RESPIREX

REPRESENTED & DISTRIBUTED BY:

Manufacturers of Personal Protective and Respiratory Protective Equipment

RESPIREX INTERNATIONAL LTD

THE LEADING MANUFACTURER OF PERSONAL AND RESPIRATORY PROTECTIVE EQUIPMENT

Our product range is the most comprehensive and technically advanced available on the market today with every consideration being given to safety and comfort.

For many years we have been at the forefront of technological development.

We are constantly striving to make new headway in the production of even more sophisticated protective equipment in the pursuit of the safest possible working environment.

Our quality management system has been accredited to ISO9001 since 1995.

We pride ourselves on a comprehensive and up-to-date knowledge of all regulatory requirements for Personal Protective Equipment and frequently advise users of the impact of legislative change.
We have representatives working on the European Committee for Standardisation (CEN) TC 162, Working Group 3, which is charged with writing standards on testing and evaluation of chemical protective clothing.

To comply with European legislation all our products are CE marked, this ensures that the clothing has passed the rigorous testing required to achieve the appropriate standard.

COMPANY BACKGROUND

Formed 1957
Privately owned Surrey based Company
Established Chemical Clothing manufacturer since 1978
Continuously profitable
policy of high level reinvestment

Worldwide Customer Base

Sector leader's in design & innovation

Hi-tech production & quality control methods

Complete range of protective clothing covering Industry & Hazmax markets

PRINCIPAL ACTIVITIES

Manufacturer of specialist chemical and respiratory protective clothing - reusable limited use

Chemical permeation testing to BSEN369 and ASTM 739 in our in-house UKAS accredited chemical permeation Laboratory

CHEMLINE UK a post incident advisory service

SERVICETECH + REPAIR CENTRE
Mobile equipment maintenance & testing service or returned to the factory

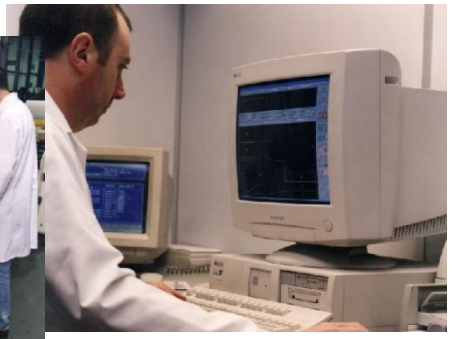
ISO 9001: 2000 accredited

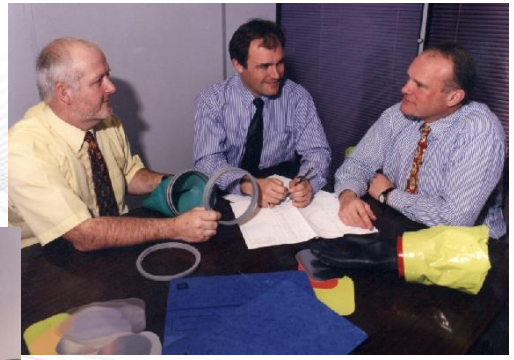
Niosh approvals

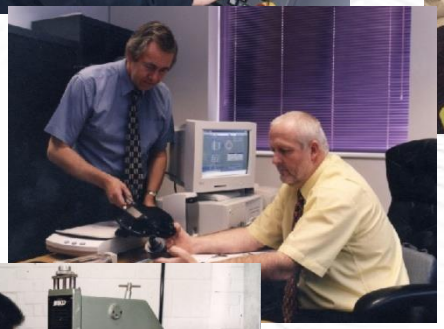
All product CE Marked

RESPIREX at work








Manufacturers of Personal Protective and Respiratory Protective Equipment

RESPIREX

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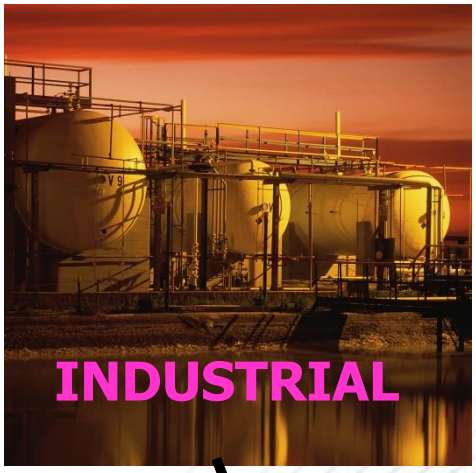
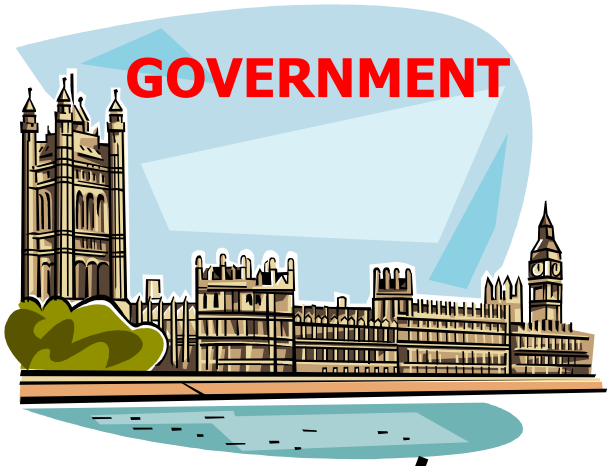
MAJOR MARKETS





Petro-Chemical, Beauty products,

Nuclear, Pharmaceutical, Food, Transport {Airports, Road /Rail}

Plastics, Paper Mills, Water & Waste Treatment, Refinery.

Military, Civil Defence, Police, Ambulance/Hospitals, Research Establishments,

Mass-Decontamination Centres

MAJOR MARKETS

- Power Stations(Conventional & Nuclear)
- Nuclear Re-processing / Decommissioning
- Military / EOD
- Oil Refineries / Petrochemical
- Water Companies
- Tank Cleaning Companies
- Fire Brigades{Industrial & Civil Defence)
- Police
- Hospital and Ambulance Services

MAJOR MARKETS

- Chemical Manufacturers
- Primary Pharmaceutical Manufacturers
- Transport & Distribution
- Cold Storage / Chemical Storage
- Paper Mills
- Fertiliser manufacturers
- Mining Companies
- Food Manufacturing / Processing

RESPIREX MARKETING GUIDE

	GAS TIGHT SUITS	SPLASH SUITS	AIR-FED RANGE	CHEMICAL WORKWEAR
RAIL TRANSPORT	GTB & GTIM	SC1 & SC4		
PORT AUTHORITIES & DOCKS	GTB & GTIM TYCHEM			
AIRPORT EMERGENCY SERVICES	GTB,TYCHEM TK	SC1 & SC4		
MILITARY & DEFENCE	GTB & GTIM + PRPS + TYCHEM	SC1 & SC4 (BLUE LAMINATE)		
INDUSTRIAL FIRE BRIGADES	GTB,TYCHEM TK	SC1 & SC4		
CHEMICAL TRANSPORT & HANDLING				JACKET & TROUSERS OR ONE PIECE SUITS
TANK CLEANING			AE TANK SUIT {SIMPLAIR}	

RESPIREX MARKETING GUIDE

	GAS TIGHT SUITS	SPLASH SUITS	AIR-FED RANGE	CHEMICAL WORKWEAR
FIRE BRIGADES	GTB, TYCHEM TK & PRPS	SC1 & SC4		
PETROLEUM ALKYLATION UNITS	GTB,TYCHEM TK		SIMPLAIR HOODS OR TANK SUITS	JACKET & TROUSERS OR ONE PIECE SUITS
CHEMICAL MANUFACTURERS	GTB,TYCHEM TK		SIMPLAIR HOODS,SUITS OR TANK SUITS AND AIRPROTEX WITH CAMFLO FRONTAIR 2	JACKET & TROUSERS OR ONE PIECE SUITS
PRIMARY PHARMACEUTICAL MANUFACTURERS	GTB,TYCHEM TK	SC1 & SC4	SIMPLAIR HOODS,SUITS OR TANK SUITS AND AIRPROTEX WITH CAMFLO FRONTAIR 2	
WATER TREATMENT PLANTS	GTB,TYCHEM TK	SC1 & SC4		
COLD STORAGE AMMONIA)	GTB,TYCHEM TK	SC1 & SC4		JACKET & TROUSERS OR ONE PIECE SUITS

RESPIREX

JUST SOME OF OUR CLIENTS

BNFL BP CHEVRON SHELL URENCO SASOL ROHM & HAAS ESSO

GSK PFIZER DEPARTMENT OF HEALTH MET POLICE INEOS

MEXICHEM SAPREF ROLLS ROYCE ESKOM FORENSIC SCIENCES

BRITISH ENERGY BRITISH TELECOM BRITISH TRANSPORT POLICE ASTRA ZENECA US DEPARTMENT OF ENERGY

DOW ELI LILLEY NOVARTIS BAYER GROWHOW

SCHENCTEDY TOTAL VICTREX LUCITE TIOXIDE

DOW CHEMICALS F2 CHEMICALS FIRE BRIGADES WORLDWIDE

ARCHEMICA NASA NATREF SHIN-ETSU ABBOTT LABORATORIES

RESPIREX INTERNATIONAL LTD

GAS TIGHT SUITS CONFORMING TO EN943-2ET

THE LEADING MANUFACTURER OF PERSONAL AND RESPIRATORY PROTECTIVE EQUIPMENT

Limited life – TYCHEM TK GAS TIGHT SUITS CONFORMING TO EN943-2(ET)

Limited life – TYCHEM TK GAS TIGHT PRPS SUITS CONFORMING TO RILS0002 (EN943-2(ET) AND EN12941)

Reusable Viton Butyl Viton GAS TIGHT SUIT CONFORMING TO EN943-2(ET)

Definitions in EN943-1

3.21 Reusable Chemical Protective Clothing

Chemical protective clothing that is constructed from materials which allow the clothing to be cleaned after repeated chemical exposures such that it remains suitable for continued use.

3.12 Limited Use and Disposable Protective Clothing

Chemical protective clothing for limited wear life usage, i.e. to be worn until hygienic cleaning becomes necessary or chemical contamination has occurred and disposal is required. This includes protective clothing for single use and for limited re-use according to the information supplied by the manufacturer.

Where and Why Reusable

- **Contamination well known and controlled i.e. chemical plant manufacturing one or more known chemicals**
- **Guarantee decontamination i.e. procedures well tried, documented and proved**
- **High risk of heavy mechanical damage to garment i.e. from surrounding areas**
- **Where high risk of flame is present**

WHERE & WHY LIMITED USE

- **Can you guarantee decontamination**
- **Cross contamination risk high - passing contamination to next wearer**
- **Garments to be fit for purpose throughout useful life**
- **Legislative responsibility of employers for employees**
- **Level of barrier resistance versus reusables**
- **Level of comfort versus reusables - Tychem® TK weighs 2kg**
- **Level of maintenance versus reusables**
- **Training versus reusables**
- **Concept easier to understand**
- **Quality of Tychem® TK gas tight suits**
- **Limited use now out selling reusables by a wide margin and growing**

GTB GAS TIGHT REUSABLE

Large rigid visor, clear vision with high chemical resistance

120cm Gas Tight zip

Twin exhalation valves

Bat-wing sleeve design

360° swivelling airline "pass-thru"

Conforming to EN943-2ET

Adjustable internal support belt

Zip/zip flap

Double Gloves / locking cuffs

Integral socks or attached Hazmax Boots

TYCHEM TK GAS TIGHT SUIT

THE LEADING MANUFACTURER OF PERSONAL AND RESPIRATORY PROTECTIVE EQUIPMENT

Coverall design

Twin exhalation valves

Bat-wing sleeve design

360° swivelling airline "pass-thru"

Conforming to EN943-2ET

Adjustable internal support belt

Laminated crystal clear visor

Zip/zip flap

Double Gloves / locking cuffs

Integral socks or attached Hazmax Boots

OPERATIONAL PRPS SUIT

THE LEADING MANUFACTURER OF PERSONAL AND RESPIRATORY PROTECTIVE EQUIPMENT

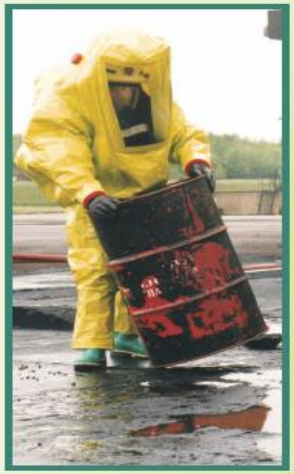
- **RILS0002 & TS0085**
  PRPS:
  - Operational suit immediately ready for single use in civil emergency incidents.
  - Designed as a limited-use garment, i.e. designed to be worn until chemical contamination has occurred and disposal is required.
  - Certified as a gas tight suit as well as offering full respiratory protection.
  - Lime Green Tychem® TK (multi-layer) which is a highly protective material used to prevent the permeation of various extremely hazardous chemicals and substances
  - Single use Lithium battery
  - PVC Visor plus Chemical Protection layer
  - Operational filters (JFR-85-CE) have very high filtration capabilities for Particles and many different types
  - Re-hydration facility
  - Exterior attachment point for dist

EN943-2 LIMITED LIFE GAS TIGHT SUITS

RESPIREX

Limited-Life Gas-Tight Suit

The Respirex limited-life Gas Tight suit (Type 1A/Level A) is manufactured from a high performance multilayer polymer fabric developed by DuPont Nonwovens. It is of one-piece construction and is fully encapsulating, covering both the wearer and breathing apparatus. The suit incorporates the latest technology in both fabric and design and is compatible with a wide range of manufacturer's breathing apparatus.

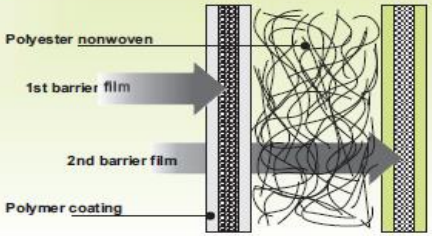


All Respirex limited-life gas tight suits are manufactured in accordance with the latest European standard for protective clothing against liquid and gaseous chemicals, including liquid aerosols and solid particles, and are extensively used by emergency teams throughout the world.

Main Features

- High performance chemical barrier, seven layer non-woven fabric.
- Lightweight.
- Adjustable internal support belt and 'Bat-Wing' sleeves for optimal wearer comfort.
- Wide, chemically resistant and mechanically strong visor providing clear undistorted vision.
- High visibility Lime Green colour.
- Available in a wide range of sizes.
- Sewn and double-taped for maximum performance.
- Replaceable dual glove system.
- Optional air line pass-thru that enables supplementary air to be supplied to the wearer's breathing apparatus.
- Integral socks with outer leg flaps or option of fitted chemical resistant safety boots.
- Supplied pre-tested in a PVC carrying bag/holdall.
- EN943 Part 2 approved for emergency team use.

Material Composition



Fabric Specification

TESTED IN ACCORDANCE WITH	PERFORMANCE REQUIREMENT	LEVEL OF PERFORMANCE	EN CLASS
EN 530 (Method 2) including pressure drop.	Abrasion Resistance	> 2000 cycles	6
Method B of EN ISO 7854 including pressure drop.	Flex Cracking Resistance	Machine direction >1000 cycles Cross direction >1000 cycles	1
EN 863	Puncture Resistance	41 N	2
EN ISO 9073-4	Trapezoidal Tear Resistance	Machine direction 159 N Cross direction 270 N	5
EN ISO 13934-1	Tensile Strength	Machine direction 396 N Cross direction 501 N	4
EN 374-3	Permeation Resistance when tested against 96.8% sulphuric acid*	Mean breakthrough time > 480 minutes	6
EN 13274-4	Resistance to flame	No part ignited or continued to burn on removal from flame	1
ISO 5082 Annex A2	Seam Strength	607 N	5

Chemical Performance

CHEMICAL	CHEMICAL BARRIER MATERIAL	GLOVE ASSEMBLY	'HAZMAX' BOOTS	LAMINATED VISOR
Acetone	> 480	> 360	> 2 hours	> 480
Acetonitrile	> 480	> 480	> 6 hours	> 480
Ammonia Gas	> 480	> 480	> 8 hours	> 480
Carbon Disulphide	> 480	> 480	> 1 hour	> 480
Chlorine Gas	> 480	> 480	> 3 hours	> 480
Dichloromethane	> 480	> 480	> 1 hour	> 480
Diethylamine	> 480	> 480	> 2 hours	> 480
Ethyl Acetate	> 480	> 360	> 4 hours	> 480
n-Heptane	> 480	> 480	> 8 hours	> 480
Hydrogen Chloride Gas	> 480	> 480	> 8 hours	> 480
Methanol	> 480	> 480	> 8 hours	> 480
Sodium Hydroxide	> 480	> 360	> 8 hours	> 480
Sulphuric Acid (3 Molar)	> 480	> 360	> 8 hours	> 480
Tetrahydrofuran	> 480	> 480	> 3 hours	> 480
Toluene	> 480	> 360	> 4 hours	> 480

Breakthrough time in minutes unless otherwise stated.

* Respirex's in-house laboratory can provide permeation data against other chemicals if required.

CE 0120

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EN943-2 LIMITED LIFE GAS TIGHT SUITS cont.

Respirex Limited-Life Gas Tight Suit

Fully encapsulating Type 1/Level A gas tight suit covering both the wearer and the breathing apparatus to protect the emergency responder against toxic, corrosive gases, liquids and solid chemicals and/or biological warfare agents, including the following features: -

Material: Produced by DuPont, a high performance chemical barrier fabric is puncture resistant, high strength, high tear resistant and 100% non-woven. This fabric is a seven layer laminated material comprising Polymer coating (1), Barrier film (2), Polymer coating (3), Polyester non-woven (4), Polymer coating (5), Barrier film (6) and Polymer coating (7).

Colour: High visibility lime yellow colour

Construction: One-piece protective with suit sewn seams taped on both the inside and outside for a very strong chemical and stress resistant seam. The suit includes a back pod to accommodate the wearing of self contained breathing apparatus (SCBA). The 'Bat-Wing' sleeve design provides ease of movement within the suit allowing the wearer to withdraw an arm to attend to the breathing apparatus.

Performance: The performance of the chemical protective suit fabric meets and exceeds the protection requirements of EN943-2:2002 and has a protection performance of more than eight hours breakthrough time against all of the 15 listed chemicals, plus 6 biological warfare agents (Tabun, Sarin, Mustard, Soman, Lewsite and VX). In addition the fabric provides protection against a wide range of other chemicals and hazardous materials under any environmental conditions.

Size: Available in Small, Medium, Large, Extra Large and XXL sizes – please specify size required when ordering (see sizing chart opposite).

Visor: Multi laminated anti-mist visor giving clear undistorted vision. The mechanical strength of the visor conforms to EN146:1991. Resists chemical permeation for the substances listed in the European standard EN943-2:2002 for more than 480 minutes. The design of the suit and the width of the visor gives the wearer a wide panoramic view with no visual obstruction.

Exhale Valves: Twin to rear of hood valves to ensure that the pressure within the suit does not exceed 4mbar.

Zip: 122cm (48") Heavy duty gas tight zip fitted to right hand side of suit front, closing at bottom complete with overlapping Velcro closure storm flaps.

Cuffs: Respirex locking cuff mechanism allowing replacement of gloves.

Dual Gloves: Five finger dual glove assembly comprising lined neoprene outer gloves providing a high level of mechanical strength with bonded Silver Shield chemical barrier laminate gloves on the inside.

Internal fittings: Adjustable internal support belt to enable wearers of varying sizes to comfortably use the suit.

External fittings: Two blank fittings for waistbelt support.

Leg fitting: Integral socks in the same high performance chemical barrier material with plain outer leg flap covers allowing the wearing of separate boots (see optional extras).

Additional Equipment: Carrying bag / holdall in blue PVC with Velcro closure for stowage.
Inner cotton gloves to ease donning.

Approval: CE marked and approved to EN943-2:2002 for emergency teams (ET).

Quality: Manufacturing, design and all quality procedures are approved to ISO9001:2000. Every gas-tight suit is supplied pre-tested in excess of European sandard requirements and sealed in a polythene bag.

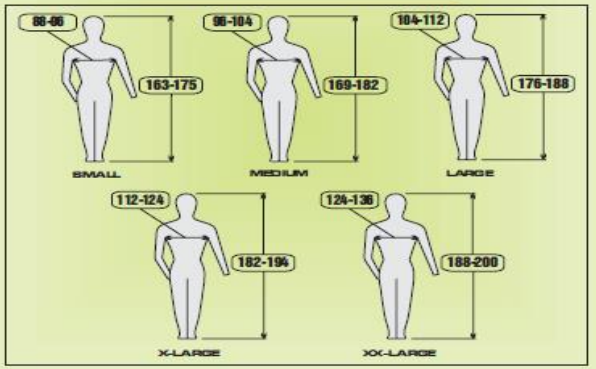
Optional Extras

Boots: Highly chemically resistant 'HAZMAX' safety boots with steel toecap and mid-sole. These are worn separately over the integral sock and inside the outer flap cover of the suit. Available in UK Sizes 6 to 12 [European Sizes 39 to 46] (Please specify size of boots required when ordering).
(Alternatively Respirex are able to supply the suit with the Hazmax boots permanently fitted instead of having the integral socks and outer leg flaps, or fitted using the Respirex detachable boot system).

Pass-thru: Swivel fitting to enable supplementary air via an external airline to be connected to the second-man attachment on the wearer's breathing apparatus including 18" internal hose. Rectus Series 95/96 CEN pattern connectors are fitted to the above pass-thru assembly with socket mounted onto the internal hose and a plug and dust cap mounted to the external swivel housing.

(NOTE: If the above connectors are not compatible with breathing apparatus used by the Fire Department, we are able to supply alternatives at an extra charge)

Sizing Chart



Suit Size	Height	Chest Size
Small	163-175 (5'4"-5'9")	88-96 (35"-38")
Medium	169-182 (5'6½"-5'11½")	96-104 (38"-41")
Large	176-188 (5'9"-6'2")	104-112 (41"-44")
X-Large	182-194 (5'11½"-6'4")	112-124 (44"-49")
XX-Large	188-200 (6'2"-6'7")	124-136 (49"-53½")

(Please specify size of suit required when ordering and size of boots if applicable)

TYCHEM TK MATERIAL

DUPONT

Tychem® TK

Technical Handbook

TYCHEM TK MATERIAL cont.

Content

Tychem® TK

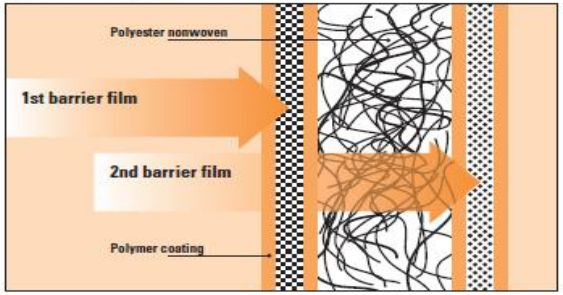
Intended use of Tychem® TK

Tychem® TK is a high performance chemical protective clothing material developed by DuPont for protection against gaseous, liquid or solid chemicals. It is mainly used in the manufacture of limited-use gas-tight (Type 1), non gas-tight (Type 2) and liquid-tight (Type 3) chemical protective suits.

Limited-use protective clothing is made to provide an optimised combination of adequate protection and comfort as needed for limited wear life usage. Limited-use clothing, i.e. clothing for limited wear life usage, is typically employed to be worn until hygienic cleaning becomes necessary or chemical contamination has occurred and disposal is required. This includes protective clothing for single use and for limited re-use according to manufacturer's instructions.

Tychem® TK passes the requirements of the European Norm prEN 943-1 & 2 – limited-use.

Tychem® TK – composition



Tychem® TK barrier material consists of high strength, high tear-resistant proprietary non-halogenated barrier films separated by 100% nonwoven polyester staple fabric.

Major benefits of Tychem® TK at a glance

- → Outstanding chemical barrier properties
- → Light weight, supple and flexible
- → High material strength and tear resistance
- → High visibility lime yellow colour
- → Physical properties maintained over a wide temperature range
- → Availability of barrier data for a wide range of chemicals
- → Availability of technical data and technical support

TYCHEM TK MATERIAL cont.

Physical properties

Mechanical properties of Tychem® TK

Property	Test method	Property value of Tychem® TK	Performance class of Tychem® TK	Minimum performance class required by prEN 943-1	Minimum performance class required by prEN 943-2
Basis Weight	ISO 536	331 g/m^2	N/A	N/A	N/A
Thickness	ISO 534	730 µm	N/A	N/A	N/A
Abrasion resistance	EN 530 Method 2 & prEN 943-1	> 2000 cycles	6 (out of 6)	3	3
Stability to heat	ISO 5978	Slight blocking	N/A	N/A	N/A
Flex cracking resistance	ISO 7854 Method B & prEN 943-1	> 1000 cycles (MD) > 1000 cycles (XD)	1 (out of 6) 1 (out of 6)	1 1	1 1
Trapezoidal tear resistance	ISO 9073-4	164 N (MD) 215 N (XD)	6 (out of 6) 6 (out of 6)	3 3	3 3
Puncture resistance	EN 863	49 N	2 (out of 6)	2	2
Resistance to ignition	prEN 1146 & prEN 943-1	Does not continue to burn	Pass	Pass	N/A
	prEN 1146 & prEN 943-2	Does not continue to burn after 1 sec. flame exposure	1 (out of 2)	N/A	1
Surface Resistivity	EN 1149-1	10^{13} Ohm	N/A	N/A	N/A

N/A – Not applicable MD – Machine direction XD – Cross direction

■ The prelimanary European standards prEN 943-1 and prEN 943-2 – limited-use, EN 466, prEN 466-2 and prEN 1511 specify the test methods applicable for Type 1, Type 2 and Type 3 limited-use chemical protective clothing and define performance classes for different properties of protective clothing materials.

Temperature range: -70 °C to 90 °C. Tychem® TK exhibits less than 2% shrinkage at 100 °C, no visible shrinkage at 70 °C and does not become brittle or fracture after 1 hour immersion in liquid nitrogen (-196 °C). The material will begin to soften above 90 °C. The auto ignition temperature is in excess of 350 °C.

Note: This usable temperature range is based on the evaluation of the physical properties of the material only. Be aware that resistance to permeation by chemicals varies heavily with temperature.

Tychem® TK meets the resistance to ignition requirements but it is not flame resistant. Therefore suits made from Tychem® TK should not be worn in a potentially flammable or explosive environment since there is no anti-static treatment applied to Tychem® TK.

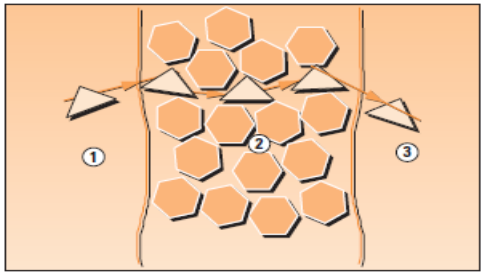
Chemical permeation

What is permeation?
Permeation is the process by which a chemical moves through a protective clothing material on a *molecular* level.

Measuring permeation
The resistance of protective clothing material to permeation by a potentially hazardous chemical is characterised by the permeation rate of the chemical through the material and the break-through time.

Permeation tests are usually conducted following the ASTM F739, EN 369 or EN 374-3 test methods simulating continous direct contact between the chemical and the protective clothing material.

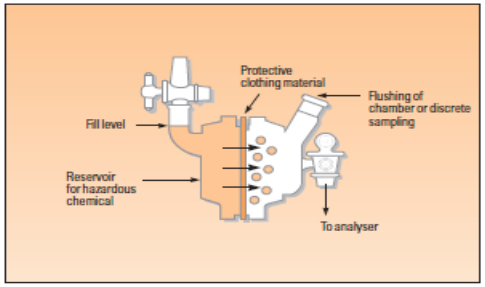
Fig. 1 **Permeation**



① Sorption of molecules of liquid liquid onto the contacted (outside) surface of the material ② Diffusion of the sorbed molecules across the material ③ Desorption of the molecules from the opposite (inside)

Schematic of a permeation test cell
The outside surface of a test material is exposed to a chemical using a permeation test cell. Permeation of the chemical to the inside material surface is monitored by sampling the collection side of the cell and analytically determining when the chemical has permeated across the material.

Fig. 2 **Permeation test cell**



Permeation Rate
The rate at which the hazardous chemical permeates through the test material.

The permeation rate is expressed as a mass of chemical passing through an area per unit of time.

$$\text{Permeation Rate} = \frac{\text{Mass}}{\text{Area x Time}} = \frac{\mu g}{cm^2 \text{ x minute}}$$

TYCHEM TK MATERIAL cont.

Steady State Permeation Rate (SSPR)
The constant permeation rate that occurs after breakthrough when chemical contact is continuous and all forces affecting permeation have reached equilibrium.

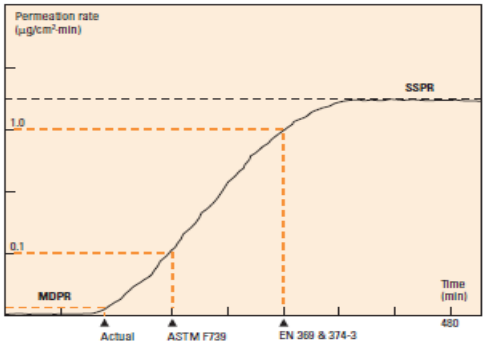
Minimum Detectable Permeation Rate (MDPR)
The minimum permeation rate that can be detected during the permeation test.

MDPR is a function of the sensitivity of the analytical measurement technique, the volume into which the permeated chemical is collected and the sampling time. Minimum detectable permeation rates can be as low as 0.001 µg/cm²·min in certain cases.

Actual breakthrough time
The average elapsed time between initial contact of the chemical with the outside surface of the material and the time at which the chemical is detected at the inside surface of the material. Thus, the 'actual breakthrough time' is dependent on the analyser sensitivity.

An actual breakthrough time of > 480 minutes and a permeation rate of "nd" (not detected) does not mean breakthrough has not occurred. It means that permeation was not detected after an observation time of eight hours. Permeation may have occurred, but at a rate less than the minimum detectable permeation rate (MDPR) of analytical device. MDPR can vary depending on the chemical or on the analytical device.

Fig. 3 **"Typical" permeation cell results**



Breakthrough time
There exist three definitions of breakthrough time. When comparing 'breakthrough times' of various materials for a given chemical it is important to ensure that data based on 'like' definitions of breakthrough times are being compared.

Note: When selecting a chemical barrier material, the MDPR and expected exposure times are used to determine if the level of protection is sufficient taking into account the toxicity of the chemical used.

Normalised breakthrough time (according to ASTM F739)
The average elapsed time between initial contact of the chemical with the outside surface of the material and the time at which the chemical is detected at the inside surface of the material at a permeation rate of 0.1µg/cm²·min. Thus the breakthrough time is 'normalised' as it is independent of the analyser sensitivity.

Normalised breakthrough time (according to EN 369 & EN 374-3)
The average elapsed time between initial contact of the chemical with the outside surface of the material and the time at which the chemical is detected at the inside surface of the material at a permeation rate of 1µg/cm²·min. Thus the breakthrough time is 'normalised' as it is independent of the analyser.

Note: A normalised breakthrough time of > 480 minutes means that the average permeation rate never reached the defined rate of 0.1 µg/cm²·min (ASTM F739) or 1.0 µg/cm²·min (EN 369 & EN 374-3). However the chemical may have actually broken through.

Performance classification of normalised breakthrough times

Normalised breakthrough time (EN 369 & EN 374-3) minutes	EN class
≥ 10	1
≥ 30	2
≥ 60	3
≥ 120	4
≥ 240	5
≥ 480	6

How is permeation performance affected by temperature?
In general, permeation is expected to increase with increasing temperatures. However, there are a few exceptions to this generality. The temperature response of permeation rates depends on the barrier material and the chemical.

For example, at room temperature, a 6 °C increase in temperature will increase the permeation rate of simple gases through an oriented polyester film from 1.3 to 2.1 fold, depending on the gases[1]. This illustrates the behaviour of one film and a few chemicals within a narrow temperature range. There are many examples of anomalous behaviour, including chemical/barrier combinations for which permeation increases with decreasing temperature.

If temperature effects are critical to the end-user's applications, DuPont suggests that the end-user conduct specific tests at the relevant conditions to answer these questions for their particular situation and refers to country specific legal situations.

1 "Diffusion in Polymers", J. Crank and G. S. Park, Ed., Academic Press, 1968, PP 46-50

Interpreting test results
Breakthrough time does not necessarily imply "safe wear time".
A breakthrough time of x minutes does not mean that the material will offer safe protection for x minutes under the user specific wear conditions. Information on breakthrough times according to EN 369 and EN 374-3 or ASTM F739 allows a specifier to determine which materials are unsuitable barriers to specific chemicals.

Should a chemical permeate through a material, but fail to reach the defined permeation rate (EN 369 & EN 374-3) of 1 µg/cm² · min, the breakthrough time is reported as being > 480 minutes. A breakthrough time of > 480 minutes does not imply the chemical has not permeated through the fabric after 480 minutes. Breakthrough time alone does not allow a user to determine how long a person could wear a garment once contaminated. Taking an example of toxic chemical, a reported breakthrough time of eight hours can easily lead a specifier to believe the fabric will provide protection up to eight hours. This is clearly not the case, as the chemical can break through the fabric and toxic levels can be built up beneath a garment long before the reported breakthrough time of 480 minutes.

The "safe user wear time" of a protective garment depends on both the toxicity of the hazardous chemical and the quantity of chemical which permeates through the material, which is dependent on:

- permeation rate of the chemical through the material
- surface area contaminated
- temperature (permeation rates are usually adversely affected by higher temperatures)
- kind of exposure (continuous, intermittant, etc.)

Therefore, strictly speaking, breakthrough time alone is only a means of comparing different material performances. In order to estimate the safe protection wear time of chemical protective clothing, permeation rate, chemical toxicity and exposure conditions need to be taken into consideration.

Realising this is a complex evaluation the TYDAT Barrier Expert System has been developed. TYDAT is a chemical data-base containing the permeation curves and exposure limits for a wide range of chemicals to estimate the approximate safe user wear time for user-specific exposure conditions.

TYCHEM TK MATERIAL cont.

Chemical permeation data

How to use the permeation data
The permeation data on the following pages is organised alphabetically.

Independent testing
The permeation test results were conducted for DuPont mainly by the independent test laboratory TRI/Environmental Inc. The permeation results for Tychem® TK were determined using the test method ASTM F739, "Test Method for Resistance of Protective Clothing Materials to Permeation by Liquids and Gases".

All permeation tests were conducted with pure chemicals at standard temperature and pressure unless otherwise specified. Sample results do vary and therefore averages for these results are reported.

Individual test certificates for each of the listed chemicals are available from DuPont on request.

Independent testing
DuPont can facilitate the independent permeation testing of your specific chemical or chemical mixtures with Tychem® TK.

Definition of terms

Physical state
The phase of the challenge chemical during the test being reported:

S – Solid
L – Liquid
G – Gas
M – Mixture

CAS no
Chemical Abstract Service Number. This number is unique for each chemical.

Permeation data

Chemical Name	CAS Number	Physical State	Average Breakthrough Time: Actual (min.)	Average Breakthrough Time: ASTM F739 normalised (min.)	Average Breakthrough Time: EN 369 & EN 374-3 normalised (min.)	SSPR ($\mu g/cm^2 \cdot min.$)	MDPR ($\mu g/cm^2 \cdot min.$)
Acetaldehyde	75-07-0	L	>480	>480	>480	<0.01	0.01
Acetic Acid, Glacial	64-19-7	L	>480	>480	>480	<0.1	0.1
Acetic Anhydride	108-24-7	L	>480	>480	>480	<0.001	0.001
Acetone	67-64-1	L	>480	>480	>480	<0.01	0.01
Acetone Cyanohydrin	75-86-5	L	>480	>480	>480	<0.01	0.01
Acetonitrile	75-05-8	L	>480	>480	>480	<0.1	0.1
Acetyl Chloride	75-36-5	L	>480	>480	>480	<0.05	0.05
Acrolein	107-02-8	L	>480	>480	>480	<0.1	0.1
Acrylamide (50% in water)	79-06-1	M	>480	>480	>480	<0.1	0.1
Acrylic Acid	79-10-7	L	>480	>480	>480	<0.06	0.06
Acrylonitrile	107-13-1	L	>480	>480	>480	<0.003	0.003
Adiponitrile	111-69-3	L	>480	>480	>480	<0.1	0.1
Allyl Alcohol	107-18-6	L	>480	>480	>480	<0.1	0.1
Allyl Chloride	107-05-1	L	>480	>480	>480	<0.06	0.06
Ammonia	7664-41-7	G	>480	>480	>480	<0.1	0.1
Ammonia (-70° C)	7664-41-7	L	>480	>480	>480	<0.1	0.1
Ammonium Hydroxide, 28%	1336-21-6	L	>480	>480	>480	<0.1	0.1
Amyl Acetate n-	628-63-7	L	>480	>480	>480	<0.003	0.003
Aniline	62-53-3	L	>480	>480	>480	<0.1	0.1
Arsine	7784-42-1	G	>480	>480	>480	<0.01	0.01
Benzene	71-43-2	L	>480	>480	>480	<0.001	0.001
Benzene Sulfonyl Chloride	98-09-9	L	>480	>480	>480	<0.1	0.1
Benzidine (75% in Methanol)	92-87-5	M	>480	>480	>480	<0.1	0.1
Benzonitrile	100-47-0	L	>480	>480	>480	<0.004	0.004
Benzoyl Chloride	98-88-4	L	>480	>480	>480	<0.05	0.05
Benzyl Chloride	100-44-7	L	>480	>480	>480	<0.01	0.01
Black Liquor	–	M	>480	>480	>480	<0.01	0.01
Boron Trifluoride Etherate	353-42-4	L	>480	>480	>480	<0.1	0.1
Bromine	7726-95-6	L	15	15	–	25	<0.01
Bromine (sat'd Vapor)	7726-95-6	G	40	40	>480	>0.6	0.1
Bromine (10g/m^2 Exposure)	7726-95-6	L	>480	>480	>480	<0.1	0.1
Bromofluorobenzene p-	460-00-4	L	>480	>480	>480	<0.001	0.001
Butadiene 1,3-	106-99-0	G	>480	>480	>480	<0.07	0.07
Butanol n-	71-36-3	L	>480	>480	>480	<0.002	0.002
Butyl Acetate n-	123-86-4	L	>480	>480	>480	<0.01	0.01
Butyl Acrylate n-	141-32-2	L	>480	>480	>480	<0.02	0.02
Butylamine n-	109-73-9	L	>480	>480	>480	<0.01	0.01
Butyl Ether n-	142-96-1	L	396	>480	>480	0.001	0.001
Butyraldehyde n-	123-72-8	L	>480	>480	>480	<0.007	0.007
Carbon Disulfide	75-15-0	L	>480	>480	>480	<0.02	0.02
Carbon Monoxide	630-08-0	G	330	330	>480	0.1	0.1
Carbon Tetrachloride	56-23-5	L	>480	>480	>480	<0.015	0.015
Chlordane	57-74-9	L	>480	>480	>480	<0.01	0.01
Chlorine	7782-50-5	G	>480	>480	>480	<0.02	0.02
Chlorine (-70° C)	7782-50-5	L	>480	>480	>480	<0.01	0.01
Chlorine Trifluoride	7790-91-2	G	45	45	–	96	0.1
Chloroacetic Acid	79-11-8	L	>480	>480	>480	<0.1	0.1
Chloroaniline p-	106-47-8	S	>480	>480	>480	<0.09	0.09

Key: Imm – Immediate
nm – not measured
nd – nothing detected
N/A – not applicable
> – greater than
< – smaller than
L – Liquid
G – Gas
S – Solid
M – Mixture
SSPR – Steady State Permeation Rate
MDPR – Minimum Detectable Permeation Rate

TYCHEM TK MATERIAL cont.

Chemical Name	CAS Number	Physical State	Average Breakthrough Time: Actual (min.)	ASTM F739 normalised (min.)	EN 369 & EN 374-3 normalised (min.)	SSPR (µg/cm². min.)	MDPR (µg/cm². min.)
Chloroaniline p- (70°C)	106-47-8	L	323	344	–	9.4	0.001
Chlorobenzene	108-90-7	L	> 480	> 480	> 480	< 0.001	0.001
Chloroethanol 2-	107-07-3	L	> 480	> 480	> 480	< 0.008	0.008
Chloroform	67-66-3	L	> 480	> 480	> 480	< 0.004	0.004
Chloromethyl Methyl Ether	107-30-2	L	305	> 480	> 480	0.03	0.001
Chlorophenol p- (Sat'd in Methanol)	106-48-9	L	> 480	> 480	> 480	< 0.013	0.013
Chlorosulfonic Acid	7790-44-5	L	> 480	> 480	> 480	< 0.1	0.1
Chlorotoluene o-	95-49-8	L	> 480	> 480	> 480	< 0.0001	0.0001
Cresol (Mixed Isomers)	108-39-4	L	> 480	> 480	> 480	< 0.01	0.01
Crude Oil	68308-34-9	L	> 480	> 480	> 480	< 0.04	0.04
Cumene	98-82-8	L	> 480	> 480	> 480	< 0.01	0.01
Cyclohexane	110-82-7	L	> 480	> 480	> 480	< 0.003	0.003
Dichloroacetone 1,3- (40° C)	534-07-6	L	> 480	> 480	> 480	< 0.1	0.1
Dichloroaniline 3,4-	95-76-1	S	> 480	> 480	> 480	< 0.001	0.001
Dichloroaniline 3,4- (70°C)	95-76-1	L	216	284	–	2.4	0.001
Dichloroethane 1,2-	107-06-2	L	> 480	> 480	> 480	< 0.002	0.002
Dichloromethane	75-09-2	L	> 480	> 480	> 480	< 0.03	0.03
Dichloroethyl Ether	111-44-4	L	> 480	> 480	> 480	< 0.01	0.01
Dichloropropane 1,2-	78-87-5	L	> 480	> 480	> 480	< 0.01	0.01
Dichloropropene 2,3-	78-88-6	L	> 480	> 480	> 480	< 0.008	0.008
Diesel Fuel	68334-30-5	L	195	> 480	> 480	0.09	0.016
Diethylamine	109-89-7	L	> 480	> 480	> 480	< 0.1	< 0.1
Diethylenetriamine	111-40-0	L	> 480	> 480	> 480	< 0.01	0.01
Di (2-ethylhexyl) phthalate	117-81-7	L	> 480	> 480	> 480	< 0.07	0.07
Diethyl Sulfate	64-67-5	L	> 480	> 480	> 480	< 0.1	0.1
Dimethylamine	124-40-3	G	> 480	> 480	> 480	< 0.05	0.05
Dimethylacetamide N,N-	127-19-5	L	> 480	> 480	> 480	< 0.006	0.006
Dimethylaniline N,N-	121-69-7	L	> 480	> 480	> 480	< 0.013	0.013
Dimethyldichlorosilane	75-78-5	L	> 480	> 480	> 480	< 0.1	0.1
Dimethyl Ether	115-10-6	L	> 480	> 480	> 480	< 0.07	0.07
Dimethylformamide N,N-	68-12-2	L	> 480	> 480	> 480	< 0.01	0.01
Dimethylhydrazine 1,1-	57-14-7	L	> 480	nm	> 480	nd	5
Dimethyl Sulfate	77-78-1	L	> 480	> 480	> 480	< 0.001	0.001
Dimethyl Sulfoxide	67-68-5	L	374	> 480	> 480	0.003	0.003
Dinitro-o-Cresol	534-52-1	L	> 480	> 480	> 480	< 0.013	0.013
Dioxane 1,4-	123-91-1	L	> 480	> 480	> 480	< 0.05	0.05
Diphenyl Methane Diisocyanate 4,4'-	101-68-8	S	> 480	> 480	> 480	< 0.07	0.07
Epichlorohydrin	106-89-8	L	> 480	> 480	> 480	< 0.014	0.014
Ethanolamine	141-43-5	L	> 480	> 480	> 480	< 0.1	0.1
Ethyl Acetate	141-78-6	L	> 480	> 480	> 480	< 0.06	0.06
Ethyl Acrylate	140-88-5	L	> 480	> 480	> 480	< 0.02	0.02
Ethylbenzene	100-41-4	L	> 480	> 480	> 480	< 0.001	0.001
Ethyl Cellosolve®	110-80-5	L	> 480	> 480	> 480	< 0.008	0.008
Ethyl Chloride	75-00-3	G	> 480	> 480	> 480	< 0.02	0.02
Ethyl Cellosolve® Acetate	111-15-9	L	> 480	> 480	> 480	< 0.002	0.002
Ethylene Dibromide	106-93-4	L	> 480	> 480	> 480	< 0.1	0.1
Ethylene Dichloride	107-06-2	L	> 480	> 480	> 480	< 0.01	0.01
Ethyleneimine	151-56-4	L	> 480	> 480	> 480	< 0.01	0.01

Permeation data cont'd

Chemical Name	CAS Number	Physical State	Average Breakthrough Time: Actual (min.)	ASTM F739 normalised (min.)	EN 369 & EN 374-3 normalised (min.)	SSPR (µg/cm². min.)	MDPR (µg/cm². min.)
Ethylene Oxide	75-21-8	G	> 480	> 480	> 480	< 0.1	0.1
Ethylene Oxide (0° C)	75-21-8	L	> 480	> 480	> 480	< 0.01	0.01
Ethylene Oxide (10% in HCFC)	Mixture	L	> 480	> 480	> 480	< 0.02	0.02
Ethyl Parathion	56-38-2	L	> 480	> 480	> 480	< 0.01	0.01
Ethyl Ether	60-29-7	L	> 480	> 480	> 480	< 0.001	0.001
Fluorobenzene	462-06-6	L	> 480	> 480	> 480	< 0.1	0.1
Fluorosilicic Acid	16961-83-4	L	> 480	> 480	> 480	< 0.1	0.1
Fluorosulfonic Acid	7789-21-1	L	> 480	> 480	> 480	< 0.1	0.1
Formaldehyde, 37%	50-00-0	L	> 480	> 480	> 480	< 0.09	0.09
Formic Acid	64-18-6	L	> 480	> 480	> 480	< 0.01	0.01
Freon® 113	76-13-1	L	> 480	> 480	> 480	< 0.01	0.01
Furaldehyde 2-	98-01-1	L	> 480	> 480	> 480	< 0.01	0.01
Gasohol	Mixture	L	170	244	> 480	0.2	0.011
Gasoline, leaded	86290-81-5	L	> 480	nm	> 480	nd	nm
Gasoline, unleaded	8006-61-9	L	> 480	> 480	> 480	< 0.001	0.001
Glutaraldehyde (5% in Water)	111-30-8	M	> 480	> 480	> 480	< 0.1	0.1
Glutaraldehyde (50% in Water)	111-30-8	M	> 480	> 480	> 480	< 0.1	0.1
Green Liquor	N/A	M	> 480	> 480	> 480	< 0.01	0.01
Hexachlorobutadiene	87-68-3	L	> 480	> 480	> 480	< 0.01	0.01
Hexafluoroisobutylene	382-10-5	G	> 480	> 480	> 480	< 0.01	0.01
Hexamethylenediamine (45° C) 1,6-	124-09-4	L	> 480	> 480	> 480	< 0.01	0.01
Hexamethylenediisocyanate	822-06-0	L	> 480	> 480	> 480	< 0.01	0.01
Hexane n-	110-54-3	L	> 480	> 480	> 480	< 0.01	0.01
Hydrazine	302-01-2	L	> 480	> 480	> 480	< 0.05	0.05
Hydrazine Hydrate, 51%	10217-52-4	L	> 480	> 480	> 480	< 0.06	0.06
Hydrazine Hydrate, 85%	10217-52-4	L	360	440	> 480	0.06	0.004
Hydrochloric Acid, 37%	7647-01-0	L	> 480	> 480	> 480	< 0.02	0.02
Hydrofluoric Acid, 48%	7664-39-3	L	> 480	> 480	> 480	< 0.1	0.1
Hydrofluoric Acid, 70%	7664-39-3	L	> 480	> 480	> 480	< 0.1	0.1
Hydrofluoric Acid, 92% (90°C)	7664-39-3	L	67	nm	–	2.8	0.07
Hydrogen Bromide	10035-10-6	G	> 480	> 480	> 480	< 0.1	0.1
Hydrogen Chloride	7647-01-0	G	> 480	> 480	> 480	< 0.1	0.1
Hydrogen Cyanide	74-90-8	G	> 480	> 480	> 480	< 0.01	0.01
Hydrogen Cyanide	74-90-8	L	> 480	> 480	> 480	< 0.01	0.01
Hydrogen Fluoride	7664-39-3	G	> 480	> 480	> 480	< 0.1	0.1
Hydrogen Fluoride	7664-39-3	L	290	290	> 480	< 0.1	0.1
Hydrogen Peroxide, 30%	7722-84-1	L	> 480	> 480	> 480	< 0.04	0.04
Hydrogen Peroxide, 70%	7722-84-1	L	> 480	> 480	> 480	< 0.01	0.01
Hydrogen Sulfide	7783-06-4	G	> 480	> 480	> 480	< 0.01	0.01
Isopropylamine	75-31-0	L	> 480	> 480	> 480	< 0.01	0.01
JP-4 Jet Fuel	N/A	L	> 480	> 480	> 480	< 0.017	0.017
JP-8 Jet Fuel	94114-98-6	L	> 480	> 480	> 480	< 0.01	0.01
Lewisite	541-25-3	L	–	720	–	< 0.012 µg/cm²·min *	
Limonene d-	5989-27-5	L	> 480	> 480	> 480	< 0.001	0.001
Lannate® LV (29% Methomyl)	16752-77-5	L	> 480	> 480	> 480	< 0.1	0.1
Lindane (Sat'd in Acetone)	58-89-9	L	> 480	> 480	> 480	< 0.06	0.06
Lindane (Sat'd in Methanol)	58-89-9	L	> 480	> 480	> 480	< 0.01	0.01
Malathion	121-75-5	L	> 480	> 480	> 480	< 0.013	0.013

Key: Imm – Immediate; nm – not measured; nd – nothing detected; N/A – not applicable; > – greater than; < – smaller than; L – Liquid; G – Gas; S – Solid; M – Mixture; SSPR – Steady State Permeation Rate; MDPR – Minimum Detectable Permeation Rate; * cumulative permeation

TYCHEM TK MATERIAL cont.

Chemical Name	CAS Number	Physical State	Average Breakthrough Time: ASTM F739 normalised (min.)	Actual (min.)	EN 369 & EN 374-3 normalised (min.)	SSPR ($\mu g/cm^2$. min.)	MDPR ($\mu g/cm^2$. min.)
Malathion (50% in Methanol)	121-75-5	M	>480	>480	>480	<0.1	0.1
Mercuric Chloride, sat.	7487-94-7	L	>480	nm	>480	nd	0.28
Mercury	7439-97-6	L	>480	>480	>480	<0.0002	0.0002
Methacrylic Acid	79-41-4	L	>480	>480	>480	<0.01	0.01
Methanol	67-56-1	L	>480	>480	>480	<0.1	0.1
Methyl Acrylate	96-33-3	L	>480	>480	>480	<0.01	0.01
Methylamine	74-89-5	G	>480	>480	>480	<0.06	0.06
Methylamine (40% in Water)	74-89-5	L	203	254	–	1.9	0.001
Methyl Bromide	74-83-9	G	>480	>480	>480	<0.01	0.01
Methyl Cellosolve®	109-86-4	L	>480	>480	>480	<0.01	0.01
Methyl Cellosolve® Acetate	110-49-6	L	>480	>480	>480	<0.01	0.01
Methyl t-Butyl Ether	1634-04-4	L	>480	>480	>480	<0.007	0.007
Methyl Chloride	74-87-3	G	>480	>480	>480	<0.02	0.02
Methylene Bis (O-Chloroaniline) (Sat'd in Methanol) 4,4'-	101-14-4	L	>480	>480	>480	<0.1	0.1
Methylene Dianiline (15% in MEK) 4,4'-	101-77-9	L	>480	>480	>480	>480	<0.1
0.1							
Methyl Ethyl Ketone	78-93-3	L	>480	>480	>480	<0.007	0.007
Methyl Ethyl Ketoxime	96-29-7	L	>480	>480	>480	<0.1	0.1
Methylglutaronitrile 2-	4553-62-2	L	>480	>480	>480	<0.1	0.1
Methyl Hydrazine	60-34-4	L	>480	>480	>480	<0.01	0.01
Methyl Iodide	74-88-4	L	>480	>480	>480	<0.01	0.01
Methyl Isobutyl Ketone	108-10-1	L	120	>480	>480	0.001	0.001
Methyl Isocyanate	624-83-9	L	>480	>480	>480	<0.01	0.01
Methyl Mercaptan	74-93-1	G	>480	>480	>480	<0.001	0.001
Methyl Methacrylate	80-62-2	L	>480	>480	>480	<0.02	0.02
Methyltrichlorosilane	75-79-6	L	>480	>480	>480	<0.1	0.1
Mineral Spirits	64475-85-0	L	>480	>480	>480	<0.01	0.01
Mustard	505-60-2	L	–	>720	–	<0.2 $\mu g/cm^2$-min *	
Nicotine	54-11-5	L	>480	>480	>480	<0.1	0.1
Nickel Carbonyl	13463-39-3	G	>480	>480	>480	<0.04	0.04
Nitric Acid, 70%	7697-37-2	L	>480	>480	>480	<0.1	0.1
Nitric Acid, 103%, Red Fuming	7697-37-2	L	390	390	>480	3.6	0.1
Nitric Oxide	10102-43-9	G	>480	>480	>480	<0.04	0.04
Nitrobenzene	98-95-3	L	>480	>480	>480	<0.1	0.1
Nitrogen Tetroxide Gas	10544-72-6	G	90	90	>480	>1.1	0.003
Nitrogen Tetroxide (0°C)	10544-72-6	L	450	450	>480	0.2	<0.1
Nitromethane	75-52-5	L	>480	>480	>480	<0.005	0.005
Nitropropane 2-	79-46-9	L	>480	>480	>480	<0.01	0.01
Octane n-	111-65-9	L	>480	>480	>480	<0.01	0.01
Oleum, 40% free SO_3	8014-95-7	L	>480	>480	>480	<0.04	0.04
Oleum, 65% free SO_3	8014-95-7	L	>480	>480	>480	<0.1	0.1
Oxalic Acid (10.5% in Water)	144-62-7	L	>480	>480	>480	<0.1	0.1
Paraphenylene Diisocyanate (PPDI) crude mixture	Mixture	L	>480	>480	>480	<0.1	0.1
Parathion	56-38-2	L	>480	>480	>480	<0.01	0.01
PCB 50%/Trichlorobenzene 50%	Mixture	L	>480	>480	>480	<0.001	0.001
Pentachlorophenol (Sat'd in Methanol)	87-86-5	M	>480	>480	>480	<0.013	0.013
Pentenenitrile 2-	25899-50-7	L	>480	>480	>480	<0.001	0.0001

Permeation data cont'd

Chemical Name	CAS Number	Physical State	Average Breakthrough Time: Actual (min.)	ASTM F739 normalised (min.)	EN 369 & EN 374-3 normalised (min.)	SSPR ($\mu g/cm^2$. min.)	MDPR ($\mu g/cm^2$. min.)
Pentenenitrile 3-	4635-87-4	L	>480	>480	>480	<0.001	0.001
Perchloric Acid, 70%	7601-90-3	L	>480	>480	>480	<0.1	0.1
Phenol, 90%	108-95-2	L	>480	>480	>480	<0.07	0.07
Phenol (45° C)	108-95-2	L	150	130	>480	2.8	0.01
Phosgene Gas	75-44-5	G	>480	>480	>480	<0.1	0.1
Phosphine	7803-51-2	G	>480	>480	>480	<0.01	0.01
Phosphoric Acid, 85%	7664-38-2	L	>480	>480	>480	<0.1	0.1
Phosphorous Oxychloride	10025-87-3	L	>480	>480	>480	<0.1	0.1
Phosphorus Trichloride	7719-12-2	L	>480	>480	>480	<0.1	0.1
Picoline 2-	109-06-8	L	>480	>480	>480	<0.02	0.02
Picoline 3-	108-99-6	L	>480	>480	>480	<0.01	0.01
Potassium Acetate, sat.	127-08-2	L	>480	nm	>480	nd	0.49
Potassium Chromate, sat.	7789-00-6	L	>480	nm	>480	nd	0.51
Propylene Oxide 1,2-	75-56-9	L	>480	>480	>480	<0.002	0.002
Pyridine	110-86-1	L	>480	>480	>480	<0.01	0.01
Pyrrolidine	123-75-1	L	407	413	–	9.2	0.012
Sarin	107-44-8	L	–	>1440	–	<0.0002 $\mu g/cm^2$-min *	
Silane	7803-62-5	G	>480	>480	>480	<0.1	0.1
Silicon Tetrachloride	10026-04-7	L	>480	>480	>480	<0.1	0.1
Sodium Cyanide, 95%	143-33-9	L	>480	nm	>480	nd	0.3
Sodium Hydroxide, 50%	1310-73-2	L	>480	>480	>480	<0.1	0.1
Soman	96-64-0	L	–	>720	–	<0.0002 $\mu g/cm^2$-min *	
Stoddard Solvent	8052-41-3	L	>480	>480	>480	<0.001	0.001
Styrene	100-42-5	L	>480	>480	>480	<0.001	0.001
Sulfur Dichloride (80%)	10545-99-0	L	>480	>480	>480	<0.1	0.1
Sulfur Dichloride	10545-99-0	L	440	440	>480	0.3	0.1
Sulfur Dioxide	7446-09-5	G	>480	>480	>480	<0.01	0.01
Sulfuric Acid, 93%	7664-93-9	L	>480	>480	>480	<0.1	0.1
Sulfuric Acid, 98%	7664-93-9	L	>480	>480	>480	<0.1	0.1
Sulfuric Acid, 103%, Fuming	8014-95-7	L	>480	>480	>480	<0.1	0.1
Sulfur Trioxide	7446-11-9	L	90	90	–	696	0.1
Sulfuryl Chloride	7791-25-5	L	>480	>480	>480	<0.1	0.1
Tabun	77-81-6	L	–	>720	–	<0.0002 $\mu g/cm^2$-min *	
Tetrachloroethane 1,1,2,2-	79-34-5	L	imm	>480	>480	0.005	0.00008
Tetrachloroethylene 1,1,2,2-	127-18-4	L	>480	>480	>480	<0.01	0.01
Tetraethyllead	78-00-2	L	>480	>480	>480	<0.07	0.07
Tetrahydrofuran	109-99-9	L	>480	>480	>480	<0.04	0.04
Thioglycolic Acid	68-11-1	L	>480	>480	>480	<0.1	0.1
Thionyl Chloride	7719-09-7	L	90	90	–	63.6	0.1
Titanium Tetrachloride	7550-45-0	L	>480	>480	>480	<0.1	0.1
Toluene	108-88-3	L	>480	>480	>480	<0.02	0.02
Toluene-1,3-Diisocyanate	26471-62-5	L	>480	>480	>480	<0.01	0.01
Toluene-2,4-Diisocyanate	584-84-9	L	>480	>480	>480	<0.01	0.01
Toluidine o-	95-53-4	L	>480	>480	>480	<0.001	0.001
Trichlorobenzene 1,2,4-	120-82-1	L	>480	>480	>480	<0.01	0.01
Trichloroethane 1,1,1-	71-55-6	L	>480	>480	>480	<0.004	0.004
Trichloroethane 1,1,2-	70-00-5	L	>480	>480	>480	<0.1	0.1
Trichloroethanol 2,2,2-	115-20-8	L	>480	>480	>480	<0.01	0.01

Key: imm – immediate; nm – not measured; nd – nothing detected; N/A – not applicable; > – greater than; < – smaller than; L – Liquid; G – Gas; S – Solid; M – Mixture; SSPR – Steady State Permeation Rate; MDPR – Minimum Detectable Permeation Rate; * cumulative permeation

TYCHEM TK MATERIAL cont.

Chemical Name	CAS Number	Physical State	Average Breakthrough Time				
			Actual (min.)	ASTM F739 normalised (min.)	EN 369 & EN 374-3 normalised (min.)	SSPR ($\mu g/cm^2 \cdot min.$)	MDPR ($\mu g/cm^2 \cdot min.$)
Trichloroethylene	79-01-6	L	> 480	> 480	> 480	< 0.1	0.1
Trichlorophenylsilane	98-13-5	L	> 480	> 480	> 480	< 0.1	0.1
Triethylamine	121-44-8	L	> 480	> 480	> 480	< 0.01	0.01
Trifluoroethanol 2,2,2-	75-89-8	L	> 480	> 480	> 480	< 0.001	0.001
Trimethylamine	75-50-3	G	> 480	> 480	> 480	< 0.1	0.1
Vinyl Acetate	108-05-4	L	> 480	> 480	> 480	< 1	1
Vinyl Chloride	75-01-4	G	> 480	> 480	> 480	< 0.001	0.001
Vinylidene Chloride	75-35-4	L	> 480	> 480	> 480	< 0.01	0.01
VX	50782-69-9	L	–	> 720	–	< 0.0002 $\mu g/cm^2 \cdot min$ *	
White Liquor	N/A	M	> 480	> 480	> 480	< 0.01	0.01
Xylene (Mixed Isomers)	1330-20-7	L	> 480	> 480	> 480	< 0.004	0.004

TYCHEM TK MATERIAL cont.

Shelf life and storage

■ Based on the results of the accelerated ageing test, the projected shelf life of Tychem® TK is five years, as long as the material is not stored in sunlight or in excessive heat (> 40 °C). However, other materials used in chemical protective garments, such as gloves, closures, zippers, face shields, and flaps in exhaust valves, are often made from elastomeric materials which may have much shorter shelf storage times than the Tychem® TK material. For specific information on storage, shelf life, and routine maintenance of protective apparel ensembles please refer to the Tychem® TK use instructions.

Disposal

■ Tychem® TK is made of polymers which do not contain halogens in their structural formula. Depending on the chemical nature and the amount of contamination on the garments, garments made from Tychem® TK could be either incinerated after use, without any harm to the environment, or buried in a responsible way. On incineration of the garment itself, traces of halogens in combustion gases and ash are at the level of ordinary halogen contamination in any non-halogen containing industrial product.

Restrictions to the disposal of used Tychem® TK suits manufactured from Tychem® TK material depends on the contaminant.

15

MATERIAL SPECIFICATION & SHELF LIFE

BS/A00097b/A/06

Performance Requirements Of Materials

The samples submitted were tested in accordance with clauses B.2.3, B.2.4, B.2.6, B.2.8, B.2.9, B.2.10, B.2.14 & B.3.5 of EN943-1 : 2002.

Product : Multi-layer chemical barrier material, Respirex Part No. A00097b.

Description : Chemical barrier material consists of a high strength, high tear resistant, 100% nonwoven polyester staple fabric sandwiched between two proprietary non-halogenated barrier films. One side is coloured high visibility green and the opposite side is coloured white. This material is used for the manufacture of limited-use suits only.

Basis Weight : 305g/m²

Thickness : 0.72mm

Tested In Accordance With	Performance Requirement	Level Of Performance	Performance Class Required For EN943-2:2002	Performance Class Achieved
EN 530:1994 (method 2) (inc. pressure drop)	Abrasion Resistance	>2000 Cycles	4	6
Method B of EN ISO 7854:1995 (inc. pressure drop)	Flex Cracking Resistance	>1000 cycles >1000 cycles	1	1
EN 863:1995	Puncture Resistance	49 N	2	2
EN ISO 9073-4:1989	Trapezoidal Tear Resistance	Machine direction 164.4 N Cross direction 215.3 N	3	5
EN ISO 13934-1:1999	Tensile Strength	Machine direction 519.6 N Cross direction 482.9 N	4	4
EN 374-3:1994	Permeation Resistance when tested against 96.8% Sulphuric acid*	Mean breakthrough time, >480 min	1	6
EN 13274-4:2001 Meth 3	Resistance to ignition	No part ignited or continued to burn on removal from flame	1	1
EN 13274-4:2001 Meth 3 (inc. pressure drop)	Resistance to flame	No part ignited or continued to burn on removal from flame	1	1
ISO 5082:1982 Annex A2	Seam Strength	607 N	5	5

*Respirex's in-house laboratory can provide permeation data against other chemicals if required.

Type approval by : **SGS United Kingdom Ltd**
Weston-super-Mare BS22 6WA

Notified Body No. 0120

RESPIREX INTERNATIONAL LIMITED, Unit F Kingsfield Business Centre, Philanthropic Road, Redhill, Surrey RH1 4DP. ENGLAND

Respirex Limited Life Gas Tight suit in Tychem-TK Material

Statement on Shelf Life

The Respirex Limited Life Gas Tight suit in Tychem-TK Material has a maintenance free shelf life of 5 years provided that the suit has not been used and that it is still in its sealed polythene bag.

Thereafter the life of the suit can be extended to a maximum of ten years, provided that it is pressure tested to EN464 and inspected annually after the five year period. After this operation the suit would need to be re-sealed into a polythene bag.

Notwithstanding the above, after every use the suit will need to be pressure tested to EN464 and inspected before being put back into service.

HM FIRE CIRCULAR

Office of the Deputy Prime Minister
Creating sustainable communities

Fire and Rescue Service
Circular

Circular number	25-2004	Date issued	12 August 2004
This circular is	For guidance	No response required	
This circular is	Not relevant to the National Framework		
Status	This circular concerns issues regarding the shelf life of Tychem TK limited life gas-tight suits and information and guidance on their resolution.		

Tychem TK Limited Life Gas Tight Suits

Issued by:
Peter Silk
Assistant Inspector of Fire Services
Technology Group
HM Fire Service Inspectorate

Addressed to:	Please forward to:
The Commissioner of the London Fire and Emergency Planning Authority The Chief Fire Officer	Procurement Officers BA and/or Equipment Officers Health and Safety Officers

Summary

This Circular informs Fire and Rescue Services of concerns raised within the UK Fire and Rescue Services regarding the shelf life of Tychem TK® limited life gas-tight suits and the actions taken to resolve these issues. It also provides information and guidance on care, maintenance and use and recommendations on periodic inspection and testing regimes and management systems necessary to be able to extend the shelf life of such suits.

For further information, contact:

Peter Silk	Direct line	020 7944 5714
Assistant Inspector of Fire Services	Fax	020 7944 5558
Technology Group	E-mail	Peter.Silk@odpm.gsi.gov.uk
HM Fire Service Inspectorate		

General helpline 020 7944 6858 Website www.odpm.gov.uk

1.0 Background

1.1 As a result of concerns raised within the UK Fire and Rescue Services regarding the shelf life of Tychem TK® limited life gas-tight suits, a number of meetings were held between HMFSI, DuPont (manufacturers of Tychem TK® fabric) and Respirex International Limited (manufacturers of the gas-tight suits).

1.2 Tychem TK® is a high performance, chemical barrier, laminate fabric developed and manufactured by DuPont specifically for protection against toxic, corrosive gases, liquids and solid chemicals.

1.3 This fabric is then manufactured into various types of chemical protective clothing. In the UK, this manufacture is carried out by Respirex. Of the different types of chemical protective clothing, the coverall gas-tight suit is the one most commonly used by the UK Fire and Rescue Services. In fact, the majority of these coverall gas-tight suits are Tychem TK® limited life suits manufactured by Respirex, as are the ODPM New Dimension gas-tight suits.

1.4 When Tychem TK® was first developed it was necessary to project the shelf life durability of the fabric using recognised accelerated ageing tests. As a result of these tests a shelf life of at least 5 years was initially predicted, with the suggestion that this would be reviewed once 'real time' data became available.

2.0 Current Situation

2.1 It is now around 5 years since this product came onto the market and since the manufacture of the first Tychem TK® limited life gas-tight suits from Respirex. Following the discussions between HMFSI, DuPont and Respirex, the predictive tests have now been validated by "real time" tests and from the initial indications DuPont have confirmed that the shelf life of Tychem TK® can be extended to 10 years.

2.2 It should be noted however that this extension refers to the material alone. Chemical protective clothing contains components other than Tychem TK® such as gloves, closures, zippers, face shields and flaps in exhaust valves, which are often made of elastomeric and other materials that may have a shorter shelf life than the Tychem TK® material. In addition the 'suits' are subjected to differing levels of 'manipulation' during the course of their storage and in their subsequent handling and use. They may also be subject to various different levels and types of packaging, storage and transportation. Extensive storage could potentially create folds and creases in the material that could become a weak point in the garment.

2.3 All of the above will have varying degrees of impact on the shelf life of the finished garment, as will of course, the actual use and any chemical or other contamination at an operational incident and any subsequent decontamination and cleaning.

HM FIRE CIRCULAR cont.

2.4 What was also confirmed during the various tests carried out by DuPont is that, if correctly applied, the internal pressure test in accordance with EN 464s had no significant 'real time' impact on the fabric or construction of the suit.

2.5 As previously stated, Respirex have been producing Tychem TK® limited life gas-tight suits for around 5 years. As a consequence, there is much evidence available, both recorded and anecdotal, regarding the 'in-service' performance of these suits and it is apparent that with good care and maintenance the shelf life of the finished garment could be extended beyond the initial 5 years to approach that of the actual material of construction.

2.6 Consequently, it has been determined that, subject to certain conditions, including a periodic inspection and testing regime, the life of a Tychem TK® limited life gas-tight suit can be extended beyond the previously stated 5 years to 10 years.

3.0 Conditions

3.1 If Fire and Rescue Services using Respirex Tychem TK® limited life gas-tight suits wish to take advantage of the extension to the shelf life of their suits, they should undertake an assessment of their current practices and ensure that:

- An effective management system for safe and proper storage, packaging and distribution, and tracking and tracing of the suits is in place.
- An effective means for the protection of suits on operational vehicles and in operational use is in place.
- Effective means for the decontamination and cleaning, care and maintenance of suits following operational use, including packaging and transportation to their service point and the appropriate testing and maintenance facilities are available.
- Personnel involved in the periodic inspection and pressure testing of the gas-tight suits have the necessary competence and certification to undertake such tests.

4.0 Periodic inspection and testing

Used Suits

4.1 Gas-tight suits that have been used will, as a matter of course, have to undergo some form of decontamination and cleaning followed by a thorough visual inspection and EN 464 pressure testing after use if they are to be put back into service. As a consequence the integrity of all used suits will have been tested during their life. However such use and subsequent after-care will contribute to the determination of the life of the suit. Therefore, in order to be able to extend the life of such suits, they will now be required to undergo an annual thorough visual inspection and EN 464 pressure testing with such a regime being commenced on or around 5 years from the date of manufacture of the suit.

Tychem TK Limited Life Gas Tight Suits

Unused Suits

4.2 To ensure the continuing integrity of any suits that have not been used during their current 5-year life, these suits will also need to be inspected and tested. It has been determined that they will need to undergo the same examination and testing process as the used suits once they have reached this age and at least annually thereafter.

4.3 Unused suits that remain in their original packaging and have been handled, transported and stored, wholly in accordance with the manufacturer's instructions will also require an assessment of their integrity if their life is to be extended. Fire and Rescue Services are urged to liase with Respirex for guidance in how best to assess such suits, bearing in mind that they will still have endured some of the conditions referred to above during their life.

5.0 Further information

5.1 Some Fire and Rescue Services use the after-sales care and maintenance service offered by Respirex, which may include the use of Chemline. Respirex will continue this service and will advise its customers of any changes to protocols following the extension of the shelf life of Tychem TK®.

5.2 Those Fire and Rescue Services that do not use this service should consider seeking the appropriate advice and guidance and any revised instructions from Respirex as the garment manufacturer.

5.3 An amendment will be made to the Fire Service Inspection and Testing Manual to reflect this current advice.

5.4 This Circular has been prepared in consultation with DuPont and Respirex International Limited.

Note: This extension of shelf life also applies to Respirex Tychem F® materials and garments, formerly known as Tyvek F®. Those Fire and Rescue Services that use garments made from this material should also liase with Respirex for similar guidance to that advised for Tychem TK®.

Peter Silk

HMFSI Technology Group

CE MARKING & DECLARATION OF CONFORMITY

Certificate GB05/65307, continued

Respirex International Limited

EC Council Directive 89/686/EEC

EC Type-examination
Issue 1.

PPE Product
Respirex Tychem® TK. "FB" Gas Suits, style code: TYFB series.
The above garments are manufactured from DuPont Tychem® TK. material,
(Respirex Part No. A00097a)
These models are also known under other brand names, see page 3.

It is certified that the manufacturer's technical file and the above mentioned PPE have been assessed and found to be in accordance with the requirements of Council Directive 89/686/EEC. When examined the PPE satisfied the requirements of the relevant harmonized standard, EN 943-2:2002 for the garment classification of Type 1A-ET.

The manufacturer's information notices (BS\026\A\2003 & BS\070\A\2003) in English have been inspected and found to have addressed all of the relevant requirements of the standard. However, the detailed content of the information notice is the responsibility of the manufacturer, as are translations into other languages.

This certificate is issued on the strict condition that appropriate checks on manufactured PPE, as detailed in Article 11 of the Directive are implemented and maintained while the model is in production.

Certification is based on technical file reference TF049, issue B.
SGS Reference Number GB/PP 212203.

This certificate remains the property of SGS United Kingdom Ltd to whom it must be returned on request.

Page 2 of 3

EC DECLARATION OF CONFORMITY

RESPIREX INTERNATIONAL LTD
Unit F Kingsfield Business Centre,
Philanthropic Road,
Redhill,
Surrey RH1 4DP
United Kingdom

clares that the new PPE described hereafter:

Respirex Tychem® TK. "FB" Gas Suit, style numbers : TYFB series,

DuPont Tychem® TK. "ProTech" Suit, style numbers : TYPR series.

All the above suits are manufactured using Dupont Tychem® TK. fabric (Respirex Part no. A00097a).

ese garments are described in the manufacturer's technical file TF049 Issue B.

identical to the PPE which is subject of EC certificate of conformity No GB05/65307 issued by :

SGS United Kingdom Ltd.
Unit 202b Wode Parkway,
Weston-super-Mare,
Somerset. BS22 6WA
United Kingdom

d is subject to the procedure set out in Article 11 point B of Directive 89/686/EEC under the pervision of the notified body:

SGS United Kingdom Ltd.
EC Notified Body No 0120.

one at: RESPIREX, Redhill, Surrey, on 27th June 2005

Signed: .....

Mark Bellas Simpson (Managing Director)

Respirex International Limited
Unit F, Kingsfield Business Centre,
Philanthropic Road, Redhill,
Surrey RH1 4DP.
Tel: +44 (0) 1737 778600
Fax: +44 (0) 1737 779441
Email: info@respirex.co.uk
Web: www.respirex.co.uk

Registered in England No. 592506 VAT No. GB 367 3117 50
Directors: M. Bellas Simpson A.C.A. D.G. Mackie C.A. Musgrove

NATO STOCK NUMBER

DEFENCE CLOTHING AND TEXTILES AGENCY (DCTA)

Transmission Details		Document Details
Serial Number:	Date and Time of Transmission: 25 Jun 99 13:02	Reference: **D/DCTA/18/6/8/2/6 Op Cl**
From: **B CLARKE**	Fax Number: **94240 4909** **01869 875909**	Subject: **LIMITED LIFE GAS TIGHT SUITS**
Telephone No:	Caversfield Military **94240 4841** **01869 875841**	Your Reference: Meeting Dated 24 Jun 99
To: Mr David Mackie Sales Director Respirex International Ltd Redhill Surrey	Fax Number: 01737 779441	Total number of pages including this cover sheet: 1

Authorising Officer	Transmit Operators
Rank, Name and Appointment: **Barbara Clarke OpCl 2b**	Rank/Grade and Name:
Signature:	Signature:

Message/Remarks:

Mr Mackie,

1. With reference to your meeting with Maj. Bryon Harness, held at DCTA Caversfield, on 24 Jun 99. We are now able to provide you with details of the NATO Sock Numbers (NSN) which are to be used for the 2 Limited-Life Gas-Tight Suits.

a. TYFB 002/412/97 NSN 8415-99-471-1420
b. TYFB 002/406/97 NSN 8415-99-161-4001

2. If you have any queries regarding the above information, Maj. Harness will be in the office on Monday, 28 Jun 99.

Regards,

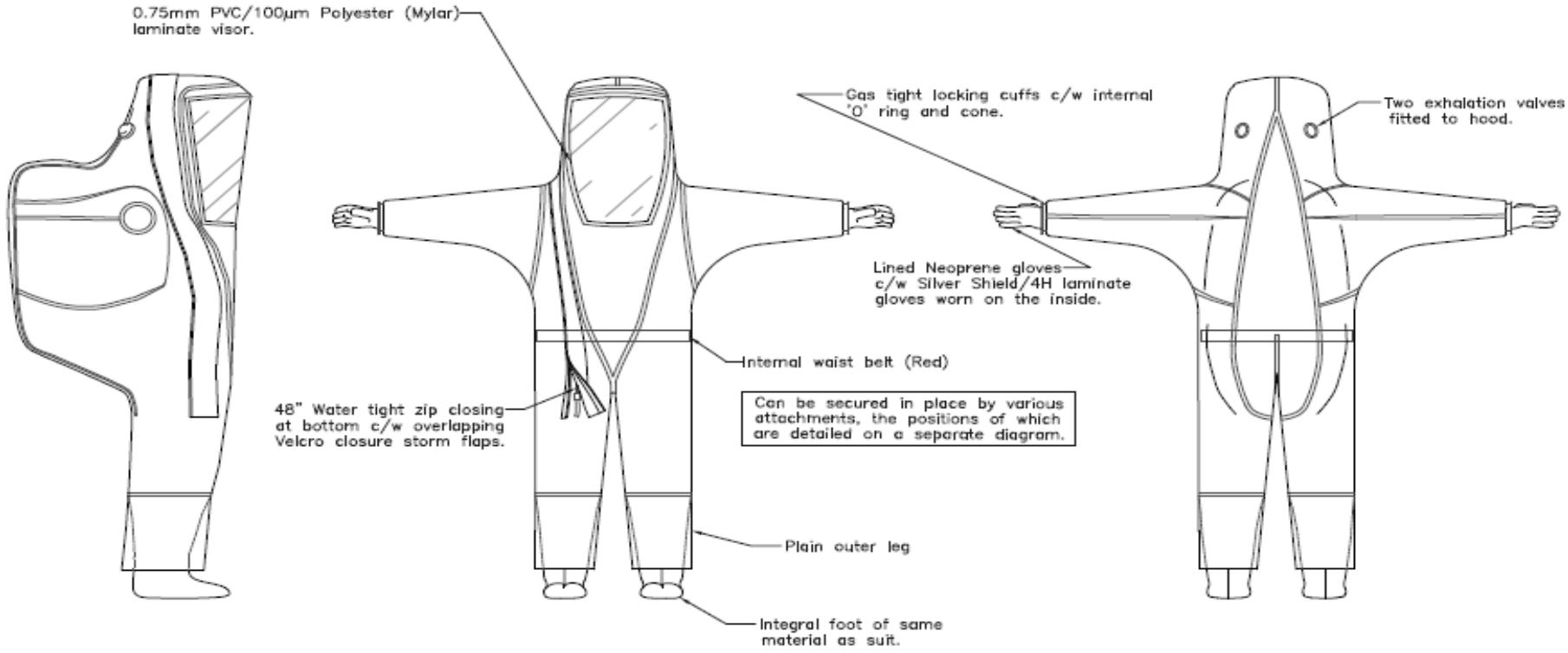
Barbara Clarke
OpCl 2b

LIMITED LIFE SUIT WITH INTEGRAL SOCKS

REPORT ERRORS AND OMISSIONS TO RESEARCH AND DEVELOPMENT DEPARTMENT

MODIFICATIONS

ISS.	DESCRIPTION	INT'L	DATE
A	FIRST ISSUE	NC	01/04/96
B	Gas-tight emblem removed part no amended	NC	11/05/05



TITLE		INITIALS	DATE	ORG. No.
LIMITED LIFE GAS TIGHT SUIT	DRAWN	NC	01/04/96	TYFB002
	CH'KD	NC	01/04/96	

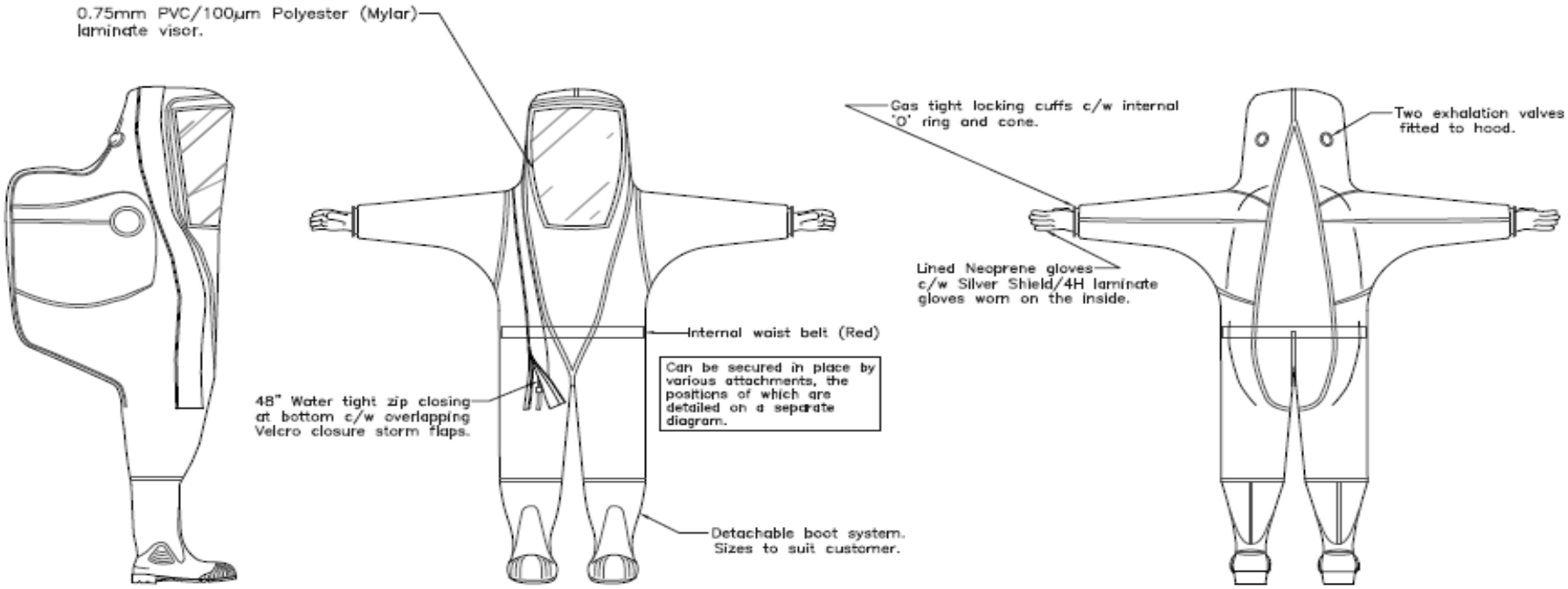
RESPIREX INTERNATIONAL LIMITED, UNIT F, KINGSFIELD BUSINESS CENTRE, PHILANTROPIC ROAD, REDHILL, SURREY RH1 4DP. ENGLAND

LIMITED LIFE SUIT WITH ATTACHED BOOTS

REPORT ERRORS AND OMISSIONS TO RESEARCH AND DEVELOPMENT DEPARTMENT

MODIFICATIONS

ISS.	DESCRIPTION	IN'TL	DATE
A	FIRST ISSUE	NC	10/11/98
B	Gas-tight emblem removed part no amended	NC	11/05/05



TITLE		INITIALS	DATE	DRG. NO.
LIMITED LIFE GAS TIGHT SUIT	DRAWN	NC	10/11/98	TYFB020
	CH'KD	NC	10/11/98	

RESPIREX INTERNATIONAL LIMITED, UNIT F, KINGSFIELD BUSINESS CENTRE, PHILANTROPIC ROAD, REDHILL, SURREY RH1 4DP, ENGLAND

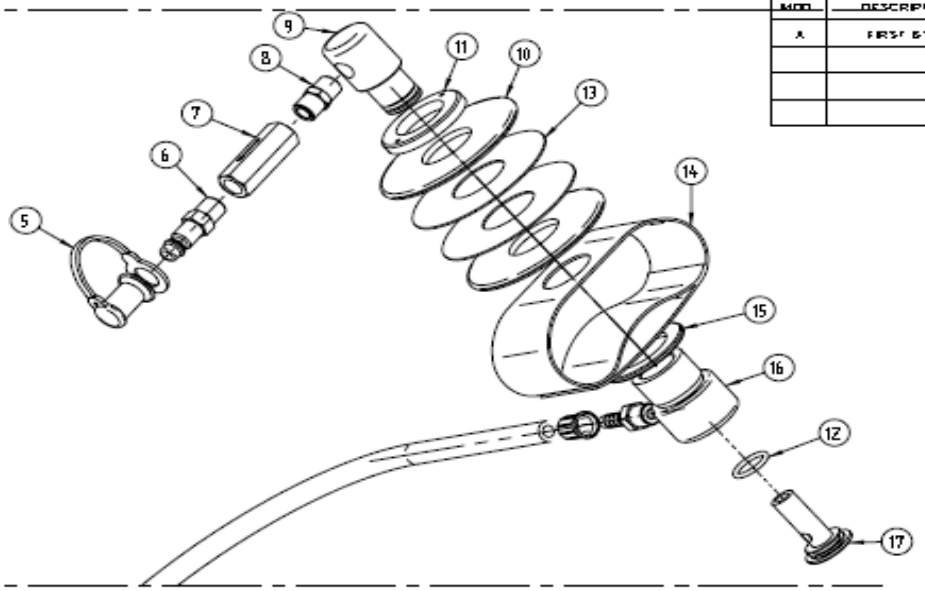
PASS THRU / DECONTAMINATION LINE

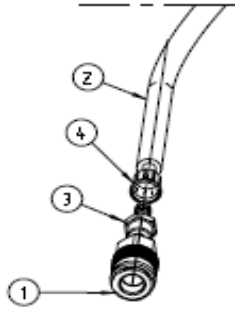
Item Number	Part Number	Title	Quantity
1	001075	Rectus 1/4" BSP Female Coupling	1
2	000508	1/4" Braided Hose	36"
3	E01052	1/4" BSP Male x 1/4" Hosetail	2
4	001054	15mm Hose Ferrule	2
5	001077	Dust Cap	1
6	001076	1/4" BSP Rectus Plug	1
7	001019	Non-Return Valve	1
8	000539	1/4 BSP Male/Male Adaptor	1
9	E01523	Low Pressure Swivel Head	1
10	B01371	Low Pressure Swivel Plate	2
11	E01519	Low Pressure Swivel Locking Ring	1
12	000688	'O' Ring BS115 Nit 70	2
13	E01536	Low Pressure Swivel Washer	2
14	G01268	Low Pressure Swivel Belt Loop	1
15	E01520	Low Pressure Swivel Washer	1
16	E01522	Low Pressure Swivel Body	1
17	E01521	Low Pressure Swivel Head Retainer	1

REPORT ERRORS AND OMISSIONS TO RESEARCH AND DEVELOPMENT DEPARTMENT

MODIFICATIONS

MOD.	DESCRIPTION	INT'L	DATE
A	FIRST ISSUE	N.C	11.03.03





Note : Internal connector to be facing upwards angled forwards at 45 degrees when fitted in suit

TITLE
AIR SYSTEM SUB-ASSY 'NEW DIMENSION' GAS TIGHT SUITS

	INT'L	DATE
DRAWN	N.C	11.03.03
CHKD		11.03.03

DRG No. G01561

RESPIREX INTERNATIONAL LTD, UNIT R, KINGSFIELD BUSINESS CENTRE, PHILANTHROPIC ROAD, REDHILL, SURREY RH1 4DP, ENGLAND

VISOR BREAK THROUGH DATA

RESPIREX TESTING LABORATORY
Unit F, Kingsfield Business Centre, Philanthropic Road, Redhill, Surrey RH1 4DP
Tel: +44 (0) 1737 778600 Fax: +44 (0) 1737 779441 Email: khoskins@respirex.co.uk

1756

CONFIDENTIAL TEST REPORT
PAGE 1 OF 2

REPORT REF. NO: CP111202A/KH

DATE: 08/01/03

CLIENT: Mr M B Simpson
Respirex International Ltd
Unit F, Kingsfield Business Centre
Redhill, Surrey, RH1 4DP

WORK REQUESTED: chemical permeation testing according to the principles of BS EN 369

CLIENT'S ORDER NO: n/a

DATE OF RECEIPT: 11/12/02 **TEST DATES:** 12/12/02,16/12/02,17/12/02,18/12/02,23/12/02

DESCRIPTION OF SAMPLE(S) (including reference numbers):-
laminate visor for chemical protective suit, 100 micron polyester (FS1649) on 0.75 mm Velbex

Test method
Breakthrough times are measured in accordance with BS EN 369 : 1993 and BS EN 374-3 : 1994.
Introduction
The greater the degree of distortion of the specimen through absorption of the test liquid the greater is likely to be the variation between results from repeat tests.
Experimental
Organic chemicals are detected by means of an FT-IR spectrometer using dry nitrogen as the collecting medium as detailed in procedure CP20 using cell compliant with BS EN 374-3 and ASTM F 739-96.
Acids and alkalis are detected using changes in conductivity with potassium chloride solution as the collecting medium as detailed in procedure CP30 using cell compliant with BS EN 374-3 and ASTM F 739-96.
Hydrofluoric acid and HF gas tests are carried out as detailed in procedures CP40a and CP40b using TISAB as the collecting medium (Total Ionic Strength Adjustment Buffer) using cell compliant with BS EN 369.
For each system the temperature is maintained at 20 ± 1°C, unless otherwise requested by the client. The minimum detectable permeation rate for each chemical is reported in the Table on page 2.
UKAS accreditation
The laboratory is UKAS accredited. However the following should be noted:
(1) Any opinion, interpretation or comments expressed in this report are outside the scope of UKAS accreditation and are marked #
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RESPIREX TESTING LABORATORY
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1756

CONFIDENTIAL TEST REPORT
PAGE 2 OF 2
REF. NO. CP111202A/KH

RESULTS TABLE for laminate visor

Chemical*	Minimum detectable permeation rate**	Test number	Breakthrough time (minutes)	Observations#
acetone	0.02	181202/A	>480	no degradation
acetonitrile	1.00	171202/D	>480	no degradation
ammonia gas	0.01	231202/A	>480	no degradation
carbon disulphide	0.02	161202/A	>480	no degradation
chlorine gas	0.01	231202/B	>480	no degradation
dichloromethane	0.02	121202/D	>480	no degradation
diethylamine	0.05	171202/A	>480	no degradation
ethyl acetate	0.01	161202/G	>480	no degradation
hexane	0.05	171202/E	>480	no degradation
hydrogen chloride gas	0.01	171202/C	>480	no degradation
methanol	0.02	161202/E	>480	no degradation
98% sulphuric acid	0.01	161202/D	>480	no degradation***
40% sodium hydroxide	0.01	171202/B	>480	no degradation
tetrahydrofuran	0.01	171202/F	>480	no degradation
toluene	0.02	161202/F	>480	no degradation

* All chemicals are GPR grade purchased from BDH
Concentrations of solutions are given on the table, otherwise % indicates purity.
** $\mu g/(min.cm^2)$
*** polyester face in contact with challenge chemical in all tests except this one when test was carried out with Velbex in contact with chemical.

All tests authorised and reported by

Kathleen Hoskins
Technical Manager, Respirex Testing Laboratory.

NB These tests were performed under laboratory conditions on new fabric and not under actual usage conditions. The test result relates only to the sample tested.
Fabric samples are accepted by the laboratory as being representative of the fabric required to be tested. No responsibility is accepted for samples submitted for testing which do not reflect the true nature of the fabric.

RESPIREX TESTING LABORATORY
Division of (RESPIREX INTERNATIONAL LIMITED) Registered in England No. 592506 VAT No. GB 367 3117 50
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VISOR / TYCHEM SEAM BREAK THROUGH

RESPIREX TESTING LABORATORY
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1756

CONFIDENTIAL TEST REPORT
PAGE 1 OF 2

REPORT REF. NO: CP080102A/KH

DATE: 16/01/02

CLIENT: M.B. Simpson,
Respirex International Ltd.,
Unit F, Kingsfield Business Centre,
Redhill,
Surrey, RH1 4DP

WORK REQUESTED: single scanning chemical permeation tests according to the principles of BS EN 369 using the 15 liquid chemicals listed in ASTM 1001.

CLIENT'S ORDER NO: n/a

DATE OF RECEIPT: 08/01/02 **TEST DATES:** 09/01/02 to 14/01/02

DESCRIPTION OF SAMPLE(S) (including reference numbers):-
the seam between the laminated visor and Tychem TK

Test method
Breakthrough times are measured in accordance with BS EN 369 : 1993 and BS EN 374-3 : 1994.
Introduction
The greater the degree of distortion of the specimen through absorption of the test liquid the greater is likely to be the variation between results from repeat tests.
Experimental
Organic chemicals are detected by means of an FT-IR spectrometer using dry nitrogen as the collecting medium as detailed in procedure CP20 using cell compliant with BS EN 374-3 and ASTM F 739-96.
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1756

CONFIDENTIAL TEST REPORT
PAGE 2 OF 2
REF. NO. CP080102A/KH

RESULTS TABLE for seam between laminated visor and Tychem TK

Chemical*	Minimum detectable permeation rate**	Mean thickness	Test number	Breakthrough time (minutes)	Comments#
acetone	0.02	n/a	110102/D	>240	no degradation
acetonitrile	1.0	n/a	110102/C	>240	no degradation
carbon disulphide	0.02	n/a	090102/A	>240	no degradation
dichloromethane	0.01	n/a	100102/G	>240	no degradation
diethylamine	0.2	n/a	100102/F	>240	no degradation
dimethylformamide	0.01	n/a	110102/B	>240	no degradation
ethyl acetate	0.01	n/a	140102/B	>240	no degradation
n-hexane	0.05	n/a	100102/C	>240	no degradation
methanol	0.02	n/a	100101/B	>240	no degradation
nitrobenzene	0.05	n/a	110102/A	>240	no degradation
sodium hydroxide 50%	0.01	n/a	100102/E	>240	no degradation
sulphuric acid 98%	0.01	n/a	100102/D	>240	no degradation
tetrachloroethylene	0.01	n/a	090102/B	>240	no degradation
terahydrofuran	0.2	n/a	140102/A	>240	no degradation
toluene	0.02	n/a	090102/C	>240	no degradation

* All chemicals are GPR grade purchased from BDH
Concentrations of solutions are given on the table, otherwise % indicates purity.
** $\mu g/(min\ cm^2)$

All tests authorised and reported by
Kathleen Hoskins

Kathleen Hoskins
Technical Manager, Respirex Testing Laboratory.

NB These tests were performed under laboratory conditions on new fabric and not under actual usage conditions. The test result relates only to the sample tested.
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TYCHEM TK SEAM BREAK THROUGH DATA

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CONFIDENTIAL TEST REPORT
PAGE 1 OF 2

REPORT REF. NO: CP031001B/JH

DATE: 10/10/01

CLIENT: Mr M B Simpson
Respirex International Ltd
Unit F
Kingsfield Business Centre
Redhill RH1 4DP

WORK REQUESTED: single scanning permeation test according to the principles of BS EN 369 using the 15 chemicals listed overleaf.

CLIENT'S ORDER NO: n/a

DATE OF RECEIPT: 03/10/01 **TEST DATES:** 03/10/01 to 08/10/01

DESCRIPTION OF SAMPLE(S) (including reference numbers):-
Tychem TK 3-way seam stripped on outside

Test method
Breakthrough times are measured in accordance with BS EN 369 : 1993 and BS EN 374-3 : 1994.
Introduction
The greater the degree of distortion of the specimen through absorption of the test liquid the greater is likely to be the variation between results from repeat tests.
Experimental
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CONFIDENTIAL TEST REPORT
PAGE 2 OF 2
REF. NO. CP031001B/JH

RESULTS TABLE for 3-way Tychem TK seam

Chemical*	Minimum detectable permeation rate**	Mean thickness	Test number	Breakthrough time (minutes)	Comments#
dichloromethane	0.01	n/a	031001/F	>240	no degradation
diethyl amine	0.2	n/a	051001/D	>240	no degradation
tetrahydrofuran	0.2	n/a	031001/G	>240	no degradation
acetone	0.02	n/a	041001/D	>240	no degradation
methanol	0.02	n/a	041001/A	>240	no degradation
hexane	0.05	n/a	041001/F	>240	no degradation
acetonitrile	1.0	n/a	041001/H	>240	no degradation
toluene	0.02	n/a	041001/I	>240	no degradation
dimethylformamide	0.01	n/a	041001/J	>240	no degradation
nitrobenzene	0.05	n/a	051001/A	>240	no degradation
tetrachloroethylene	0.01	n/a	081001/B	>240	no degradation
carbon disulphide	0.02	n/a	081001/C	>240	no degradation
ethyl acetate	0.01	n/a	041001/B	>240	no degradation
98% sulphuric acid	0.01	n/a	041001/E	>240	no degradation
40% sodium hydroxide	0.01	n/a	041001/G	>240	no degradation

* All chemicals are GPR grade purchased from BDH
Concentrations of solutions are given on the table, otherwise % indicates purity.
** µg/(min.cm^2)

All tests authorised and reported by

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INSTRUCTIONS FOR USE

RESPIREX

Instructions for use of Limited-Use Gas-Tight Suit manufactured from Tychem®TK.

® DuPont registered trademark

Table Of Contents

INSTRUCTIONS FOR USE cont.

General Information

You have purchased a Respirex limited-use chemical protective gas-tight suit manufactured from Tychem®TK., a high-performance chemical protective clothing material developed by DuPont for protection against gaseous, liquid and solid chemicals. The suit is for use within certain contaminated environments only and you should carefully read and follow these operating instructions closely.

All Respirex limited-use gas-tight suits are CE Marked to indicate compliance with European directives on personal protective equipment (PPE). The suit has been tested and marked in accordance with EN943-2:2002, this standard specifies performance requirements both for materials of construction and for the suit as a whole.

Worn in conjunction with suitable gloves and safety boots, Respirex limited-use gas-tight suits manufactured from Tychem®TK. meet the performance requirements of a TYPE 1a-ET limited-use "gas-tight"chemical protective suit for emergency teams.

Respirex limited-use gas-tight suits must be worn in conjunction with self-contained open-circuit compressed air breathing apparatus conforming to EN 137:1993.

®DuPont's registered trademark

Suit Features

The limited-use gas-tight suit is a one-piece coverall designed to enclose the wearer's whole body and self-contained breathing apparatus (SCBA).

A large semi-rigid visor is bonded to the suit produced from materials designed to be resistant to permeation against the chemicals listed in EN943-2:2002.

Two exhalation valves are fitted which automatically release excess pressure that builds up inside the suit. This ensures that the pressure within the suit does not exceed 400 Pa, as required by EN 943-1:2002.

A 120cm (48") long gas-tight zipper is fitted to the right hand side of the suit which enables easy donning or doffing. The zipper is shrouded by two outer flaps which must be fastened together by means of a Velcro strip when the suit is in use.

The legs of the suit are fitted with integral booties that are designed to be worn inside a suitable pair of safety boots. Outer splash guards that prevent liquid ingress into the wearer's safety boots are also attached to the legs. Alternatively, highly chemically resistant safety boots conforming to EN 345-2:1996 (Type FPA) with steel toe cap and mid-soles can be either permanently bonded to the suit or fitted by means of the Respirex detachable boot system (see page 8).

The limited-use gas-tight suit is supplied with a dual glove system that consists of a laminated inner glove with excellent resistance to permeation by chemicals (NORTH Silver Shield/4H®) bonded to an outer neoprene glove that provides a degree of protection against mechanical hazards. The outer neoprene glove also offers a limited amount of resistance to permeation by chemicals. The gloves are fitted to the suit by means of the Respirex locking cuff system.

The waist of the suit is supported by means of an internal belt.

As an option the suit can be fitted with an attachment that enables supplementary air to be passed to the ancillary airline connection of the wearer's self-contained breathing apparatus, this can be via either,

a). low pressure pass-thru
b). high pressure pass-thru

Low Pressure Pass -Thru

This is a 360° swivel unit that will withstand the working pressure of a two-stage breathing apparatus. On the inside of the suit is a length of airline hose with a coupling that connects to the ancillary airline connection on the wearer's self-contained breathing apparatus. The maximum working pressure of this unit is 10 bar.

INSTRUCTIONS FOR USE cont.

High Pressure Pass -Thru

As low pressure pass-thru but will withstand the working pressure of a single-stage breathing apparatus set. The maximum working pressure of this unit is 10 bar.

Accessory Attachment Points

The suit can be fitted with various accessory attachment points intended to carry life lines, personal lines, torches, distress signal units (DSU) etc.

Limitations & Warnings

Respirex limited-use gas-tight suits should only be worn by persons who have been fully trained and are familiar with suit equipment. It is essential to ensure that the suit you are wearing is made from a material that will give you adequate protection against the chemical hazard you are about to encounter.

Limited-use gas-tight suits manufactured from Tychem®TK. are designed to be worn until hygenic cleaning becomes necessary or limited use chemical contamination has occurred and disposal is required.

If, after use, you consider that the suit has not been damaged and that the chemical exposure to the fabric surface is very limited, it would need to be decontaminated in the proper fashion before being re-packed for use. The decision to re-use the suit is a subjective one. A certain amount of professional assistance can be offered by Respirex but the end-user shall be the sole judge on whether or not the suit can be adequately cleaned or decontaminated for re-use.

Respirex can offer advice on the breakthrough time for the chemical substance the suit has come into contact with to assist the end-user in deciding whether to re-use the garment.

If the suit becomes heavily contaminated or mechanically damaged in any way it MUST NOT be reused and MUST be disposed of.

Tychem®TK. material is made of polymers which do not contain halogens in their structural formula. Depending on the chemical nature and the amount of contamination on the garments, garments made from Tychem®TK. could be either incinerated after use, without any harm to the environment, or buried in a responsible way. On incineration of the garment itself, traces of halogens in combustion gases and ash are at the level of ordinary halogen contamination in any non-halogen containing industrial product. Restrictions to the disposal of used limited-use gas-tight suits manufactured from Tychem®TK. depends on the contaminant.

Tychem®TK. material is designed specifically for limited-use garments. Excessive flexing or folding can lead to weaknesses in the structure of the material which may have an adverse effect on the chemical resistance offered by the suit. Nevertheless extensive operational use of garments manufactured from Tychem®TK. has demonstrated its durability beyond that of a single-use fabric.

Caution: Tychem®TK. is a non-breathable material and the wearer's body temperature will rise whilst wearing the suit, particulary during periods of intense physical activity. Wherever possible operational procedures should be planned to minimise the risk of heat stress occuring. The wearer should leave the work area and disrobe the suit before becoming distressed.

Tychem®TK. meets the resistance to ignition requirements of EN943-2: 2002 but is not flame resistant. Suits manufactured from Tychem®TK. should not be worn in potentially flammable or explosive environments. There is no anti-static treatment applied to Tychem®TK..

The usable temperature range of Tychem®TK. material is -70°C to 90°C. Note : This usable temperature range is based on the evaluation of the physical properties of the material only. Users should note that resistance to permeation by chemicals varies with temperature.

Continuous contact with certain chemicals can adversely effect the field of vision and protection offered by the visor. If any discolouration of the visor is apparent the suit MUST NOT be re-used.

Always use compatible PPE, e.g. gloves and safety boots advised by Repirex.

For any enquiries please contact the Respirex customer services department on Tel : +44 (0) 1737 778600, Fax : +44 (0) 1737 779441 or
Email : info@respirex.co.uk.

INSTRUCTIONS FOR USE cont.

Physical Properties Of Tychem®TK. Suit Material

The samples submitted were tested in accordance with clauses B.2.3, B.2.4, B.2.5, B.2.6, B.2.8, B.2.9, B.2.14 & B.3.5 of EN943-1:2002.

Property	Test Method	Property value of Tychem®TK.	Performance class of Tychem®TK.	Minimum Performance Class Required For EN943-2:2002
Basis Weight	ISO 536:1995	331 g/m²	N/A	N/A
Thickness	ISO 534:1998	730 µm	N/A	N/A
Abrasion resistance	EN 530:1994 Meth 2 (inc. pressure drop)	>2000 cycles	6 (out of 6)	4
Flex cracking resistance	ISO 7854:1995 Method B (inc. pressure drop)	>1000 cycles (MD) >1000 cycles (XD)	1 (out of 6)	1
Flex cracking resistance at low temperatures (-30°C)	Method B of EN ISO 7854:1997 at -30° C (inc. pressure drop)	>500 cycles	3 (out of 6)	2
Trapezoidal tear resistance	ISO 9073-4:1989	164 N (MD) 215 N (XD)	5 (out of 5)	3
Puncture resistance	EN 863:1995	49 N	2 (out of 5)	2
Tensile Strength	EN ISO 13934-1:1999	519.6 N (MD) 482.9 N (XD)	4 (out of 6)	4
Resistance to flame	EN 13274-4:2001 Meth 3 modified (inc. pressure drop)	No part ignited or continued to burn on removal from the flame	2(out of 3)	1
Surface resistivity	EN 1149:1995	10^3 Ohm	N/A	N/A
Seam strength	ISO 5082:1982 Annex A2†	607 N	5 (out of 5)	3

Key: N/A=Not applicable MD=Machine direction XD= Cross direction

Fitting Gloves Into The Respirex Locking Cuff

1. Turn the sleeves of the suit inside out.
2. Carefully slide the tapered cone inside the Silver Shield®/neoprene gloves so that they stretch over the cone (see Figs 1 & 2).

Fig.1

Fig.2

3. Push the gloves and cone into the cuff body with the little finger of the gloves at 90° to the seam at the rear of the sleeve (see Fig 3).
4. Make sure that the gloves and cone are pushed into the cuff body with equal pressure all around its circumference (see Fig 4).

Fig.3

Fig.4

INSTRUCTIONS FOR USE cont.

5. Locate the locking ring over the gauntlet of the gloves and screw into the cuff body (see Fig 5). If necessary the gauntlet section of the gloves can be cut down if they are causing interference with the locking ring.

Fig.5

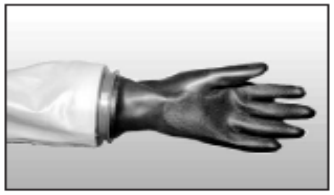


Fig.6

6. Turn the sleeve the correct way out by carefully pulling on the glove (see Fig 6).

Check that there are no creases in the outer neoprene glove around the cuff seal. If there are any creases or the glove is pinched in any way it should be removed and re-fitted. If the cuff and gloves have been assembled as described there should now be a gas tight wrist seal.

Assembly Of Boot Into Detachable Boot System

1. Fit the rubber 'O' ring (D00693) into the groove on the boot sealing collar. Locate the 'O' ring at the bottom of the groove, Figs. 7 & 8.

Fig.7

Fig.8

2. If there is an 'O' ring already fitted, check that it is not damaged. If in doubt fit a new 'O' ring (D00693) to the boot sealing collar.
3. With the leg of the suit turned inside out, locate the boot through the leg sealing collar so that the 'O' ring can be seen in the groove. Ensure that the boot is facing in the correct direction, Fig.9.

Fig.9

Fig.10

4. Locate the retaining collar (B01603) around the top groove of the leg sealing collar and snap into position, Fig.10.

INSTRUCTIONS FOR USE cont.

5. When snapped into position the retaining collar should appear as shown in Fig.11.

Fig.11

Fig.12

6. Pull the boot sealing collar up so that the retaining collar is trapped in position as shown in Fig.12.

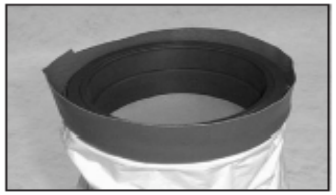


Fig.13

Fig.14

7. Turn the PVC protective strip up over the stainless steel band as shown in Fig.13.
8. Pull the leg of the garment through. The final assembly of the boot into the detachable boot system should appear as shown in Fig.14.

Parts required:

Rubber 'O' ring - Part number D00693

Retaining collar - Part number B01603

Removing Boot From Detachable Boot System

1. Turn the leg of the suit inside out. Fold down the PVC protective strip then pull the leg sealing collar down so that a gap appears under the retaining collar as shown in Fig. 15.

Fig.15

Fig.16

2. Using a pair of external circlip pliers remove the retaining collar as shown in Fig. 16.
3. Push the boot sealing collar through the leg sealing collar and remove the boot from the suit leg, Fig. 17.

Fig.17

INSTRUCTIONS FOR USE cont.

Recommended Donning Procedure

Donning the limited-use gas-tight suit is a very simple matter, although it will be necessary for a dresser to assist the wearer in the donning procedure.

1. Unzip the suit by pulling approximately 61cm (24") at a time, keeping the zipper straight with one hand as you pull the slider with the other. Repeat this exercise for the whole length of the zip. **FAILURE TO FOLLOW THIS PROCEDURE MAY RESULT IN THE ZIP BECOMING JAMMED.**
2. Fold up the outer splash guards approximately 20-23cms (8"-9") and fold down the suit to expose the top of the integral booties. The wearer should step into the integral booties and then into a pair of safety boots. Fold the outer splash guards down over the exterior of the safety boots and with the aid of the dresser lift the suit to the waist, making sure the crotch is positioned comfortably. The suit waist belt should be fastened firmly ensuring that it is not twisted (see Figs 18 & 19). Note: Suits fitted with integral safety boots are not supplied with outer splash guards.
3. With the assistance of the dresser the wearer should now don a self-contained breathing apparatus set (SCBA) in the usual manner, but without starting up. Leave the face mask of the SCBA hanging on its strap around the wearer's neck. The dresser should lift the pod at the rear of the suit up and over the SCBA cylinder. The wearer can now carry out all SCBA necessary pre-checks.

Fig.18

Fig.19

4. Next, the SCBA cylinder should be switched on in accordance with the manufacturer's instructions and the face mask donned by the wearer. The dresser can assist the wearer to adjust the head straps of the face mask until comfortable. If required a fireman's safety helmet can now also be donned by the wearer.
5. The wearer's arms should be folded across the chest whilst the dresser lifts the suit up and over the wearer's shoulders and head and fastens the zip carefully following the procedure outlined in stage 1. The wearer's arms can now be slid down the sleeves and into the gloves (see Figs 20 & 21).
6. Finally the outer zip flaps should be sealed together using the Velcro fastening provided (Fig 22).

Fig. 20

Fig. 21

Fig. 22

INSTRUCTIONS FOR USE cont.

Recommended Doffing Procedure

Firstly the suit must be decontaminated sufficiently to safely remove the wearer from the garment (see Decontamination). It will be necessary for the dresser to aid the wearer to remove the suit (it is ESSENTIAL that the dresser wears suitable protective clothing).

1. The wearer's arms should be removed from the sleeves and folded across the chest.
2. The dresser should unzip the suit carefully (following the procedure outlined in the dressing instructions).
3. Fold the suit over the wearer's head and off the SCBA down to the waist. The outer surface of the suit should be kept away from the wearer at all time.
4. Shut down the SCBA cylinder according to the manufacturer's instructions having removed the wearer's face mask. With the assistance of the dresser the BA can now be removed in the usual way.
5. Unfasten the suit waist belt.
6. Fold the suit down to the top of the integral socks (or safety boots) so that the wearer can step out of the suit.

Replacing Exhalation Valve Diaphragm

1. Using the Hexagon Key (Tool No. B00311) loosen the screw from the center of the exhalation valve and remove the cap.
2. Carefully stretch the diaphragm over the center spigot to remove from the exhalation valve body.
3. Check that there is no debris or contamination in the exhalation valve body.
4. Carefully stretch a new diaphragm over the center spigot making sure that it is correctly orientated and that the hole in the diaphragm is located under the shoulder of the spigot. (see Fig 24).
5. Replace the exhalation valve cap making sure that the location channel on the cap is located over the location key on the valve body (The Respirex lettering should be at the top).
6. Replace the center screw and hand tighten using the Hexagon Key (Tool No. B00311).

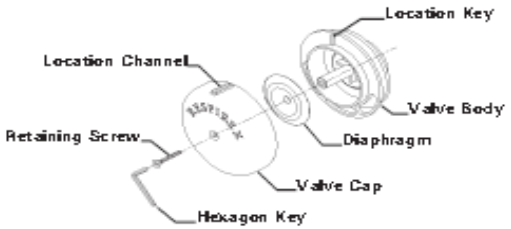


Fig.23

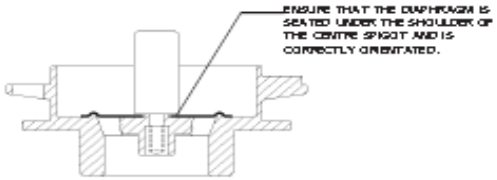


Fig.24

INSTRUCTIONS FOR USE cont.

Removing Exhalation Valve Assembly

1. Lay the suit on a clean flat surface and open the zip to its fullest extent.
2. Using a two pin wrench (Tool No. G01486) locate the pins into the two holes in the exhalation valve retaining ring and unscrew.
3. Remove the rubber sealing washer.
4. Then from the outside of the suit carefully remove the exhalation valve assembly.

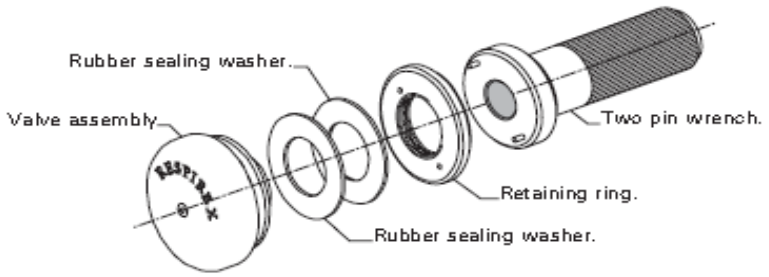


Fig.25

Replacing Exhalation Valve Assembly

1. The new exhalation valve will have all the parts screwed together, so remove the retaining ring and one of the rubber sealing washers.
2. Check that the remaining rubber sealing washer is laying flat against the valve body.
3. Locate the thread on the exhalation valve assembly through the hole in the back of the suit.
4. Locate the second rubber sealing washer around the thread on the valve body so that it is laying flat against the material of the suit .
5. Hand tighten the retaining ring onto the exhalation valve.
6. Check that the exhalation valve is orientated correctly (the Respirex lettering should be at the top of the valve and the three slots under the cover must be at the bottom).
7. Tighten the retaining ring using the two pin wrench (Tool No. G01486).

Decontamination

The end user shall be the sole judge for how long a limited-use gas-tight suit manufactured from Tychem®TK. can be worn on a specific application, and whether or not the garment can be sufficiently cleaned or decontaminated.

Preliminary washing by means of a high pressure shower will remove most of the contaminate from the outer surfaces of the suit sufficient to allow the wearer to undress from the garment.

Should you not have access to a high pressure shower, the suit can be sprayed with copious quantities of water and a suitable detergent and neutralizer for a minimum period of 5 minutes.

If the garment has been used in acid the recommended neutralizer is a solution of bicarbonate of soda and water (6% bicarbonate of soda w/v). Water will neutralize alkali contamination.

If you intend to re-use the garment it should now be removed for further cleaning.

The inner surfaces should be sprayed with Synodor® to kill all bacteria within the garment.

The outer surfaces can be cleaned using a diluted solution of Citrikleen (5 to 20 parts water to 1 part Citrikleen) applied using a soft cloth or soft brush if necessary. Never use a washing machine, spin or tumble drier.

Remove all excess water and allow the suit to dry naturally.

Warnings

HAND WASH ONLY
DO NOT SPIN
DO NOT DRY CLEAN
DO NOT BLEACH
DO NOT IRON
DO NOT TUMBLE DRY
DO NOT USE CLEANING SOLVENT
DO NOT USE AGGRESSIVE CLEANING POWDERS
DO NOT SCRUB THE SURFACE OF THE FABRIC

INSTRUCTIONS FOR USE cont.

Cleaning Accessories

The outer surfaces of the suit can be cleaned with Citrikleen, Part No. F00938.

The inner surfaces of the suit can be cleaned with Synodor® Odor San, Part No.F00936, this will neutralize any bacteria build-up within the suit.

The visor can be cleaned with Respirex 'Fog-Off', Part No. F00934.

The zip must be regularly lubricated with 'Max-Wax™', Part No. F00149.

All these accessories are available from Respirex. Please contact our Customer Services Department on Tel : +44(0) 1737 778600.

Storage

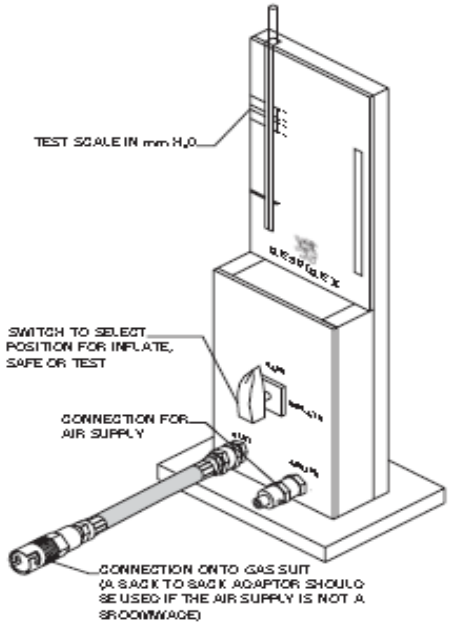
When not in use it is recommended that the suit is stored in the container supplied. An internal pressure test in accordance with EN464 : 1994 should be carried out after every use if it is deemed that the suit may be re-used. The suit must always be stored in a dry, decontaminated, clean condition with the zip fully waxed and closed leaving approximately 10cms (4") open.

Based on the results of accelerated ageing tests, the projected shelf life of Tychem®TK. is five years, as long as the material is not stored in sunlight or in excessive heat (>40°C). Additional research on Tychem®TK. material would suggest a possible shelf life of up to ten years.

NOTE : The zip should always be waxed when in the fully closed position. This is to prevent wax blocking the inner portion of the zip teeth leading to possible failure of the zip.

How To Fill A Test Rig

To do this insert the male instant air plug attached to the length of cord into the socket on the length of hose connected to the **'SUIT'** socket on the test rig. Turn the switch to **'TEST'**. Place the black tube from the small filling bottle into the 60ml bottle filled with manometer liquid. Squeeze the small bottle and draw up manometer liquid. Once the small bottle is full remove the tube from the 60ml bottle and place into the top of the test rig with the end of the black tube level with the narrow Red band. Squeeze the bottle to empty the liquid into the test rig, repeat the operation until liquid is level with Red filling band. Should an air bubble form agitate the liquid until it clears. This may be done by leaving the valve set at **'TEST'** and gently blowing and releasing to make the liquid move up and down in the tube. If the test rig is overfilled place the tube from the small filling bottle into the test rig and suck up any excess liquid. If for any reason the fluid needs 'topping up' repeat instructions as above.



INSTRUCTIONS FOR USE cont.

Conducting An Internal Pressure Test

1. Lay the suit out as flat as possible, away from any source of heat and/or currents of air. Seal the exhalation valves with the rubber bungs provided. Visually inspect the suit and remove any creases and folds as far as is practicable. Leave the suit at ambient temperature (20°C + 5°C) for minimum of 1 hour.

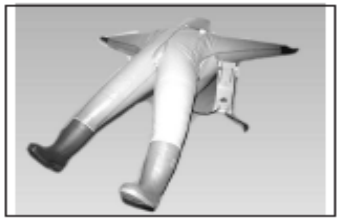


Fig.26

2. Connect the black hose from the port marked 'SUIT' on the test rig to the airline coupling on the suit. Make certain that the rig selector valve is turned to 'SAFE'. Connect a suitable compressed air source providing air at approx 15 PSI (1.03 bar) to the port marked 'AIRLINE' on the test rig.
3. Turn the rig selector valve to INFLATE. Inflate the suit carefully to a pressure of 1750 + 50 Pa. Ensure that any creased areas are unfolded and that the suit takes up its full shape (see Fig 26).
4. Check the inflation level by turning the valve through 'SAFE' to 'TEST'. When the pressure begins to approach the marks inflate a little at a time until the bottom of the red area is reached.
5. As the material stretches the pressure will drop. For 10 minutes keep adding sufficient air to keep the liquid in the Yellow area (1750 + 50) Pa. After 10 minutes adjust the fluid level to the top of the Green area (1650 + 50) Pa. Allow a further 6 minutes to elapse and record the drop in pascals. The pressure drop must not exceed 300 Pa to comply with EN 943-1 : 2002.

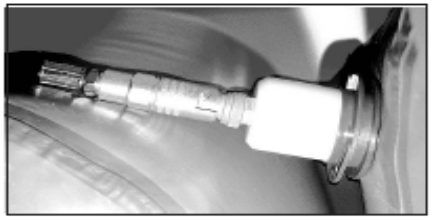


Fig.27

NOTE

Gas-tight suits that have a non-return valve fitted to the swivelling pass-thru must be inflated and tested through one of the exhalation valves by carrying out the following procedure.

1. Using a 2mm hexagon key loosen the screw from the centre of the exhalation valve and remove the cap.
2. Carefully stretch the diaphragm over the centre spigot to remove from the exhalation valve body.
3. Push the inflation & test plug into the exhalation valve body until sealed (see Fig 27).
4. Connect the inflation hose from the test rig onto the coupling fitted to the plug.
5. Now carry out test procedures as previously described.
6. After completing the test remove the inflation hose from the inflation & test plug.
7. Remove the inflation & test plug from the exhalation valve and any other plugs that may have been fitted.
8. Carefully stretch the diaphragm over the centre spigot making sure that it is correctly orientated and that the hole in the diaphragm is located under the shoulder of the spigot.
9. Replace the exhalation valve cap making sure that the location channel on the cap is located over the location key on the exhalation valve body (the RESPIREX lettering should be at the top).
10. Replace the centre screw and hand tighten using a 2mm hexagon key.

Note : If you are performing leak-tightness tests using the electrically operated Respirex automatic test unit please refer to the instructions supplied with the unit.

If you currently use a manual test rig but are interested in purchasing an automatic test unit please contact our customer services department.

INSTRUCTIONS FOR USE cont.

Chemical Permeation Testing At Respirex

At its headquarters at the Kingsfield Business Centre, Redhill, Respirex operate a chemical testing laboratory equipped with the latest technology. All the testing is carried out by fully qualified chemists who are able to test Respirex's own fabrics against any challenge chemical that the customer requests. In this way the customer can be advised and recommended of the most suitable material to use against any challenging chemical encountered in the workplace.

Permeation is the process by which a chemical moves through protective clothing material on a molecular level. The permeation tests are carried out according to both the European standards EN 369 and EN 374 as well as the American standard ASTM F739. The clothing material is exposed to the challenging chemical in a permeation cell so that breakthrough times and permeation rates can be measured. Breakthrough time is the time taken for the chemical to permeate through the material after continuous contact with the outer surface of a chemical protective suit. Permeation rates, measured in μg (min.cm²), are an indication of the amount of chemical reaching the wearer inside the suit after breakthrough occurs.

For advice on chemical permeation or decontamination contact the Respirex laboratory on Tel : +44 (0)1737 778600 or Fax : +44 (0) 1737 779441, where our qualified staff will be happy to help you. Outside of normal working hours (9.00am-5.00pm) please leave details of your enquiry on the answering service so that laboratory staff can deal with your query with the minimum of delay.

Permeation Performance

The following test results indicate the resistance to permeation by chemicals of Tychem®TK. material, gloves and visor as required EN943-2: 2002. Information on the permeation resistance of safety boots (if fitted) is detailed on a separate data sheet supplied with the suit.

All tests carried out under laboratory conditions by independent accredited laboratories in accordance with EN369:1993 unless otherwise stated.

Table shows average breakthrough times in minutes.

Chemical	Physical State	Tychem®TK. Material	Silver Shield Glove*	Visor
Acetone	L	>480	>360	>480
Acetonitrile	L	>480	>480	>480
Ammonia	G	>480	>120	>480
Carbon Disulphide	L	>480	>480	>480
Chlorine	G	>480	>480	>480
Dichloromethane	L	>480	>480	>480
Diethylamine	L	>480	>480	>480
Ethyl Acetate	L	>480	>360	>480
Hexane	L	>480	>360	>480
Hydrogen Chloride	G	>480	>240	>480
Methanol	L	>480	>60	>480
Sodium Hydroxide 40%	L	>480	>360	>480
Sulphuric Acid 98%	L	>480	>360	>480
Tetrahydrofuran	L	>480	>480	>480
Toluene	L	>480	>360	>480

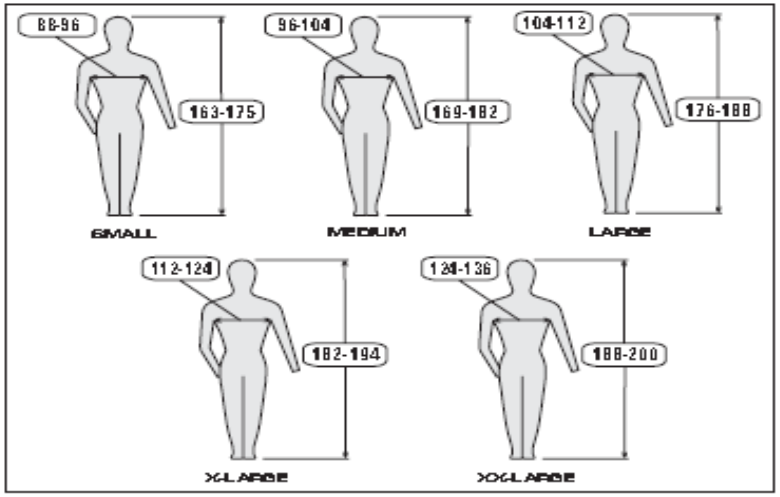
Key: L=Liquid G=Gas

*Glove tests performed in accordance with ASTM standard F739-91.

INSTRUCTIONS FOR USE cont.

Sizing

The following pictograms designate the range of height & chest sizes suitable for the limited-use gas-tight suit, check your body measurements to make sure you are suitable. Body measurements in cm (inch).



Suit Size	Height	Chest Size
Small	163 175 (5'4" 5'9")	88 96 (35" 38")
Medium	169 182 (5'6½" 5'11½")	96 104 (38" 41")
Large	176 188 (5'9" 6'2")	104 112 (41" 44")
X Large	182 194 (5'11½" 6'4")	112 124 (44" 49")
XX Large	188 200 (6'2" 6'7")	124 136 (49" 53½")

RESPIREX INTERNATIONAL LIMITED
Unit F Kingsfield Business Centre,
Philanthropic Road,
Redhill,
Surrey. RH1 4DP
ENGLAND
Tel : +44(0)1737 778600
Fax : +44(0)1737 779441
Email : info@respirex.co.uk

Type examination by: SGS United Kingdom Ltd
Ellesmere Port,
Cheshire CH65 3EN
ENGLAND
Notified Body No. 0120

BS\026\A\2003

HAZMAX BOOTS

FOOTWEAR SPECIFICATION

ARTICLE :	892-77210
DESCRIPTION :	HAZMAX Antistatic with steel Toe cap, Stainless Steel midsole and Oil resistant Vulcanised Rubber sole.
CERTIFIED TO :	EN 345-1, EN 50321 and PPE DIR 89/686/EEC
TOE CAP :	200 Joule Epoxy coated Steel to EN 345-1.
MIDSOLE :	Stainless Steel penetration resistance to EN 345-1
COLOUR :	Green Shaft / Yellow 2nd injection / Green Rubber sole.
SOLE :	Chemical and Oil Resistant Vulcanised Rubber. Increased Slip resistance by 30%, surpasses TM144 by x3. MAINTAINS SLIP RESISTANCE during wear, Increased wear by 2 to 3 times Resistant to hot contact 300°C.
SOLE DESIGN :	Cleated outsole for maximum grip Design is excellent for climbing ladders. Slip resistance to TM144 0.4 minimum. 30% Better slip resistance than a PVC sole. MAINTAINS EXCELLENT GRIP during wear.
BOOT :	HAZMAX CHEMICAL resistant compound. Chemical permeation conforms to EN 943 Chemical permeation conforms to NFPA 1991
SHAFT DESIGN :	Kick off lug, Extra shin protection, adjustable height, ankle guard.
HEEL :	Energy absorbing Tunnel system.
LINING :	Washable Knitted NYLON.
INSOLE :	Removable, washable.
SIZES :	European 35 - 47
MARKING :	CE marked on the shaft with date and year.

HAZMAX BOOTS BREAK THROUGH DATA

Chemical	CAS no.	Method	Breakthrough time
Acetic acid (Glacial)	64-19-7	EN374-3	Over 8 HOURS
Acetone	67-64-1	EN374-3	Over 2 HOURS
Acetone Cyanohydrin	75-86-5	EN374-3	Over 8 HOURS
Acetonitrile	75-05-08	EN374-3	Over 6 HOURS
Acrylic Acid	79-10-7	EN374-3	Over 8 HOURS
Acrylonitrile	107-13-1	EN374-3	Over 2 HOURS
Ammonia 5%	1336-21-6	EN374-3	Over 8 HOURS
Ammonia Gas	7664-41-7	EN374-3	Over 8 HOURS
Ammonium Pentadecafluoro-octanoate (30% in water)	3825-26-1	EN374-3	Over 8 HOURS
Aniline	62-53-3	EN374-3	Over 8 HOURS
Anti-knock(Tetraethyl lead 60%Dibromoethane 30%/Dichloroethane 10% TEL-CB	78-00-2 / 106-03-4 / 107-06-2	EN374-3	Over 8 HOURS
Aqueous Phenol 85%	108-95-2	EN374-3	Over 8 HOURS
Arsenic Acid	7778-39-4	EN374-3	Over 8 HOURS
Benzene	71-43-2	EN374-3	Over 4 HOURS
Benzene 85.5%/Toluene 8.6%/ Xylene3.2%/ Naphalene2.7%		EN374-3	Over 3 Hours Benzene only
Benzyl Chloride	100-44-7	EN374-3	Over 8 HOURS
Bromine	7726-95-6	EN374-3	Over 7 HOURS
Buta-1,3diene Gas	106-99-0	EN374-3	Over 3 HOURS
Butyl Acetate	123-86-4	EN374-3	Over 6 HOURS
Cadie oil		EN374-3	Over 8 HOURS
Carbazole	86-74-8	EN374-3	Over 8 HOURS
Carbon Disulphide	75-15-0	EN374-3	Over 1 HOUR
Chlorine Gas	7782-50-5	EN374-3	Over 3 HOURS
Chromic Acid	1333-82-0	EN374-3	Over 8 HOURS
Cyanogen Chloride	506-77-4	NFPA	No permeation detected
Cyclohexylamine	108-91-8	EN374-3	Over 8 HOURS
Dichloromethane	75-09-02	EN374-3	Over 1 HOUR
Diethylamine	109-89-7	EN374-3	Over 2 HOURS
Diethylene Glycol dimethylether	111-46-6	EN374-3	Over 8 HOURS
Dimethyl Formamide	68-12-2	EN374-3	Over 8 HOURS
Dimethylformamide	68-12-2	EN374-3	Over 3 HOURS
Epichlorohydrin	106-89-8	EN374-3	Over 7 HOURS
Ethyl Acetate	141-78-6	EN374-3	Over 4 HOURS
Ethylene Dichloride	107-06-2	EN374-3	Over 8 HOURS
Ethylene Oxide	75-21-8	EN374-3	Over 2 HOURS
Ethylenediamine tetra-acetic acid tetrasodium salt(EDTA) 5%	64-02-8	EN374-3	Over 8 HOURS
Formic Acid 65%	64-18-6	EN374-3	Over 8 HOURS
Hexane	110-54-3	EN374-3	Over 7 HOURS
Hydrazine	302-01-2	EN374-3	Over 8 HOURS
Hydrazine 5%	7803-57-8	EN374-3	Over 8 HOURS
Hydrochloric Acid 48%	7647-01-0	EN374-3	Over 8 HOURS
Hydrofluoric Acid 48%	7664-39-3	EN374-3	Over 8 HOURS
Hydrofluoric Acid 48%	7664-39-3	EN374-3	Over 66 HOURS
Hydrofluoric Acid 73%	7664-39-3	EN374-3	Over 8 HOURS
Hydrogen Chloride Gas	7647-01-0	EN374-3	Over 8 HOURS
Hydrogen Fluoride gas anhydrous	7664-39-3	EN374-3	Over 8 HOURS
Hydrogen Peroxide (10 volume (3%) solution)	7722-84-1	EN374-3	Over 8 HOURS
Hydrogen Peroxide (50%)	7722-84-1	EN374-3	Over 8 HOURS
Lewisite	541-25-3	NFPA	No permeation detected
m-Cresol	108-39-4	EN374-3	Over 8 HOURS
Methanol	67-56-1	EN374-3	Over 8 HOUR
Methyl Ethyl Ketone (M.E.K) 2-Butanone	78-93-3	EN374-3	Over 2 HOURS
Methyl Methacrylate	80-62-6	EN 369	Over 3 HOURS
methyl-1,2-pyrolidone	872-50-4	EN369	Over 8 HOURS
Methylene Chloride Gas	74-87-3	EN374-3	Over 1 HOUR
Mustard Gas	505-60-2	NFPA	No permeation detected
Naphalene	91-20-3	EN374-3	Over 8 HOURS
N,N-Dimethylaniline	121-69-7	EN374-3	Over 8 HOURS
N,N-dimetyl acetamide	127-19-5	EN374-3	Over 8 HOURS
Nitric Acid 50%	7697-37-2	EN374-3	Over 8 HOURS
Nitric Acid 70% conc	7697-37-2	EN374-3	Over 8 HOURS
Nitric Acid Etchant 80/20	7697-37-2	EN374-3	Over 8 HOURS
Nitro Benzene	98-95-3	EN374-3	Over 3 HOURS
Oleum 40% SO3	8014-95-7	EN374-3	Over 8 HOURS
Oxalic Acid saturated solution	6153-56-6	EN374-3	Over 8 HOURS
Phenol 50% In Methanol	108-95-2/67-56-1	EN374-3	Over 8 HOURS
Phosphoric acid 25%	7664-38-2	EN374-3	Over 8 HOURS
Phosphoric acid 75%	7664-38-2	EN374-3	Over 8 HOURS
Propylene 1,2 oxide	75-56-9	EN374-3	Over 1 HOUR
Red Fuming Nitric acid	7697-37-2	EN374-3	Over 4 HOURS
Sarin Gas	107-44-8	NFPA	No permeation detected
Sodium Cyanide 30wt%	143-33-9	EN374-3	Over 8 HOURS
Sodium Hydroxide 40%	1310-73-2	EN374-3	Over 8 HOURS
Sodium Hypochlorite 15%	7681-52-9	EN374-3	Over 8 HOURS
Sulphuric Acid 98%	7664-93-9	EN374-3	Over 8 HOURS
Tetrachlororethylene	127-18-4	EN374-3	Over 3 HOURS
Tetraethyl Lead (Octel Anti Knock)	78-00-2	EN374-3	Over 8 HOURS
Tetrahydofuran	109-99-9	EN374-3	Over 3 HOURS
Toluene	108-88-3	EN374-3	Over 4 HOURS
Toluene 2,4 Diisocyanate	584-84-9	EN374-3	Over 8 HOURS
Trichloroethane	71-55-6	EN374-3	Over 6 HOURS
Trichloroethylene 1,1,2	79-01-6	EN374-3	Over 3 HOURS
Triethanol-amine	102-71-6	EN374-3	Over 8 HOURS
Triethylene Glycol	112-27-6	EN374-3	Over 8 HOURS
Trigonox K-80 Cumylhydroperoxide 80% / 20% Cumene	80-15-9/ 98-82-8	EN 369	Over 8 HOURS
VX	50782-69-9	NFPA	No permeation detected
Xylene	1330-20-7	EN374-3	Over 4 HOURS

NEOPRENE & SILVERSHIELD GLOVES

HEAVY - DUTY PROTECTION

SFC340E - Rev 2 - 08.04.99

CATEGORY III CERTIFICATION

CE

NEOTEX 340 - 341

CE-Type Examination Certificates
NEOTEX 340 : 0072/014/162/12/96.0669
NEOTEX 341 : 0072/014/162/12/96.0670
issued by the approved body nr. 0072
I.T.F. - B.P.60 - F-69132 ECULLY CEDEX

Certificate of conformity of the Quality Assurance System
issued by the approved body nr. 0334
ASQUAL - 14, rue des Recollets - F-75013 PARIS

These gloves conform to the provisions of Directive 89/686/EEC for protection against mechanical risks, contact heat, chemicals and micro-organisms within the limit of the recommendations hereafter.

67, rue de Villiers - B.P. 150
92203 NEUILLY SUR SEINE Cedex - FRANCE
Tel. : (33) 1 46 84 22 00 - Fax. : (33) 1 46 84 24 29

MAPA (U.K.) Ltd
Unit 4 - Hollowfield 14 - ILFORD IG1 4QR
Tel (01) 952 834 431 Fax (01) 952 580 959

MAPA PROFESSIONNEL

NEOTEX 340 - 341

DESCRIPTION AND GENERAL PROPERTIES

Liquidproof gloves made of **black neoprene (polychloroprene)** over a **cotton knit.**

Curved fingers and contoured palm.

Smooth external surface.

Guaranteed silicone-free.

Reference	Glove Length for all sizes (in cm)*	Thickness in wristarea (in mm)*	Sizes available	Corresponding European Sizes
Neotex 340	38	1.15	7 - 7 ½ 8 - 8 ½ 9 - 9 ½ 10 - 10 ½ 11 - 11 ½	7.5 8 9 10 10.5
Neotex 341		1.45	8 - 8 ½ 9 - 9 ½ 10 - 10 ½ 11 - 11 ½	8 9 10 10.5

* nominal value

Standard packaging :

- each pair in printed polyethylene bag
- 50 pairs per carton

"CE"-TYPE EXAMINATION RESULTS

PROTECTION AGAINST CHEMICALS
According to EN 374 standard.
Liquidproof gloves.
Permeation data : see the enclosed chemical resistance chart.

PROTECTION AGAINST MICRO-ORGANISMS
According to EN 374 standard.

PROTECTION AGAINST MECHANICAL RISKS
Levels of performance according to EN 388 standard.

2 2 3 1
- 1 → puncture resistance (0 to 4)
- 2 → tear resistance (0 to 4)
- 3 → blade cut resistance (0 to 5)
- 2 → abrasion resistance (0 to 4)

PROTECTION AGAINST HEAT
Levels of performance according to EN 407 standard.
Only the mentioned test is relevant to the usage of the gloves

X 1 X X X X
- 1 → Contact heat (0 to 4)

Thanks to their internal liner and their neoprene coating, these gloves can be used for handling hot parts up to 100°C.

67, rue de Villiers - B.P. 150
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MAPA (U.K.) Ltd
Unit 4 - Hollowfield 14 - ILFORD IG1 4QR
Tel (01) 952 834 431 Fax (01) 952 580 959

MAPA PROFESSIONNEL

RESPIREX

NEOPRENE & SILVERSHIELD GLOVES

NEOTEX 340 - 341

SPECIFIC ADVANTAGES

- Freedom of movement : very comfortable high-quality cotton lining.
- Multi-purpose chemical resistance (acids, aliphatic solvents) increased by heavyweight rubber coating.
- Longer working-life for heavy-duty work.
- Forearm protection : long cuff gloves.
- High mechanical performance.
- Products manufactured in a MAPA factory which is ISO 9002 certified.

MAIN FIELDS OF USE

- Manufacture of pumps and compressors.
- Boiler room work.
- Timber treatment
- Mineral production.
- Railway work.
- Handling of fuel oil.

INSTRUCTIONS FOR USE

For enhanced safety and service life of the gloves :

- Store the gloves in the original packaging at a temperature not below 5°C.
- It is recommended to check that the gloves are suitable for the intended use, because the conditions of use at the workplace may differ from the "CE"-type tests.
- It is not recommended for persons sensitized to natural latex, thiurames, thiazoles, thiourea and dithiocarbamates to use these gloves.
- Put the gloves on dry, clean hands.
- Do not use the gloves in contact with a chemical for a duration in excess of the measured breakthrough time. Refer to the chemical resistance chart hereafter or contact the Technical Customer Service - MAPA PROFESSIONNEL in order to know this breakthrough time. Use 2 pairs alternatively when in long duration contact with a solvent.
- Turn the cuff end down in order to prevent a hazardous chemical from dripping onto the arm.
- Before taking off the gloves, clean them as appropriate :
  - ☐ In use with paints, pigments and inks : wipe with a clean cloth dampened with a suitable solvent, and rub over with a dry cloth
  - ☐ In use with a solvent (diluents, etc..) : rub over with a dry cloth
  - ☐ In use with acids or alkalines : thoroughly rinse the gloves under running water, and rub over with a dry cloth

  Caution : using the gloves or submitting them to another cleaning or laundering process can alter their performance levels.
- Ensure the inside of the gloves is dry before putting them on again.
- Inspect the gloves for cracks or snags before reusing them.

5 F, rue de Villiers - B.P. 150
92205 NEUILLY SUR SEINE Cedex - FRANCE
Tél. : (33) 1 49 64 22 00 - Fax : (33) 1 49 64 24 29

MAPA (U.K.) Ltd
Unit 4 - Hollowfield 14 - ILFORD IG7 4QR
Tel (01) 552 534 437 | Fax (01) 552 530 359

MAPA PROFESSIONNEL

NEOTEX 340 - 341

CHEMICAL RESISTANCE CHART

These gloves are designed for protection against numerous chemicals such as acids, bases, alcohols, petroleum solvents. In order to know whether these gloves are appropriate for a given chemical, refer to the table hereafter or enquire to Mapa Professionnel's Technical Customer Service.

The results quoted in the table hereafter are relative to tests performed on the glove style NEOTEX 341.

CHEMICAL	Chemical Resistance Index	Degradation Index (1 to 4)	Permeation (EN 374) Breakthrough time (minutes)	Permeation Index (0 to 6)
Acetone	+	3	14	1
Acrylic acid 95 %	+	NT	28	1
Butyl acetate	+	2	36	2
Cyclohexane	++	3	68	3
Dichloromethane	-	1	5	0
Dimethyl formamide	++	3	60	2
Ethanol	++	4	105	3
Ethyl acetate	+	3	19	1
Ethyl acrylate	-	NT	6	0
Hydrochloric acid 35 %	++	4	> 480	6
Isopropanol	++	4	>360	5**
Methanol	++	4	114	3
Methyl T-butylether *	=	3	NT	NT
Methyl ethyl ketone	=	2	15	1
Methyl methacrylate	-	NT	5	0
N-Methyl 2-pyrrolidone *	+	3	NT	NT
Nitric acid 68 % *	+	4	NT	NT
2-Nitropropane *	+	3	NT	NT
Sulfuric acid 95 %	=	2	104	3
Tetrahydrofurane	-	1	9	0
Toluene	-	1	10	0
1,1,1 Trichlorethane *	=	2	NT	NT
Xylene	-	1	15	1

** : test discontinued after 8 hours result only NT : not tested yet * : Chemical Resistance Index determined from degradation

Chemical Resistance Index :

- ++ can be used for long duration contact (limited to breakthrough time)
- + can be used for short repeated contacts (for a total duration not exceeding the breakthrough time)
- = can be used against splashes
- - not recommended

Degradation Index : a high index indicates a big degradation of the glove in contact with the chemical.

Breakthrough Time : permeation test performed on the palm of the glove in MAPA laboratories, unless otherwise specified.

Permeation Index : a high index indicates a big breakthrough time.

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MAPA PROFESSIONNEL

NEOPRENE & SILVERSHIELD GLOVES

"CE" DECLARATION OF CONFORMITY

The Company **MAPA s.n.c.**

57, rue de Villiers
BP 190
92205 Neuilly-sur-Seine Cedex - France

declares that the following MAPA PROFESSIONNEL protective gloves :

NEOTEX 340 NEOTEX 341

conform to the gloves which are the subject of "CE" certificates of conformity n°

NEOTEX 340 : 0072/014/162/12/96/0669
NEOTEX 341 : 0072/014/162/12/96/0670

issued by the notified body nr **0072**
Institut Textile de France
BP 60 - F-69132 ECULLY CEDEX

They are manufactured under a certified Quality Assurance System issued by the notified body nr **0334**
ASQUAL
14, rue des Reculettes
F-75013 PARIS

CATEGORY III CERTIFICATION

They conform to the provisions of directive 89/686/CEE, designed for protection against chemicals, micro-organisms, mechanical risks and contact heat, as specified in Article 8-4.(a) within the limits of use described in the technical documentation.

and are manufactured in conformance with the following European Standards :
EN 420, EN 374, EN 388 and EN 407.

Prepared at Neuilly-sur-Seine, on April 7, 1999

M.RODOT
Technical Customer Service

NEOPRENE & SILVERSHIELD GLOVES

NORTH
Safety Products

Silver Shield®/4H®
Chemical Protection Guide

A comprehensive listing of Permeation Rates and Breakthrough Times for North Silver Shield®/4H® Hazardous Chemical Gloves, Aprons, Sleeves and Booties against 280 Chemical Contaminants in two temperatures.

TEST PROCEDURE
Chemical testing as per ASTM Standard F 739-91.
Detection limit: 0.1 µg / cm² / min.
Chemical testing as per EN 374: CE-0120.

KEY TO BREAKTHROUGH AND PERMEATION RATE
NT - Not Tested
NC - Not Calculated
C - Known or suspected Carcinogen

Chemical	CAS Reg. No.	21° C (70° F) Break-Through Time minutes	21° C (70° F) Permeation Rate µg / cm² / minute	35° C (95° F) Break-Through Time minutes	35° C (95° F) Permeation Rate µg / cm² / minute
ACCUMIXR (mixture) N-Alkyl Dimethyl Benzyl Amm. Chloride N-Alkyl Dimethyl Ethylbenzyl Amm. Chloride Water Ethyl Alcohol	68391-01-5 68956-79-6 7732-18-5 64-17-5	> 240		NT	
Acetaldehyde	75-07-0	> 240		NT	
Acetic Acid 100%	64-19-7	> 480		53	2.4
Acetic Anhydride	108-24-7	> 480		> 240	
Acetone	67-64-1	> 1440		> 240	
Acetone/Petrol 1:1	67-64-1 8032-32-4	9	NC	3	NC
Acetone/Toluene/ Methylated Spirit/ Conc. Ammonia 2 : 1 : 1 : 1	67-64-1 108-88-3 — 7664-41-7	190	NC	40	NC

Chemical	CAS Reg. No.	21° C (70° F) Break-Through Time minutes	21° C (70° F) Permeation Rate µg / cm² / minute	35° C (95° F) Break-Through Time minutes	35° C (95° F) Permeation Rate µg / cm² / minute	
Acetone/Water 20:80	67-64-1	> 240		> 240		
Acetonitrile	75-05-8	> 1440		> 240		
Acetonitrile 25% in water	75-05-8	> 240		> 240		
Acetophenone	98-86-2	> 480		> 240		
Acrolein	107-02-8	> 480		> 240		
Acrylamide 15% in MEK	79-06-1 78-93-3	> 240		> 240		C
Acrylamide Mixture n-n' methylenebisacrylamide	79-06-1 110-26-9	> 240		> 240		
Acrylate UV Lacquer (ethylacetate/butylacetate)	—	> 240 *		> 240		
Acrylic Acid	79-10-7	> 240		> 210	NC	
Acrylonitrile	107-13-1	> 480		> 240		C
AeroShell Fluid 4	—	> 240		> 240		
Allyl chloride	107-05-1	> 240		> 240		
Allylamine (propyleneamine)	107-11-9	15	NC	NT		
Ammonia Water 2N	7664-41-7	110	NC	40	NC	
Ammonia Water 25%	7664-41-7	> 240		30	NC	
Ammonium Flouride 34%	12125-01-8	> 240		> 240		
Ammonium Hydroxide (29, 1 w/w%) in water	1336-21-6	> 240		> 240		
Aniline	62-53-3	> 1440		> 240		
BENLATER (Benomyl)	17804-35-2	> 240		NT		
Benzaldehyde	100-52-7	> 480		> 240		
Benzene	71-43-2	> 1440		> 240		C
3, 3', 4, 4' Benzophenone Tetracarboxylic Dianhydride	2421-28-5	> 240		NT		
Benzyl Alcohol	100-51-6	> 480		NT		
Benzyl Chloride	100-44-7	> 480		> 240		
Benzyl Cyanide	140-29-4	> 240		> 240		
n-Benzyl Dimethylamine	103-83-3	> 240		NT		
Bispenol A diglycidyl Ether (EPOXY) 50% in MEK	1675-54-3 78-93-3	> 480		> 240		
Bromoacetic Acid	79-08-3	> 240		> 240		
Bromoacetonitrile	590-17-0	> 240		> 240		
2-Bromoacetonphenone	70-11-1	> 240		> 240		
1-Bromoethylethyl Carbonate	89766-09-6	> 240		> 240		
1, 4-Butanediol diglycidyl ether 50% in MEK	2425-79-8 78-93-3	> 240		> 240		
n-Butanol	71-36-3	> 480		> 240		
sec-Butanol	78-92-2	> 480		> 240		
tert-Butanol	75-65-0	> 480		> 240		
n-Butyl Acetate	123-86-4	> 480		> 240		
Butyl Acrylate	141-32-2	> 480		> 240		
2-Butoxyethanol (butyl glycol)	111-76-2	> 240		> 240		
tert-Butyl Hydroperoxide	75-91-2	> 240		NT		
Butyraldehyde	123-72-8	> 480		> 240		
Carbon Disulfide	75-15-0	> 1440		> 240		
Carbon Tetrachloride	56-23-5	> 480		> 240		
Chlorine	7782-50-5	> 240		NT		
Chloroacetone	78-95-5	> 240		> 240		
2-Chloroethanol	107-07-3	> 240		> 240		
Chloroform	67-66-3	> 1440		> 240		C
Chloroform/ tert. Butanol 80 : 20	67-66-3 75-65-0	> 240		> 8		C

RESPIREX

NEOPRENE & SILVERSHIELD GLOVES

Chemical	CAS Reg. No.	21° C (70° F) Break-Through Time minutes	21° C (70° F) Permeation Rate µg / cm² / minute	35° C (95° F) Break-Through Time minutes	35° C (95° F) Permeation Rate µg / cm² / minute	
Chloroform w/30% Methanol	67-66-3 67-56-1	> 240		> 240		C
3-Chloropropene	107-05-1	> 240		NT		
CLOVA THINNER #19* Toluene 50% MEK 15% Methanol 15% 2-Butoxyethanol 10% Ethyl Acetate 10%	 108-88-3 78-93-3 67-56-1 111-76-2 141-78-6	> 240			NT	
Chromic Acid 50%	1333-82-0	> 240		> 240		
Chromic Acid/ Sulphuric Acid	1333-82-0 7664-93-9	> 240		> 240		
Coal Tar/ Benzene 1:1	— 71-43-2	> 240		> 240		C
Corrosive Fluid Dyrup 49685	—	102	NC	20	NC	
Creosote	8001-58-9	> 240		> 240		C
p-Cresol 50% in MEK	106-44-5 78-93-3					
Cyclohexane	110-82-7	> 480		> 240		
Cyclohexanol	108-93-0	> 480		> 240		
Cyclohexanone	108-94-1	> 480		> 240		
Cyclohexylamine 32% Morpholine 8% Water 60%	108-91-8 110-91-8	> 240	NT			
Cyclopentanone	120-92-3	> 240		> 240		
CYMBUSHR (Cypermethrin)	52315-07-8	> 240		NT		
DEEP WOODS OFF* (Mixture) N, N-Diethyltoluamide Ethanol	 134-62-3 64-17-5	> 240		NT		
DEGALAN S 309* (Mixture)	—	> 240		NT		
DEGALAN S 696* (Mixture)	—	> 240		NT		
Diacetone alcohol	123-42-2	> 240		> 240		
4, 4'-Diaminodiphenyl-methane (MDA) 50% in MEK	537-65-5 78-93-3	> 480		> 240		C
1, 2-Dibromoethane	106-93-4	> 480		NT		
Dibutyl Ether	142-96-1	> 480		NT		
Di-n-Butyl Phthalate	84-74-2	> 240		> 240		
1, 3-Dichloro-2-Butene	926-57-8	> 240		NT		
1, 2-Dichlorobenzene	95-50-1	> 240		> 240		
1, 2-Dichloroethane	107-06-2	> 240		> 240		C
1, 1-Dichloroethylene	75-35-4	> 420		> 420		
Dichloromethane 90% Isopropyl Alcohol 10%	75-09-2 67-63-0	> 480		> 240		
Diethanolamine 50% in Water	111-42-2	> 240		> 240		
n, n-Diethylacetamide	685-91-6	> 480		> 240		
Diethylamine	109-89-7	> 60	NC	6	NC	
Diethylenetriamine	111-40-0	> 240		NT		
Diethyl Ether	60-29-7	> 480		> 240		
N, N Diethyl nitrosoamine	55-18-5	> 240		NT		

Chemical	CAS Reg. No.	21° C (70° F) Break-Through Time minutes	21° C (70° F) Permeation Rate µg / cm² / minute	35° C (95° F) Break-Through Time minutes	35° C (95° F) Permeation Rate µg / cm² / minute	
Diethylphthalate (Phthalic acid diethylester)	84-66-2	> 240		NT		
Diisobutyl ketone	108-83-8	> 240		> 240		
Dimercaptothiodiazole 10% in Butyldioxotol/MEK 1:1	1072-71-5	> 240		> 240		
N, N Dimethyl- Cyclohexylamine	98-94-2	> 480		NT		
Dimethylmercury	593-74-8	60		NT		
Dimethyl Sulfoxide	67-68-5	> 480		194	2.2	
N, N-Dimethylacetamide	127-19-5	> 240		> 240		
2 – Dimethylamino - Ethanol	108-01-0	350		NT		
N, N-Dimethylaniline	121-69-7	> 240		> 240		
Dimethylethanolamine	108-01-0	> 240		> 240		
Dimethylethylamine	598-56-1	9	NC	2	NC	
Dimethylformamide	68-12-2	> 1440		> 240		
Dimethylsulphate	77-78-1	> 240		> 240		C
Dinol	—	> 240		NT		
Dinoseb (47, 6% in Xylene)	88-85-7 1330-20-7	> 240		> 240		
1, 4-Dioxane	123-91-1	> 480		> 240		C
Dipentene (limonen)	138-86-3	> 480		36		
2, 3-Diphenyl-2-cyclopropen-1-one 2% Acetone w/10% Propyleneglycol	886-38-4 67-64-1 57-55-6	> 240		> 240		
Di-(2-ethylhexyl) phthalate	117-81-7	> 240		> 240		C
Diquat Dibromide	85-00-7	> 240		> 240		
Dodecane	112-40-3	> 480		> 240		
Dynasylan BH-N	—	> 480		NT		
Epichlorohydrin	106-89-8	> 240		> 240		C
EPOXIDHARZ-KLEBSTOFF* Schüco art. 298011 A	—	> 240		> 240		
EPOXIDHARZ-KLEBSTOFF* Schüco art. 298011 B	—	> 240		> 240		
Ethanol 96%	64-17-5	> 480		> 240		
Ethanolamine	141-43-5	> 480		> 240		
Ethidium Bromide	1239-45-8	> 480		NT		
2-(2-Aminoethoxy)ethanol	929-06-6	> 240		> 240		
2-Ethoxy-1-Propanol	19089-45-5	> 240		> 240		
Ethyl Acetate	141-78-6	> 1440		> 240		
Ethyl Acrylate	140-88-5	> 240		> 240		C
Ethyl Benzene	100-41-4	> 480		> 480		
Ethyl Glycol	110-80-5	> 240		> 240		
Ethyl Glycol Acetate	111-15-9	> 240		> 240		
Ethylendiamine	107-15-3	92	NC	47	NC	
Ethylene Glycol	107-21-1	> 240		> 240		
Ethylene Oxide	75-21-8	> 240		NT		
Extraction petrol 80/110	—	> 240		> 240		
Fluoroboric solution: Hydrofluoric acid Boric acid Nitric acid	 7664-39-3 10043-35-3 7697-37-2	> 240		NT		
Formaldehyde	50-00-0	> 240		> 240		
Formaldehyde 37% w/10% Methanol	50-00-0 67-56-1	> 480		> 240		C

NEOPRENE & SILVERSHIELD GLOVES

Chemical	CAS Reg. No.	21° C (70° F) Break-Through Time minutes	21° C (70° F) Permeation Rate µg / cm² / minute	35° C (95° F) Break-Through Time minutes	35° C (95° F) Permeation Rate µg / cm² / minute	
Formic Acid 98-100%	64-18-6	120	NC	60	NC	
Freon 113	76-13-1	> 240		> 240		
Furfural	98-01-1	> 480		> 240		
Furfuryl Alcohol	98-00-0	> 480		> 240		
GammaButyrolactone Merck 801661	96-48-0	> 480		NT		
GLANCER (mixture)	—	> 240		NT		
Glutardialdehyde 2% in Water	111-30-8	> 240		> 240		
Glutardialdehyde 25% in Water	111-30-8	> 240		> 240		
Glycerol	56-81-5	> 240		> 240		
Glycerol Monothioglycolate 80%	30618-84-9	> 240		NT		
Glycerolpropoxy-triacrylate	—	> 240		> 240		
GLUMA	—	> 240		NT		
Heptane	142-82-5	> 480		> 240		
1, 1, 1, 3, 3, 3 – Hexamethyl Disilazane	999-97-3	> 240		> 240		
n-Hexane	110-54-3	> 1440		> 240		
Hexane/Benzene 9:1	110-54-3 71-43-2	> 240		> 240		C
Hydraulic oils	—	> 240		> 240		
Hydrazin 80%	7803-57-8	> 240		> 240		C
Hydrocarbon Mixture (K-Blend)	—	> 240		NT		
Hydrochloric Acid 2N	7647-01-0	> 240		> 240		
Hydrochloric Acid 37%	7647-01-0	> 240		NT		
Hydrochloric Acid 37% /Nitric Acid 65% 3:1	7647-01-0 7697-37-2	> 240		> 240		
Hydrofluoric Acid 10%	7664-39-3	> 240		120	NC	
Hydrofluoric Acid 30%	7664-39-3	> 240		120	NC	
Hydrofluoric Acid 40%	7664-39-3	> 240		120	NC	
Hydrofluoric Acid 49%	7664-39-3	> 240		30	NC	
Hydrofluoric Acid 70%	7664-39-3	60	NC	30	NC	
Hydrofluoric Acid 100%	7664-39-3	15				
Hydrogen Cyanide	74-90-8	> 240		NT		
Hydrogen Peroxide 30%	7722-84-1	> 240		NT		
Hydroquinone 33% in Ethanol	123-31-9 64-17-5	> 240		> 240		
2-Hydroxy-Methacrylate (HEMA)	868-77-9	> 240		NT		
2-Hydroxyethyl-N, N, N-Trimethyl ammonium Hydroxid	—	> 240		> 240		
2-Hydroxyethyl Acrylate	818-61-1	> 240		> 240		
IMRON 192R S/Hexamethylene Diisocyanate 37%	—	> 240		NT		
Isobutanol	78-83-1					
Isopentylalcohol/ Chloroform 1:24	123-51-3 67-66-3	176	NC	40	NC	C
Isophorone	78-59-1	> 240		> 240		
Isopropanol	67-63-0	> 240		> 240		
Isopropyl Nitrate	1712-64-7	> 240		NT		
Jet Fuel (Jet A-1/Shell)	—	> 240		> 240		

Chemical	CAS Reg. No.	21° C (70° F) Break-Through Time minutes	21° C (70° F) Permeation Rate µg / cm² / minute	35° C (95° F) Break-Through Time minutes	35° C (95° F) Permeation Rate µg / cm² / minute	
KOWAC'S INDOLREGENT*	—	> 240		> 240		
Lubricat. Oil, DTE 25	—	> 240		> 240		
Malathion	121-75-5	> 240		NT		
2-Mercaptoethanol	60-24-2	> 240		> 240		
Mercury (Hg)	7939-97-6	> 480		NT		
Methacrylic Acid	79-41-4	> 480		> 240		
Methacrylic Adhesive	—	> 240		> 240		
Methanol	67-56-1	> 480		30	1.6	
1-Methoxy-2-Propanol	107-98-2	> 240		> 240		
1-Methoxy-2-Proprylacetate	108-65-6	> 240		> 240		
2-Methoxyethanol	109-86-4	> 240		> 240		
2-Methoxyethyl-Acetate	110-49-6	> 240		> 240		
Methyl Acetate	79-20-9	> 480		> 240		
Methyl Ethyl Ketone (MEK)	78-93-3	> 1440		> 240		
Methyl Ethyl Ketone/ Toluene 1:1	78-93-3 108-88-3	114	NC	9	NC	
5-Methyl-2-Hexanone (Methyl Isoamyl Ketone)	110-12-3	> 480		> 240		
Methyl Isobutyl Ketone	108-10-1	> 480		> 240		
Methyl Methacrylate	80-62-6	> 480		> 480		
5-Methyl-5-Norbornene 2, 3-Dicarboxylic Anhydride (Methyl Nadic Anhydride)	25134-21-8	> 240		NT		
Methyl-pentyl-ketone	110-43-0	> 240		> 240		
Methyl n-propyl Ketone (2-Pentanone)	107-87-9	> 480		NT		
N-Methyl-2-Pyrrolidone	872-50-4	> 240		> 240		
Methyl-tert-Butyl Ether	1634-04-4	> 480		NT		
Methyl Trichlorosilane	75-79-6	> 240		NT		
Methylamine 40%	74895	> 240		80	1.3	
4, 4' -Methylene bis (MOCA, MBOCA or MBOCHA) (2-Chloroaniline) 50% in Acetone	101-14-4 67-64-1	> 240		NT		C
Methylene Bisphenyl-4, 4-diisocyanate (MDI)	101-68-8	> 480		> 240		
Methylene Chloride	75-09-2	> 1440		> 240		C
4, 4' -Methylenedianiline 10% in Isopropyl alcohol	537-65-5 67-63-0	> 240		NT		
Methylenedianiline 50% in MEK (MDA)	537-65-5 78-93-3	> 480		NT		C
Methyliodide	74-88-4	123	NC	8	NC	
Mixture of: N-Methyl Pyrrolidone Butyrolactone Styrene	872-50-4 96-48-0 100-42-5	> 480		> 480		
Mixture of: Methylene Chloride 20% Trichlorethylene 20% Xylene 45% Mineral Spirits 15%	75-09-02 79-01-06 1330-20-7 8032-32-4	> 240		> 240		
Mixture of: MEK 66% Cyclohexanone 24% Toluene 10%	78-93-3 108-94-1 108-88-3	> 480		NT		

NEOPRENE & SILVERSHIELD GLOVES

Chemical	CAS Reg. No.	21° C (70° F) Break-Through Time minutes	21° C (70° F) Permeation Rate µg / cm² / minute	35° C (95° F) Break-Through Time minutes	35° C (95° F) Permeation Rate µg / cm² / minute	
Mixture of: 1, 3-Phenylenediamine 30% Ethylacetate 70%	108-45-2 141-78-6	> 480		NT		
Mixture of: Toluene 50% Isopropylalcohol 25% Methylethylketone 25%	108-88-3 67-63-0 78-93-3	> 480		NT		
Morpholine	110-91-8	> 480		94	2.5	
Mustard Gas	505-60-2	> 1440		> 1440		C
N35091 Cleaning agent	—	> 480		NT		
N 39/3010 Thinner	—	> 480		NT		
Naphathalene 25% in Toluene	91-20-3	> 240		> 240		
1-Naphthylamine 25% in Isopropanol	134-32-7	> 240		> 240		
Nicotine	54-11-5	> 240		> 240		
Ninhydrin 4% in 2-Methoxyethanol	485-47-2	> 240		> 240		
Nitric Acid 2N	7697-37-2	> 480		> 240		
Nitric Acid 65%	7697-37-2	> 40		NT		
Nitric Acid 100% (red fuming)	7697-37-2	180	NC	60		
Nitrobenzene	98-95-3	> 1440		> 240		
2-Nitrobenzylbromide	3958-60-9	> 240		> 240		
4-Nitrodiphenylamine	119-75-5	> 240		> 240		
Nitroethane	79-24-1	> 480		> 240		
Nitroglycerol	55-63-0	> 240		NT		
Nitroglycol	628-96-6	> 240		NT		
Nitromethane	75-52-5	> 480		> 240		
2-Nitropropane	79-46-9	> 240		> 240		C
O-Toluidine	95-53-4	> 480		> 480		
Orthocid 83	133-06-2	> 240		NT		
KVK PARATHION 35R	—	> 240		NT		
PAINTSTRIPPER D23® 30% in Dichloromethane	—	200	NC	NT		
PCB 12/60 Chloric	1336-36-3	> 240		> 240		C
Pentane	109-66-0	> 480		> 240		
Perchloric Acid 70%	760 1-90-3	> 240		> 240		
Perchloroethylene	127-18-4	> 480		> 480		C
PERGA KAN® Domo/Master A/S - DK	—	> 240		> 240		
PERMA FLUID "MICA" (8% Ammonia Thioglycolate)	—	> 240		> 240		
Petroleum (Gasoline) 95 & 96 unleaded/leaded	93572-29-3	> 240		> 240		
Petroleum (Gasoline) (Shell specialty)	—	> 240		> 240		
80% Petroleum 20% n-Methyl-2-pyrrolidon	— 872-50-4	> 240		> 240		
Petroleum ether 80/110	8032-32-4	> 480		> 480		
Phathalic Acid Anhydride	85-44-9	> 240		NT		
Phenol 50% in MEK	108-95-2 78-93-3	> 240		> 240		

Chemical	CAS Reg. No.	21° C (70° F) Break-Through Time minutes	21° C (70° F) Permeation Rate µg / cm² / minute	35° C (95° F) Break-Through Time minutes	35° C (95° F) Permeation Rate µg / cm² / minute	
Phenol/Isopentanol/ Chloroform 25:1:24	108-95-2 123-51-3 67-66-3	130	NC	70	NC	C
Phosphoric Acid 85%	766-38-2	> 240		> 240		
Phosphorylic Chloride	10025-87-3	> 240		> 240		
PHOTO RESIST 1450® (INMOS)	111-15-9 1330-20-7 123-86-4	> 240		> 240		
3-Picolyl Chloride Hydrochloride 25% in water	6959-48-4	> 240		> 240		
3-Picolyl Chloride Hydrochloride/ Acetonitrile/water 4:3:9	6959-48-4 75-05-8	> 240		> 240		
4-Picolylchloride hydrochloride	1822-51-1	> 240		> 240		
Polyethyleneglycol	25322-68-3	> 480		NT		
Polyol mixture	—	> 480		NT		
Posistrip LE, (INMOS)	110-91-8 96-48-0 872-50-4	> 240		> 240		
Potassium Hydroxide 50%	1310-58-3	> 240		> 240		
Potass. Permanganate Solution, Saturated	7722-64-7	> 240		NT		
PRAMITOLR	1610-18-0	> 240		NT		
PRO STRIPR (Mixture): Monoethanolamine Glycol Ether Isopropanol Polyoxyethylene Phenylether Phosphate Ammonium Hydroxide	 141-43-5 111-76-2 67-63-0 39464-70-5 1336-21-6	> 240		NT		
1-Propanol	71-23-8	> 240		> 240		
Propiophenone	93-55-0	> 240		> 240		
Propyl Acetate	109-60-4	> 480		> 240		
Propylene Glycol	57-55-6	> 240		> 240		
Propylene Glycol Monoethyl Ether Acetate	19234-20-9	> 240		> 240		
1, 2-Propylene Oxide	75-56-9	> 480		NT		
1, 2-Propylene Oxide in Water	75-56-9	> 240		26	3.0	C
Propyzamide 50% (Kerb 50®) 10% suspended in Water	23950-58-5	> 240		NT		
Pyridine	110-86-1	> 480		> 240		
PYROTEC HFD 46R	—	> 240		NT		
Quinoline	91-22-5	> 240		> 240		
REGLONER	85-00-7	> 240		NT		
630 RESIST STRIPPERR (INMOS)	929-06-6 872-50-4	> 240		> 240		
ROUNDUP® Glyphosat-isopropylamine derivate 450 g/l	38641-94-0	> 240		NT		
SADOFOSS PRIMER® 17	—	> 240		> 240		
SADOFOSS PRIMER® 513	—	> 240	64	NC		

NEOPRENE & SILVERSHIELD GLOVES

Chemical	CAS Reg. No.	21° C (70° F) Break-Through Time minutes	21° C (70° F) Permeation Rate µg / cm² / minute	35° C (95° F) Break-Through Time minutes	35° C (95° F) Permeation Rate µg / cm² / minute	
Silver Cyanide 4%	506-64-9	> 240		NT		
SKYDROL® (mix of Tributyl phosphate/ Dibutylhenolphosphate	126-73-8	> 480		NT		
Sodium Hydroxide 2N	1310-73-2	> 1440		> 240		
Sodium Hydroxide 50%	1310-73-2	> 480		> 240		
Sodium Hydroxide 96-98%	1310-73-2	> 480		NT		
Sodium Hypochlorite 15% in Water	7681-52-9	> 240		> 240		
SOLMASTER® Methylene Chloride/Ethanol	—	> 240		> 240		
STAR THINNER 7040® Xylene/Butylglycol	1330-20-7 111-76-2	> 240		> 240		
Styrene	100-42-5	> 1440		> 240		
Sulphuric Acid 90%	7664-93-9	> 480		> 240		
Sulphuric Acid 93%	7664-93-9	> 1440		NT		
Sulphuric Acid 96% w.65% SO_3 (oleum)	7664-93-9	120	NC	30	NC	
Sulphuric Acid 2N	7664-93-9	> 240		> 240		C
Sulphuric Acid 96% Hydrogen Peroxide 30% 3:1	7664-93-9 7722-84-1	> 480		NT		
Tetrachloroethylene	127-18-4	> 1440		> 240		
Tetraethyl Orthosilicate	78-10-4	> 480		> 480		
Tetrafluoroboric Acid (HBF4) 35%	16872-11-0	> 240		NT		
Tetrahydrofuran	109-99-9	> 480		> 240		
Tetrahydrofuran 50% Toluene 50%	109-99-9 108-88-3	89	NC	NT		
Tetramethyl Ammonium Hydroxide in water	75-59-2	> 240		> 240		
Thioglycolic Acid	123-93-3	> 240		> 240		
Thiourea 7, 5% in 50% Ethanol	62-56-6 64-17-5	> 240		> 240		
Toluene	108-88-3	> 1440		> 240		
Toluene-2, 4-Diisocyanate TDI 40% in Xylene	584-84-9 1330-20-7	> 480		> 240		
Toluene Isopropanol 1:1	108-88-3 67-63-0	> 240		> 240		
Transformer Oil Nytro 10X, Nynäs/Oslo	—	> 240		> 240		
Transmission Oil Opel, Dextron GM 6137M	—	> 240		> 240		
Tributylphosphate	126-73-8	> 240		> 240		
1, 1, 1-Trichloroethane	71-55-6	> 480		> 240		C
1, 1, 1-Trichloroethane w. 3% 1, 4-Dioxane	71-55-6 123-91-1	> 240		> 240		
1, 1, 1-Trichloroethane /Ethanol/Turpentine amounts unknown	71-55-6 64-17-5 8006-64-2	> 240		NT		
1, 1, 1-Trichloroethane 73% Methylene Chloride 17% Dodecylbenzensulphohonacid 10%	71-55-6 75-02-9 2776-87-0	> 240		NT		
1, 1, 1-Trichloroethane/ Propyleneglycolmono-ethyletheracetate 3:1	71-55-6 19234-20-9	> 240		>240		
Trichloroethylene	79-01-6	> 1440		> 240		

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Triethanolamine 50% in Water	102-71-6	> 240		> 240	
Triethylenediamine	280-57-9	> 480		NT	
Triethylendiamine 25% in Water	280-57-9	> 240		220	NT
Triethylene Tetramine (TETA) 50% in MEK	112-24-3 78-93-3	> 240		> 240	
Trifluoroacetic Acid	76-05-1	> 240		> 240	
Triphosgene	32315-10-9	> 240		> 240	
Tripropylene glycol Diacrylate	42978-66-5	> 240		> 240	
TURCO 5092® (Stripping agent)	—	132	NC	28	NC
U-V RESIN 20074®	—	> 240		> 240	
Vinyl Acetate	108-05-4	> 480		> 240	
Vinyl Chloride 99%	75-01-4	> 480		> 480	
N-Vinylpyrrolidone	88-12-0	> 240		> 240	
White Spirit (Naphtha)	8052-41-3	> 480		> 240	
XYLAMON®	—	> 240		NT	
Xylene	1330-20-7	> 1440		> 240	
Xylene/Ethyl Glycol 1:1	1330-20-7, 110-80-5	> 240		> 240	

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