in Methanol)	534-52-1	Liquid										>480	>480	6
Dioxane, 1,4-	123-91-1	Liquid							>480	>480	6	>480	>480	6
Diphenyl methane diisocyanate, 4,4'-	101-68-8	Solid				>480	>480	6				>480	>480	6
Disodium sulfide (60%)	1313-82-2	Liquid				>480	>480	6						
Disulphur dichloride	10025-67-9	Liquid										>480	>480	6
Epichlorohydrin	106-89-8	Liquid				15	15	1	372	>480	6	>480	>480	6
Epoxy ethane (10% in HCFC)	75-21-8	Vapor										>480	>480	6
Epoxy ethane (gaseous)	75-21-8	Vapor	imm	imm		imm	imm		126	>480	6	>480	>480	6
Epoxy ethane (liquid at -70 °C)	75-21-8	Liquid										>180	>180	4
Epoxy ethane (liquid at 0 °C)	75-21-8	Liquid										>480	>480	6
Epoxy propane, 1,2-	75-56-9	Liquid							14	nm		>480	>480	6
Ethane 1,2-diol	107-21-1	Liquid	>480	>480	6	>480	>480	6	>480	>480	6	>480	>480	6
Ethane dioic acid (10.5%)	144-62-7	Liquid										>480	>480	6
Ethane dioic acid (sat)	144-62-7	Liquid							>480	>480	6			
Ethane diol dipropanoate, 1,2-	123-73-9	Liquid				34	34	2				>480	>480	6
Ethane nitrile	75-05-8	Liquid	imm	imm		60	>480	6	>480	>480	6	>480	>480	6
Ethane thiol	75-08-1	Liquid				5	6		>480	>480	6	>480	>480	6
Ethane trichloride	79-00-5	Liquid							164*	202*	4			
Ethanol	64-17-5	Liquid				>480	>480	6	>480	>480	6			
Ethanol amine	141-43-5	Liquid							>480	>480	6	>480	>480	6
Ethanoyl chloride	75-36-5	Liquid				39*	>480	6	>480	>480	6	>480	>480	6
Ethoxy ethanol, 2-	110-80-5	Liquid				>480	>480	6	>480	>480	6	>480	>480	6
Ethoxy ethylacetat	111-15-9	Liquid				116*	>480	6	>480	>480	6	>480	>480	6
Ethyl acetate	141-78-6	Liquid	imm	imm		imm	9*		>480	>480	6	>480	>480	6
Ethyl acrylate	140-88-5	Liquid										>480	>480	6
Ethyl alcohol	64-17-5	Liquid				>480	>480	6	>480	>480	6			
Ethyl amine	75-04-7	Liquid										>480	>480	6
Ethyl benzene	100-41-4	Liquid				8	>480	6	>480	>480	6	>480	>480	6
Ethyl chloride	75-00-3	Vapor										>480	>480	6
Ethyl ethanamine, N-	109-89-7	Liquid	imm	imm		15	nm		>480	>480	6	>480	>480	6

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			BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN
Ethyl ether	60-29-7	Liquid				imm	imm		>480	>480	6	>480	>480	6
Ethyl mercaptan	75-08-1	Liquid				5	6		>480	>480	6	>480	>480	6
Ethyl nitrile	75-05-8	Liquid	imm	imm		60	>480	6	>480	>480	6	>480	>480	6
Ethyl parathion	56-38-2	Liquid										>480	>480	6
Ethylene carboxylic acid	79-10-7	Liquid	imm	imm		>480	>480	6	>480	>480	6	>480	>480	6
Ethylene chlorohydrin	107-07-3	Liquid	imm	imm					>480	>480	6	>480	>480	6
Ethylene diamine	107-15-3	Liquid				>480	>480	6	>480	>480	6			
Ethylene dibromide	106-93-4	Liquid							144*	>480	6	>480	>480	6
Ethylene dichloride	107-06-2	Liquid				imm	imm	0	93	109	3	>480	>480	6
Ethylene glycol	107-21-1	Liquid	>480	>480	6	>480	>480	6	>480	>480	6	>480	>480	6
Ethylene glycol mono ethyl ether acetate	111-15-9	Liquid				116*	>480	6	>480	>480	6	>480	>480	6
Ethylene glycol monobutyl ether	111-76-2	Liquid				>480	>480	6	>480	>480	6			
Ethylene glycol monoethyl ether	110-80-5	Liquid				>480	>480	6	>480	>480	6	>480	>480	6
Ethylene glycol monomethyl ether	109-86-4	Liquid				>480	>480	6	>480	>480	6	>480	>480	6
Ethylene glycol monomethyl ether acetate	110-49-6	Liquid				>480	>480	6	>480	>480	6	>480	>480	6
Ethylene imine	151-56-4	Liquid										>480	>480	6
Ethylene oxide (10% in HCFC)	75-21-8	Vapor										>480	>480	6
Ethylene oxide (gaseous)	75-21-8	Vapor	imm	imm		imm	imm		126	>480	6	>480	>480	6
Ethylene oxide (liquid at -70 °C)	75-21-8	Liquid										>180	>180	4
Ethylene oxide (liquid at 0 °C)	75-21-8	Liquid										>480	>480	6
Ethylene tetrachloride	127-18-4	Liquid	imm	imm		imm	imm		>480	>480	6	>480	>480	6
Ethylene trichloride	79-01-6	Liquid				imm	imm		>480	>480	6	>480	>480	6
Ethylglycol acetate	111-15-9	Liquid				116*	>480	6	>480	>480	6	>480	>480	6
Ferric (II) chloride (50%)	7758-94-3	Liquid				>480	>480	6						
Ferric (III) chloride (40%)	7705-08-0	Liquid	>480	>480	6									
Ferric (III) chloride (50%)	7705-08-0	Liquid				>480	>480	6						
Fluorine	7782-41-4	Vapor										>480	>480	6
Fluorobenzene	462-06-6	Liquid				imm	imm		>480	>480	6	>480	>480	6
Fluoroboric acid	16872-11-0	Liquid				>480	>480	6						
Fluorosilicic acid	16961-83-4	Liquid							>480	>480	6	>480	>480	6
Fluorosulfonic acid	7789-21-1	Liquid							194	>480	6	>480	>480	6

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< Smaller than

imm Immediate (< 4 min)
nm Not measured
sat Saturated solution
N/A Not Applicable

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TYCHEM® FABRICS – Permeation Data

Chemical Name	CAS	Physical State	Tychem® C/C2			Tychem® 4000			Tychem® F/F2			Tychem® TK.		
			BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN
Formaldehyde (10%)	50-00-0	Liquid	>480	>480	6									
Formaldehyde (100 ppm)	50-00-0	Vapor										>480	>480	6
Formaldehyde (37%)	50-00-0	Liquid	imm	>480	6	>480	>480	6	>480	>480	6			
Formalin (10%)	50-00-0	Liquid	>480	>480	6									
Formalin (100 ppm)	50-00-0	Vapor										>480	>480	6
Formalin (37%)	50-00-0	Liquid	imm	>480	6	>480	>480	6	>480	>480	6			
Formic acid (30%)	64-18-6	Liquid												
Formic acid (50%)	64-18-6	Liquid							>480	>480	6			
Formic acid (88%)	64-18-6	Liquid				>480	>480	6						
Formic acid (>95%)	64-18-6	Liquid							260	>480	6			
Fuel oil	68476-30-2	Liquid	imm	imm		>480	>480	6						
Fuel-oil no 2	68476-30-2	Liquid	imm	imm		>480	>480	6						
Furaldehyde, 2-	98-01-1	Liquid				198*	nm		>480	>480	6	>480	>480	6
Furfural	98-01-1	Liquid				198*	nm		>480	>480	6	>480	>480	6
Gasoline, leaded	N/A	Liquid							4*	>480	6	>480	>480	6
Gasoline, unleaded	86290-81-5	Liquid				imm	imm		>480	>480	6	>480	>480	6
Glutaral (50%)	111-30-8	Liquid				>480	>480	6	170	200	4	>480	>480	6
Glutaraldehyde (50%)	111-30-8	Liquid				>480	>480	6	170	200	4	>480	>480	6
Glycerol	56-81-5	Liquid												
Glycol alcohol	107-21-1	Liquid	>480	>480	6	>480	>480	6	>480	>480	6	>480	>480	6
Glycol chlorohydrin	107-07-3	Liquid	imm	imm					>480	>480	6	>480	>480	6
Glycolic acid (sat)	79-14-1	Liquid										>480	>480	6
Green liquor	68131-30-6	Liquid				>480	>480	6				>480	>480	6
Hexachloro butadiene	87-68-3	Liquid										>480	>480	6
Hexachloro cyclohexane, 1,2,3,4,5,6- (sat in Acetone)	58-89-9	Liquid										>480	>480	6
Hexachloro cyclohexane, 1,2,3,4,5,6- (sat in Methanol)	58-89-9	Liquid										>480	>480	6
Hexafluoro ethane	76-16-4	Vapor										>480	>480	6
Hexafluoro isobutylene	382-10-5	Vapor										>480	>480	6
Hexamethyl disilazane	999-97-3	Liquid				>480	>480	6				>480	>480	6
Hexamethyl disilazane, 1,1,1,3,3,3-	999-97-3	Liquid				>480	>480	6				>480	>480	6

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			BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN
Hexamethylene diamine (molten at 45 °C)	124-09-4	Liquid				80	120	3	>480	>480	6	>480	>480	6
Hexamethylene diisocyanate	822-06-0	Liquid				>480	>480	6	>480	>480	6	>480	>480	6
Hexane dinitrile	111-69-3	Liquid							>480	>480	6	>480	>480	6
Hexane n-	110-54-3	Liquid				imm	>480	6	>480	>480	6	>480	>480	6
Hexanone	108-94-1	Liquid				136	136	4	>480	>480	6	>480	>480	6
Hexone	108-10-1	Liquid							>480	>480	6	>480	>480	6
Hydrazine	302-01-2	Liquid				>480	>480	6	283	352	5			
Hydrazine hydrate (51%)	10217-52-4	Liquid										>480	>480	6
Hydrazine hydrate (85%)	10217-52-4	Liquid										440	>480	6
Hydriodic acid (47%)	10034-85-2	Liquid				>480	>480	6						
Hydriodic acid (57%)	10034-85-2	Liquid							>480	>480	6			
Hydrochloric acid (32%)	7647-01-0	Liquid	>480	>480	6									
Hydrochloric acid (37%)	7647-01-0	Liquid	265*	>480	6	>480	>480	6	>480	>480	6	>480	>480	6
Hydrofluoric acid (48%)	7664-39-3	Liquid	17	>480	6	>480	>480	6	>480	>480	6	>480	>480	6
Hydrofluoric acid (60%)	7664-39-3	Liquid	6	81	3				52	373	5			
Hydrofluoric acid (70%)	7664-39-3	Liquid	imm	15*	1	imm			35	293	5	>480	>480	6
Hydrogen bromide (gazeuse)	10035-10-6	Vapor							>480	>480	6			
Hydrogen chloride (gaseous)	7647-01-0	Vapor				>480	>480	6	>480	>480	6	>480	>480	6
Hydrogen chloride (liquid at -90 °C)	7647-01-0	Liquid										>180	>180	4
Hydrogen cyanide (gaseous at 27 °C)	74-90-8	Vapor										>480	>480	6
Hydrogen cyanide (liquid at 21 °C)	74-90-8	Liquid										>480	>480	6
Hydrogen fluoride (gaseous at 21 °C)	7664-39-3	Vapor							nm	48	2	>480	>480	6
Hydrogen fluoride (liquid at 0 °C)	7664-39-3	Liquid										290	360	5
Hydrogen fluoride (liquid at 18 °C)	7664-39-3	Liquid							28*	60*	2			
Hydrogen peroxide (30%)	7722-84-1	Liquid				>480	>480	6				>480	>480	6
Hydrogen peroxide (50%)	7722-84-1	Liquid	>480	>480	6				>480	>480	6			
Hydrogen peroxide (70%)	7722-84-1	Liquid	>480	>480	6				>480	>480	6	>480	>480	6
Hydrogen sulfide	7783-06-04	Vapor										>480	>480	6
Hydroxy 1,2,3-propanetricarboxylic acid, 2- (sat)	77-92-9	Liquid							>480	>480	6			
Hydroxy 1-ethanethiol, 2-	60-24-2	Liquid							>480	>480	6	>480	>480	6
Hydroxy 2-methylpropionitrile, 2-	75-86-5	Liquid							>480	>480	6	>480	>480	6

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TYCHEM® FABRICS – Permeation Data

Chemical Name	CAS	Physical State	Tychem® C/C2			Tychem® 4000			Tychem® F/F2			Tychem® TK.		
			BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN
Hydroxy 2-nitrobenzene, 1- (molten at 70 °C)	88-75-5	Liquid				imm	imm					208	>480	6
Hydroxy acetic acid (sat)	79-14-1	Liquid										>480	>480	6
Hydroxy chlorobenzene (sat in Methanol)	106-48-9	Liquid										>480	>480	6
Hydroxy isobutyronitrile	75-86-5	Liquid							>480	>480	6	>480	>480	6
Hydroxy propene	107-18-6	Liquid				>480	>480	6	>480	>480	6	>480	>480	6
Hydroxy toluene	100-51-6	Liquid				>480	>480	6	>480	>480	6			
Hydroxy toluene, o-	95-48-7	Liquid				>480	>480	6	180	205	4			
Hypophosphorus acid (50%)	6303-21-5	Liquid							>480	>480	6			
Iodine (5% in Carbon tetrachloride)	7553-56-2	Liquid				>480	>480	6						
Iodomethane	74-88-4	Liquid	imm	imm		imm	imm		296	>480	6	>480	>480	6
Isoamyl alcohol	123-51-3	Liquid				>480	>480	6						
Isobutyl methyl ketone	108-10-1	Liquid							>480	>480	6	>480	>480	6
Isophthaloyldichloride (molten at 45 °C)	99-63-8	Liquid							>480	>480	6			
Isopropanol	67-63-0	Liquid	imm	imm		>480	>480	6	>480	>480	6			
Isopropyl alcohol	67-63-0	Liquid	imm	imm		>480	>480	6	>480	>480	6			
Isopropyl amine	75-31-0	Liquid							>480	>480	6	>480	>480	6
Isopropyl benzene	98-82-8	Liquid							>480	>480	6	>480	>480	6
Isopropylidenediphenol diglycidyl ether, 4,4'-	1675-54-3	Liquid				>480	>480	6	>480	>480	6	>480	>480	6
Kerosene	8008-20-6	Liquid							>480	>480	6			
Ketone propane	67-64-1	Liquid	imm	nm		imm	29*	1	>480	>480	6	>480	>480	6
Lewisite (L), FINABEL 0.7.C	541-25-3	Liquid							>260*[8]					
Lewisite (L), MIL-STD-282 (10 g/m2)	541-25-3	Liquid				>360[8]						>480[8]		
Lewisite (L), MIL-STD-282 (100 g/m2)	541-25-3	Liquid							360[8]			>480[8]		
Limonene d-	5989-27-5	Liquid	imm	imm					>480	>480	6	>480	>480	6
Lindane (sat in Acetone)	58-89-9	Liquid										>480	>480	6
Lindane (sat in Methanol)	58-89-9	Liquid										>480	>480	6
Low boiling point naphtha - unspecified	8052-41-3	Liquid										>480	>480	6
MEK	78-93-3	Liquid				18	18	1	40*	>480	6	>480	>480	6
Malathion (50% in Methanol)	121-75-5	Liquid										>480	>480	6
Malathion (50%)	121-75-5	Liquid				>480	>480	6						
Mercapto acetic acid	68-11-1	Liquid							>480	>480	6	>480	>480	6

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TYCHEM® FABRICS – Permeation Data

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			BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN
Mercapto ethanol	60-24-2	Liquid							>480	>480	6	>480	>480	6
Mercuric I chloride (sat)	10112-91-1	Liquid							>480	>480	6			
Mercuric II chloride (sat)	7487-94-7	Liquid	>480	>480	6	>480	>480	6				>480	>480	6
Mercury	7439-97-6	Liquid	>480	>480	6	>480	>480	6	>480	>480	6	>480	>480	6
Methacrylic acid	79-41-4	Liquid							>480	>480	6	>480	>480	6
Methanesulfonyl chloride	124-63-0	Liquid							>480	>480	6	>480	>480	6
Methanesulphonic acid (70%)	75-75-2	Liquid				>480	>480	6	>480	>480	6			
Methanethiol	74-93-1	Vapor							>480	>480	6	>480	>480	6
Methanol	67-56-1	Liquid	imm	imm		>480	>480	6	117	>480	6	>480	>480	6
Methomyl (29%)	16752-77-5	Liquid										>480	>480	6
Methoxy 2-methylpropane, 2-	1634-04-4	Liquid				>480	>480	6	>480	>480	6			
Methoxy chloromethane	107-30-2	Liquid							8*	>480	6	>480	>480	6
Methoxy ethanol, 2	109-86-4	Liquid				>480	>480	6	>480	>480	6	>480	>480	6
Methoxy ethylacetate, 2-	110-49-6	Liquid				>480	>480	6	>480	>480	6	>480	>480	6
Methyl 1,5-pentantedinitrile, 2-	4553-62-2	Liquid							>480	>480	6			
Methyl 1,5-pentantedinitrile, 2- (87%)	4553-62-2	Liquid										>480	>480	6
Methyl 2-methyl-2-propenoate	80-62-6	Liquid				23	23	1	8*	180*	4	>480	>480	6
Methyl 2-pyrrolidon, N-	872-50-4	Liquid				>480	>480	6	>480	>480	6	>480	>480	6
Methyl 4-isopropenyl-1-cyclohexene, 1-	5989-27-5	Liquid	imm	imm					>480	>480	6	>480	>480	6
Methyl N-nitrosomethanamine, N-	62-75-9	Liquid							>480	>480	6			
Methyl acetyl	67-64-1	Liquid	imm	nm		imm	29*	1	>480	>480	6	>480	>480	6
Methyl acrolein	123-73-9	Liquid				34	34	2				>480	>480	6
Methyl acrylate	96-33-3	Liquid							>480	>480	6	>480	>480	6
Methyl amine	74-89-5	Vapor							>480	>480	6	>480	>480	6
Methyl aniline, o-	95-53-4	Liquid				>480	>480	6	>480	>480	6	>480	>480	6
Methyl benzol	108-88-3	Liquid	imm	imm		imm	imm		>480	>480	6	>480	>480	6
Methyl benzylamine, N-	103-67-3	Liquid							>480	>480	6			
Methyl bromide	74-83-9	Vapor				>480	>480	6				>480	>480	6
Methyl butan-1-ol, 3-	123-51-3	Liquid				>480	>480	6						
Methyl chloride	74-87-3	Vapor				>480	>480	6				>480	>480	6
Methyl chloride (flüssig at -70 °C)	74-87-3	Liquid										>180	>180	4

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			BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN
Methyl chloroform	71-55-6	Liquid										>480	>480	6
Methyl chloroformate	79-22-1	Liquid							204*	>480	6	>480	>480	6
Methyl cyanide	75-05-8	Liquid	imm	imm		60	>480	6	>480	>480	6	>480	>480	6
Methyl ethyl ketone	78-93-3	Liquid				18	18	1	40*	>480	6	>480	>480	6
Methyl ethyl ketoxime	96-29-7	Liquid				>480	>480	6	>480	>480	6	>480	>480	6
Methyl ethylamine, 1-	75-31-0	Liquid							>480	>480	6	>480	>480	6
Methyl fluoride	593-53-3	Vapor										>480	>480	6
Methyl formamide, N-	123-39-7	Liquid							>480	>480	6			
Methyl hydrazine	60-34-4	Liquid							183*	280*	5	>480	>480	6
Methyl iodide	74-88-4	Liquid	imm	imm		imm	imm		296	>480	6	>480	>480	6
Methyl isocyanate	624-83-9	Liquid				imm	imm		4*	>480	6	>480	>480	6
Methyl ketone	67-64-1	Liquid	imm	nm		imm	29*	1	>480	>480	6	>480	>480	6
Methyl mercaptan	74-93-1	Vapor							>480	>480	6	>480	>480	6
Methyl methacrylate	80-62-6	Liquid				23	23	1	8*	180*	4	>480	>480	6
Methyl pentan-2-one, 4-	108-10-1	Liquid							>480	>480	6	>480	>480	6
Methyl phenols	1319-77-3	Liquid				100	90*	3				>480	>480	6
Methyl propan-2-ol, 2-	75-65-0	Liquid							37*	>480	6			
Methyl propenoic acid, 2-	79-41-4	Liquid							>480	>480	6	>480	>480	6
Methyl pyridine, 2-	109-06-8	Liquid							>480	>480	6	>480	>480	6
Methyl pyridine, 3-	108-99-6	Liquid							>480	>480	6	>480	>480	6
Methyl salicylate	119-36-8	Liquid				>480	>480	6						
Methyl tert-butyl ether	1634-04-4	Liquid				>480	>480	6	>480	>480	6			
Methyl trichloromethane	71-55-6	Liquid										>480	>480	6
Methyl trichlorosilane	75-79-6	Liquid							>480	>480	6	>480	>480	6
Methyl vinyl ketone	78-94-4	Liquid							nm	>480	6			
Methylene bis(2-Chloroaniline), 4,4- (sat)	101-14-4	Liquid										>480	>480	6
Methylene bromide	74-95-3	Liquid							imm	20	1			
Methylene chloride	75-09-2	Liquid	imm	imm		imm	imm		imm	imm		>480	>480	6
Methylene dianiline	101-77-9	Liquid										>480	>480	6
Methylene dianiline (15% in Methyl Ethyl Ketone)	101-77-9	Liquid										>480	>480	6
Methylene diphenyl diisocyanate, 4,4'-	101-68-8	Solid				>480	>480	6				>480	>480	6

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			BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN
Mineral oil	8012-95-1	Liquid				>480	>480	6						
Mineral oil	8002-05-09	Liquid				>480	>480	6				>480	>480	6
Mineral spirit	64475-85-0	Liquid				190	>480	6				>480	>480	6
Morpholine	110-91-8	Liquid				158	>480	6				>480	>480	6
Naphthalene	91-20-3	Solid							>480	>480	6			
Naphthalene (25% in Diethylene glycol dimethylether)	91-20-3	Liquid				79	>480	6	>480	>480	6	>480	>480	6
Neoprene (50% in Butanol)	126-99-8	Liquid							>480	>480	6			
Nickel carbonyl	13463-39-3	Liquid										>480	>480	6
Nicotine	54-11-5	Liquid							>480	>480	6	>480	>480	6
Nitric acid (70%)	7697-37-2	Liquid	>480	>480	6	>480	>480	6	>480	>480	6	>480	>480	6
Nitric acid (90%)	7697-37-2	Liquid										>480	>480	6
Nitric acid (>95%)	7697-37-2	Liquid										390	420	5
Nitric acid, red fuming (90%)	52583-42-3	Liquid							15	15	1			
Nitric oxide	10102-43-9	Vapor										>480	>480	6
Nitro benzene	98-95-3	Liquid	imm	imm		37*	37*	2	>480	>480	6	>480	>480	6
Nitro chlorobenzene, o- (35-40 °C)	88-73-3	Liquid							>480	>480	6			
Nitro methane	75-52-5	Liquid							233	nm		>480	>480	6
Nitro phenol, o- (molten at 70 °C)	88-75-5	Liquid				imm	imm					208	>480	6
Nitro propane, 2-	79-46-9	Liquid							>480	>480	6	>480	>480	6
Nitro toluene, 2-	88-72-2	Liquid				95	141*	4						
Nitrogen dioxide	10102-44-0	Vapor							<15	nm		>480	>480	6
Nitrogen tetroxide (21 °C)	10544-72-6	Liquid										450	>480	6
Nitrogen trifluoride	7783-54-2	Vapor										>480	>480	6
Nitrous oxide	10024-97-2	Vapor										>480	>480	6
Norflurane	811-97-2	Vapor				>480	>480	6				>480	>480	6
Octachlor-2,3,3a,4,7,7a-hexahydro-4,7-methanoindane 1,2,4,5,6,7,8,8-	57-74-9	Liquid										>480	>480	6
Octane n-	111-65-9	Liquid										>480	>480	6
Oleum (103%)	8014-95-7	Liquid										>480	>480	6
Oleum (20%)	8014-95-7	Liquid				>480	>480	6						
Oleum (30%)	8014-95-7	Liquid	82	105	3	450								

BT 0.1 Normalized breakthrough time at 0.1 µg/cm²/min
BT 1.0 Normalized breakthrough time at 1.0 µg/cm²/min
EN Classification according to EN 14325
CAS Chemical abstracts service registry number

mins Minutes
> Larger than
< Smaller than

imm Immediate (< 4 min)
nm Not measured
sat Saturated solution
N/A Not Applicable

***** Based on lowest single value
[8] Actual breakthrough time; normalized breakthrough time is not available

TYCHEM® FABRICS – Permeation Data

Chemical Name	CAS	Physical State	Tychem® C/C2			Tychem® 4000			Tychem® F/F2			Tychem® TK.		
			BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN
Oleum (40%)	8014-95-7	Liquid							455*	>480	6	>480	>480	6
Oleum (65%)	8014-95-7	Liquid							248	370	5	>480	>480	6
Oxalic acid (10.5%)	144-62-7	Liquid										>480	>480	6
Oxalic acid (sat)	144-62-7	Liquid							>480	>480	6			
PCB 1254 (50% in Mineral Oil)	11097-69-1	Liquid				>480	>480	6						
PCB 1254 (50% in Trichlorbenzen)	11097-69-1	Liquid							>480	>480	6			
PCB 1254 (90%)	11097-69-1	Liquid				>480	>480	6						
PCB 1254 (Mixture)	11097-69-1	Liquid										>480	>480	6
Paclitaxel (6 mg/ml, 10 % Acetonitril)	33069-62-4	Liquid							>480	>480	6			
Pentachloroantimony	7647-18-9	Liquid				>480	>480	6	15	15	1			
Pentanedial, 1,5- (50%)	111-30-8	Liquid				>480	>480	6	170	200	4	>480	>480	6
Pentanol, 1-	71-41-0	Liquid							>480	>480	6			
Pentene nitrile, 2-	13284-42-9	Liquid							>480	>480	6			
Pentene nitrile, 3-	4635-87-4	Liquid										>480	>480	6
Pentene nitrile, cis-2- (70%)	25899-50-7	Liquid										>480	>480	6
Pentyl acetate	628-63-7	Liquid							136*	>480	6	>480	>480	6
Perchloric acid (70%)	7601-90-3	Liquid	>480	>480	6							>480	>480	6
Perfluoroethane	76-16-4	Vapor										>480	>480	6
Phenethylene	100-42-5	Liquid				16	16	1	>480	>480	6	>480	>480	6
Phenol (85%)	108-95-2	Liquid				>480	>480	6	>480	>480	6			
Phenol (88% at 45 °C)	108-95-2	Liquid										90	180	4
Phenol (90%)	108-95-2	Liquid										>480	>480	6
Phenol (molten at 45 °C)	108-95-2	Liquid				44	79	3	25	29	1	>480	>480	6
Phenol (molten at 60 °C)	108-95-2	Liquid				imm	imm					125	165	4
Phenyl acetonitrile	140-29-4	Liquid							>390	>390	5			
Phenyl amine	62-53-3	Liquid	imm	imm		>480	>480	6	>480	>480	6	>480	>480	6
Phenyl chloride	108-90-7	Liquid							>480	>480	6	>480	>480	6
Phenyl cyanide	100-47-0	Liquid							>480	>480	6	>480	>480	6
Phenyl ethane	100-41-4	Liquid				8	>480	6	>480	>480	6	>480	>480	6
Phenyl ethanol, 1-	98-85-1	Liquid				>480	>480	6						
Phenyl glycidyl ether	122-60-1	Liquid				>480	>480	6						

BT 0.1 Normalized breakthrough time at 0.1 µg/cm²/min
BT 1.0 Normalized breakthrough time at 1.0 µg/cm²/min
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CAS Chemical abstracts service registry number

mins Minutes
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< Smaller than

imm Immediate (< 4 min)
nm Not measured
sat Saturated solution
N/A Not Applicable

***** Based on lowest single value
[8] Actual breakthrough time; normalized breakthrough time is not available

TYCHEM® FABRICS – Permeation Data

Chemical Name	CAS	Physical State	Tychem® C/C2			Tychem® 4000			Tychem® F/F2			Tychem® TK.		
			BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN
Phenyl mercaptan	108-98-5	Liquid										>480	>480	6
Phenyl propane, 2-	98-82-8	Liquid							>480	>480	6	>480	>480	6
Phenyl trichlorosilane	98-13-5	Liquid				>480	>480	6	>480	>480	6	>480	>480	6
Phosgene	75-44-5	Vapor							>480	>480	6	>480	>480	6
Phosphine	7803-51-2	Vapor							imm	nm	nm	>480	>480	6
Phosphinic acid (50%)	6303-21-5	Liquid							>480	>480	6			
Phosphoric acid (50%)	7664-38-2	Liquid												
Phosphoric acid (85%)	7664-38-2	Liquid	>480	>480	6	>480	>480	6	>480	>480	6	>480	>480	6
Phosphorus oxychloride	10025-87-3	Liquid							>480	>480	6	>480	>480	6
Phosphorus trichloride	7719-12-02	Liquid				imm	imm		>480	>480	6	>480	>480	6
Picoline, 2-	109-06-8	Liquid							>480	>480	6	>480	>480	6
Picoline, 3-	108-99-6	Liquid							>480	>480	6	>480	>480	6
Pimelic ketone	108-94-1	Liquid				136	136	4	>480	>480	6	>480	>480	6
Polymethylene polyphenyle isocyanate (p-MDI)	9016-87-9	Liquid				>480	>480	6	>480	>480	6	>480	>480	6
Potassium acetate (sat)	127-08-2	Liquid				>480	>480	6				nm	>480	6
Potassium chromate (sat)	7789-00-6	Liquid	>480	>480	6	>480	>480	6	>480	>480	6	nm	>480	6
Potassium hydroxide (45%)	1310-58-3	Liquid				>480	>480	6				>480	>480	6
Potassium hydroxide (50%)	1310-58-3	Liquid	>480	>480	6				>480	>480	6			
Prop-2-en-1-al	107-02-8	Liquid							48*	>480	6	>480	>480	6
Prop-2-en-1-al (90%)	107-02-8	Liquid				24	24	1						
Prop-2-yn-1-ol	107-19-7	Liquid							123	127	4	>480	>480	6
Propan-1-ol	71-23-8	Liquid							>480	>480	6			
Propan-2-ol	67-63-0	Liquid	imm	imm		>480	>480	6	>480	>480	6			
Propan-2-one	67-64-1	Liquid	imm	nm		imm	29*	1	>480	>480	6	>480	>480	6
Propanol, 1-	71-23-8	Liquid							>480	>480	6			
Propanol, n-	71-23-8	Liquid							>480	>480	6			
Propargyl alcohol	107-19-7	Liquid							123	127	4	>480	>480	6
Propen-1-ol, 2-	107-18-6	Liquid				>480	>480	6	>480	>480	6	>480	>480	6
Propenamide (50%)	79-06-1	Liquid				>480	>480	6	>480	>480	6	>480	>480	6
Propene acid	79-10-7	Liquid	imm	imm		>480	>480	6	>480	>480	6	>480	>480	6
Propenenitrile, 2-	107-13-1	Liquid	imm	imm		36*	36*	2	8	>480	6			

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mins Minutes
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nm Not measured
sat Saturated solution
N/A Not Applicable

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[8] Actual breakthrough time; normalized breakthrough time is not available

TYCHEM® FABRICS – Permeation Data

Chemical Name	CAS	Physical State	Tychem® C/C2			Tychem® 4000			Tychem® F/F2			Tychem® TK.		
			BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN
Propenoic acid butyl ester, 2-	141-32-2	Liquid										>480	>480	6
Propenoic acid nitrile	107-13-1	Liquid	imm	imm		36*	36*	2	8	>480	6			
Propyl alcohol	71-23-8	Liquid							>480	>480	6			
Propyl amine, n-	107-10-8	Liquid							16*	>480	6			
Propyl bromide, n-	106-94-5	Liquid				12	12	1						
Propylene aldehyde	123-73-9	Liquid				34	34	2				>480	>480	6
Propylene imine (90%)	75-55-8	Liquid										120	>480	6
Propylene oxide, 1,2-	75-56-9	Liquid							14	nm		>480	>480	6
Pyridene, 2-fluoro-6-(trifluoromethyl)	94239-04-0	Liquid							>480	>480	6			
Pyridine	110-86-1	Liquid				31	31	2	>480	>480	6	>480	>480	6
Pyroacetic ether	67-64-1	Liquid	imm	nm		imm	29*	1	>480	>480	6	>480	>480	6
Pyrrolidine	123-75-1	Liquid							45*	145*	4	413	nm	nm
Sarin (GB), FINABEL 0.7.C	107-44-8	Liquid							>1400[8]					
Sarin (GB), MIL-STD-282 (10 g/m2)	107-44-8	Liquid				>480[8]						>480[8]		
Sarin (GB), MIL-STD-282 (100 g/m2)	107-44-8	Liquid							>480[8]			>480[8]		
Silane	7803-62-5	Vapor							>480	>480	6	>480	>480	6
Silicon tetrachloride	10026-04-7	Liquid				35	35	2	>480	>480	6	>480	>480	6
Sodium cyanide (45%)	143-33-9	Liquid							>480	>480	6			
Sodium cyanide (sat)	143-33-9	Liquid				>480	>480	6						
Sodium fluoride (sat)	7681-49-4	Liquid	>480	>480	6	>480	>480	6						
Sodium hydroxide (42%)	1310-73-2	Liquid	>480	>480	6									
Sodium hydroxide (50%)	1310-73-2	Liquid	>480	>480	6	>480	>480	6	>480	>480	6	>480	>480	6
Sodium hypochlorite (15%)	7681-52-9	Liquid	>480	>480	6	>480	>480	6	>480	>480	6	>480	>480	6
Sodium hypochlorite (sat)	7681-52-9	Liquid												
Sodium metabisulphite (38%)	7681-57-4	Liquid				>480	>480	6						
Sodium methylate (50% in Methanol)	124-41-4	Liquid										>480	>480	6
Soman (GD), FINABEL 0.7.C	96-64-0	Liquid							>1400[8]					
Soman (GD), MIL-STD-282 (10 g/m2)	96-64-0	Liquid										>480[8]		
Soman (GD), MIL-STD-282 (100 g/m2)	96-64-0	Liquid							>480[8]			>480[8]		
Spiritus	64-17-5	Liquid				>480	>480	6	>480	>480	6			
Stoddard solvent	8052-41-3	Liquid										>480	>480	6

BT 0.1 Normalized breakthrough time at 0.1 µg/cm²/min
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CAS Chemical abstracts service registry number

mins Minutes
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< Smaller than

imm Immediate (< 4 min)
nm Not measured
sat Saturated solution
N/A Not Applicable

***** Based on lowest single value
[8] Actual breakthrough time; normalized breakthrough time is not available

TYCHEM® FABRICS – Permeation Data

Chemical Name	CAS	Physical State	Tychem® C/C2			Tychem® 4000			Tychem® F/F2			Tychem® TK.		
			BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN
Styrene	100-42-5	Liquid				16	16	1	>480	>480	6	>480	>480	6
Sulfamic acid (15%)	5329-14-6	Liquid										>480	>480	6
Sulfamidic acid (15%)	5329-14-6	Liquid										>480	>480	6
Sulfur Mustard (HD), FINABEL 0.7.C	505-60-2	Liquid							>1400[8]					
Sulfur Mustard (HD), MIL-STD-282 (10 g/m2)	505-60-2	Liquid				>480[8]						>480[8]		
Sulfur Mustard (HD), MIL-STD-282 (100 g/m2)	505-60-2	Liquid							>480[8]			>480[8]		
Sulfur dioxide	7446-09-05	Vapor				>480	>480	6	24*	24*	1	>480	>480	6
Sulfur hexafluoride	2551-62-4	Vapor										>480	>480	6
Sulfur monochloride	10025-67-9	Liquid										>480	>480	6
Sulfur trioxide	7446-11-09	Liquid										90	90	3
Sulfuric acid (50%)	7664-93-9	Liquid	>480	>480	6									
Sulfuric acid (>95%)	7664-93-9	Liquid	>480	>480	6	>480	>480	6	>480	>480	6	>480	>480	6
Sulfuric acid diethyl ester	64-67-5	Liquid							>480	>480	6	>480	>480	6
Sulfuric acid dimethyl ester	77-78-1	Liquid				>480	>480	6	>480	>480	6	>480	>480	6
Sulfuric acid fuming (103%)	8014-95-7	Liquid										>480	>480	6
Sulfuric acid fuming (20%)	8014-95-7	Liquid				>480	>480	6						
Sulfuric acid fuming (30%)	8014-95-7	Liquid	82	105	3	450								
Sulfuric acid fuming (40%)	8014-95-7	Liquid							455*	>480	6	>480	>480	6
Sulfuric acid fuming (65%)	8014-95-7	Liquid							248	370	5	>480	>480	6
Sulfuryl chloride	7791-25-5	Liquid							>480	>480	6	>480	>480	6
Sulphur dichloride	10545-99-0	Liquid										440	>480	6
Tabun (GA), FINABEL 0.7.C	77-81-6	Liquid							>1400[8]					
Tabun (GA), MIL-STD-282 (10 g/m2)	77-81-6	Liquid										>480[8]		
Tabun (GA), MIL-STD-282 (100 g/m2)	77-81-6	Liquid							>480[8]			>480[8]		
Tetracarbonylnickel	13463-39-3	Liquid										>480	>480	6
Tetrachloro bisphenol-A, 2,2',6,6'-	79-95-8	Solid							>480	>480	6			
Tetrachloro ethane, 1,1,2,2,-	79-34-5	Liquid				98	>480	6	>480	>480	6	>480	>480	6
Tetrachloro ethylene, 1,1,2,2-	127-18-4	Liquid	imm	imm		imm	imm		>480	>480	6	>480	>480	6
Tetrachloro methane	56-23-5	Liquid							4*	>480	6	>480	>480	6
Tetraethoxysilane	78-10-4	Liquid										>480	>480	6
Tetraethyl ammonium hydroxide (35%)	77-98-5	Liquid				>480	>480	6						

BT 0.1 Normalized breakthrough time at 0.1 µg/cm²/min
BT 1.0 Normalized breakthrough time at 1.0 µg/cm²/min
EN Classification according to EN 14325
CAS Chemical abstracts service registry number

mins Minutes
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< Smaller than

imm Immediate (< 4 min)
nm Not measured
sat Saturated solution
N/A Not Applicable

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[8] Actual breakthrough time; normalized breakthrough time is not available

TYCHEM® FABRICS – Permeation Data

Chemical Name	CAS	Physical State	Tychem® C/C2			Tychem® 4000			Tychem® F/F2			Tychem® TK.		
			BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN
Tetraethyl lead	78-00-2	Liquid										>480	>480	6
Tetraethylene pentamine	112-57-2	Liquid				>480	>480	6	>480	>480	6	>480	>480	6
Tetrafluoroethane, 1,1,1,2-	811-97-2	Vapor				>480	>480	6				>480	>480	6
Tetrafluoromethane	75-73-0	Vapor										>480	>480	6
Tetrahydrofuran	109-99-9	Liquid	imm	imm		imm	imm		>480	>480	6	>480	>480	6
Tetramethyl ammonium hydroxide (25%)	75-59-2	Liquid	>480	>480	6				>480	>480	6	>480	>480	6
Tetramethyl tin (0.5% in Pentane)	N/A	Liquid										>480	>480	6
Thioglycolic acid	68-11-1	Liquid							>480	>480	6	>480	>480	6
Thionyl chloride	7719-09-07	Liquid							21	33	3	90	90	3
Thiotepa (10 mg/ml)	52-24-4	Liquid							>480	>480	6			
Tin chloride, mono-n-butyl	1118-46-3	Liquid							>480	>480	6			
Tin chloride, tri-n-butyl	1461-22-9	Liquid							nm	>480	6			
Titan(IV) chloride	7550-45-0	Liquid				imm	45	2	>480	>480	6	>480	>480	6
Titanium tetrachloride	7550-45-0	Liquid				imm	45	2	>480	>480	6	>480	>480	6
Toluene	108-88-3	Liquid	imm	imm		imm	imm		>480	>480	6	>480	>480	6
Toluene diisocyanate, 1.3-	26471-62-5	Liquid										>480	>480	6
Toluene diisocyanate, 2.4-	584-84-9	Liquid	imm	imm										
Toluene diisocyanate, 2.4- (80%)	584-84-9	Liquid				>480	>480	6	>480	>480	6			
Toluidine, m-	108-44-1	Liquid				>480	>480	6						
Toluidine, o-	95-53-4	Liquid				>480	>480	6	>480	>480	6	>480	>480	6
Trichlor vinylsilane	75-94-5	Liquid				100	110	3						
Trichloro 1,2,2-trifluoroethane, 1,1,2-	76-13-1	Liquid										>480	>480	6
Trichloro 1,3,5-triazine, 2,4,6- (20% in Toluene)	108-77-0	Liquid										>480	>480	6
Trichloro acetic acid	76-03-9	Liquid							>480	>480	6			
Trichloro acetone, 1,1,3-	921-03-9	Liquid							nm	>480	6			
Trichloro benzene, 1,2,4-	120-82-1	Liquid	imm	imm		87	175	4	>480	>480	6	>480	>480	6
Trichloro ethane, 1,1,1-	71-55-6	Liquid										>480	>480	6
Trichloro ethane, 1,1,2-	79-00-5	Liquid							164*	202*	4			
Trichloro ethanol, 2,2,2-	115-20-8	Liquid				>480	>480	6	>480	>480	6	>480	>480	6
Trichloro ethylene	79-01-6	Liquid				imm	imm		>480	>480	6	>480	>480	6
Trichloro methane	67-66-3	Liquid				imm	imm		8	8		>480	>480	6

BT 0.1 Normalized breakthrough time at 0.1 µg/cm²/min
BT 1.0 Normalized breakthrough time at 1.0 µg/cm²/min
EN Classification according to EN 14325
CAS Chemical abstracts service registry number

mins Minutes
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< Smaller than

imm Immediate (< 4 min)
nm Not measured
sat Saturated solution
N/A Not Applicable

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TYCHEM® FABRICS – Permeation Data

Chemical Name	CAS	Physical State	Tychem® C/C2			Tychem® 4000			Tychem® F/F2			Tychem® TK.		
			BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN
Trichloro phenylsilane	98-13-5	Liquid				>480	>480	6	>480	>480	6	>480	>480	6
Trichloro silane	10025-78-2	Liquid				60	60	2				>480	>480	6
Triethyl amine	121-44-8	Liquid				12*	>480	6	>480	>480	6	>480	>480	6
Triethylentetramine (60%)	112-24-3	Liquid				>480	>480	6	>480	>480	6	>480	>480	6
Trifluoro acetic acid	76-05-1	Liquid				>480	>480	6	>480	>480	6			
Trifluoro ethanol, 2,2,2-	75-89-8	Liquid										>480	>480	6
Trifluoro methane	75-46-7	Vapor										>480	>480	6
Trifluoro methansulfonic acid	1493-13-6	Liquid				>480	>480	6	>480	>480	6	>480	>480	6
Trifluoro-2-(trifluoromethyl)propene, 3,3,3-	382-10-5	Vapor										>480	>480	6
Trimethyl amine	75-50-3	Vapor										>480	>480	6
Trimethyl aminomethane	75-64-9	Liquid										>480	>480	6
Trimethyl chinon (30 °C)	935-92-2	Liquid							nm	>480	6			
Trimethyl phosphate	512-56-1	Liquid										>480	>480	6
Tripropyl amine	102-69-2	Liquid										>480	>480	6
Tungsten hexafluoride	7783-82-6	Vapor										>480	>480	6
VM & P Naphtha	8030-30-6	Liquid				12*	>480	6				>480	>480	6
VX Nerve Agent, FINABEL 0.7.C	50782-69-9	Liquid							>1400[8]					
VX Nerve Agent, MIL-STD-282 (10 g/m2)	50782-69-9	Liquid				>480[8]						>480[8]		
VX Nerve Agent, MIL-STD-282 (100 g/m2)	50782-69-9	Liquid							>480[8]			>480[8]		
Vinyl acetate	108-05-4	Liquid										>480	>480	6
Vinyl benzol	100-42-5	Liquid				16	16	1	>480	>480	6	>480	>480	6
Vinyl carbinol	107-18-6	Liquid				>480	>480	6	>480	>480	6	>480	>480	6
Vinyl chloride	75-01-4	Vapor				>480	>480	6	>480	>480	6	>480	>480	6
Vinyl cyanide	107-13-1	Liquid	imm	imm		36*	36*	2	8	>480	6			
Vinyl ethylene (gaseous)	106-99-0	Vapor	imm	imm		>480	>480	6	>480	>480	6	>480	>480	6
Vinyl ethylene (liquid at 0 °C)	106-99-0	Liquid										>180	>180	4
Vinyl magnesium chloride (16.5% in THF)	3536-96-7	Liquid				imm	imm							
Vinyl pyridine, 4-	100-43-6	Liquid				15	45	2						
Vinylidene chloride	75-35-4	Liquid							>480	>480	6	>480	>480	6
White liquor	68131-33-9	Liquid				>480	>480	6				>480	>480	6
White spirit	N/A	Liquid							>480	>480	6			
Xylene, mixed isomers	1330-20-7	Liquid							>480	>480	6	>480	>480	6

BT 0.1 Normalized breakthrough time at 0.1 µg/cm²/min
BT 1.0 Normalized breakthrough time at 1.0 µg/cm²/min
EN Classification according to EN 14325
CAS Chemical abstracts service registry number

mins Minutes
> Larger than
< Smaller than

imm Immediate (< 4 min)
nm Not measured
sat Saturated solution
N/A Not Applicable

***** Based on lowest single value
[8] Actual breakthrough time; normalized breakthrough time is not available

TYVEK® FABRICS – Permeation Data

Chemical Name	CAS	Physical State	Tyvek® L1431N			Tyvek® 800		
			BT 0.1 mins	BT 1.0 mins	EN	BT 0.1 mins	BT 1.0 mins	EN
Acetic acid (30%)	64-19-7	Liquid	imm	imm				
Ammonium hydroxide (16%)	1336-21-6	Liquid	imm	imm				
Ammonium hydroxide (30%)	1336-21-6	Liquid	imm	imm				
Dimethyl sulfate	77-78-1	Liquid	imm	imm				
Ethylene glycol	107-21-1	Liquid	imm	imm		4	15	1
Formic acid (30%)	64-18-6	Liquid	imm	imm				
Glycerol	56-81-5	Liquid	>480	>480	6			
Hydrochloric acid (16%)	7647-01-0	Liquid	60*	65*	3			
Hydrochloric acid (30%)	7647-01-0	Liquid	imm	imm				
Hydrogen peroxide (10%)	7722-84-1	Liquid	>480	>480	6			
Hydrogen peroxide (30%)	7722-84-1	Liquid	imm*	nm				
Mercuric II chloride (sat)	7487-94-7	Liquid	>480	>480	6			
Nitric acid (10%)	7697-37-2	Liquid	>480	>480	6			
Nitric acid (30%)	7697-37-2	Liquid	60*	60*	2	75*	95*	3
Phosphoric acid (50%)	7664-38-2	Liquid	>480	>480	6			
Potassium chromate (sat)	7789-00-6	Liquid	>480	>480	6			
Potassium hydroxide (40%)	1310-58-3	Liquid	60*	>480	6			
Sodium acetate (sat)	127-09-3	Liquid	>480	>480	6			
Sodium hydroxide (>95%, solid)	1310-73-2	Solid	>480	>480	6			
Sodium hydroxide (10%)	1310-73-2	Liquid	>480	>480	6			
Sodium hydroxide (40%)	1310-73-2	Liquid	>480	>480	6			
Sodium hydroxide (50%)	1310-73-2	Liquid	220*	>480	6	>480	>480	6
Sodium hypochlorite (13%)	7681-52-9	Liquid	>480	>480	6			
Sodium hypochlorite (sat)	7681-52-9	Liquid	>480	>480	6			
Sulfuric acid (18%)	7664-93-9	Liquid	>480	>480	6			
Sulfuric acid (30%)	7664-93-9	Liquid	>240	>240	5	>480	>480	6
Sulfuric acid (50%)	7664-93-9	Liquid	50*	75*	3			

BT 0.1 Normalized breakthrough time at 0.1 µg/cm²/min
BT 1.0 Normalized breakthrough time at 1.0 µg/cm²/min
EN Classification according to EN 14325
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mins Minutes
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imm Immediate (< 4 min)
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N/A Not Applicable

***** Based on lowest single value
[8] Actual breakthrough time; normalized breakthrough time is not available

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