CHEM SUIT
HD

HANSEN
PROTECTION

ChemSuit
The suit is produced to protect personnel who may be exposed to chemicals. Recommended for ADR transport. Suit without boots, manufactured in fluorescent color for visibility. The suit is resistant to chemicals, flame resistant and anti-static. Delivered in 4 sizes, M to XXL.

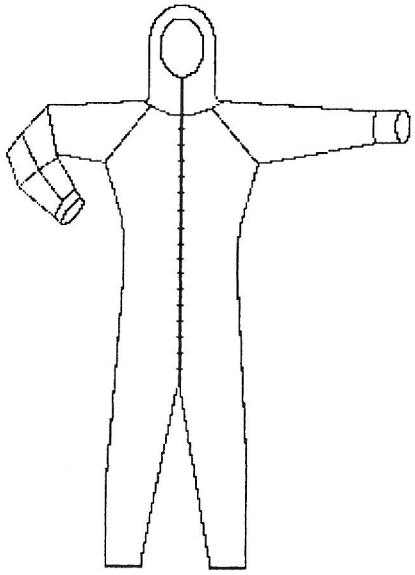
CHEMICAL PROTECTIVE SUIT

TYPE : CHEM-SUIT HD

MODEL NO. : NX 65 FLUO Front Zip Fastener

PRODUCT NO. : 215150, 215151, 215152, 215153 & 215154

TECHNICAL DATA :



Weight	1,2 kg
Sizes	S, M, L, XL
	(special sizes on request)
Fabric	Texturised polyester
	Fluo - PVC/Chemical Resistance/Flame retardant/Antistatic
	(EN 369, EN 467, EN533, EN 1149:1)

ITL GROUP

DATA SHEET
PRODUCT NO. *NX 65* *Date: 231194*

Vekt, g/m^2 Weight, grams per square meter Gewicht, g/m^2	ca. 340				BS.3424.5
Bredde (cm) Width Breite	150				
Strekkstyrke (N/5 cm) Tensile strength Zugfestigkeit	Warp ca. Warp 415 Kette		Weft ca. Weft 415 Schuss		DIN 53354
Rivestyrke (N) Tearing strength Weiter-Reiss Festigkeit	Warp ca. Warp 120 Kette		Weft ca. Weft 145 Schuss		DIN 53356
Sveiset vedheft, N/ 5 cm Adhesion / 5 cm (welded) Adhesion / 5 cm (geschweisst)					EU.BN.51-1.
Kuldebestandighet (°C) Cold Resistance Kaltebestandigkeit	- 25				BS.3424-10.
Vanngjennomgang Water permeability Wasserdurchlassigkeit	0				SIS.650006.
Lysekthet Light fastness Lichtechtheit	Fluoriserende farver : 4 - 5 Andre farver : 6 - 7				Wool scale.
RÅDUK - BASE CLOTH - GEWEBE Materiale Material Material	Polyester				
BELEGG - COATING - BESCHICHTUNG Materiale Material Material	Elastomer/ PVC				
Øvrige opplysninger Further informations Weitere Information	Flammehemmende/Antistatisk Flame retardent/ Antistatic Schwer entflambar /Antistatic				

ITL GROUP

PROTECTIVE SUIT - SIZES

	Unit Enhet	XXS 46	XS 48	S 50	M 52	L 54	XL 56
A Height **A Høyde**	cm	167-172	172-177	177-182	182-187	187-192	192-197
B Waist **B Livvidde**	cm	96	102	108	114	120	126
C Sleeve **C Armlengde**	cm	67	69	71	73	75	77
D Inside leg **D Høyde i skritt**	cm	82	84	86	88	90	92
E Boots size **E Strørrelse vernestøvel**	Int. Eur.	6 39	7 40	8 42	9 43	10 44/45	11 46

Manufacturer: Helly Hansen Spesialprodukter as
PO Box 218
N-1501 Moss.
Norway

tel.69249000 fax 69249290

CE 0403

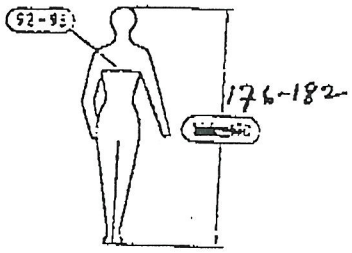
Model no. 54151

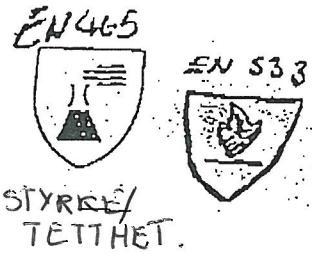
EN 465 EN 533 EN 1149:1

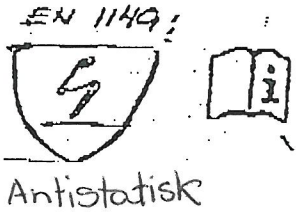
Date of manufacture
21.01.99

Wash with a mild detergent and dry at room temperature.
Preferably hang from a coat rack.

SIZE.







SIZE CHART	HEIGHT	CHEST
X-SMALL	152-164	84-88
SMALL	164-170	88-92
MEDIUM	170-176	92-96
LARGE	176-182	96-100
X-LARGE	182-188	100-104
XX-LARGE	188-194	104-110

The Helly Hansen Spesialprodukter AS CHEM -SUIT is to be used as a protective outer garment .

USER INFORMATION

It has been tested against a number of chemicals in the following group : EN 369,EN467,EN533,EN1149.

PERFORMANCE TABLE

CLASSIFICATION OF PERMEATION RESISTANCE

The CHEM-SUIT can be used in the transportation of hazardous substances and materials.The suit is manufactured in Norway ,it is comfortable to wear even in conditions of extreme cold.It is produced in textured polyester ,Fluo-PVC chemical resistant/flame retardant/ant-static material.Fluorescent effect making the wearer easily visible.

Maintenance/ cleaning : Wash with a mild detergent and dry at room temperature.
Storage : preferably hang from a coat rack.

TYÖTERVEYSLAITOS
FINNISH INSTITUTE OF OCCUPATIONAL HEALTH (FIOH)
Fysiikan osasto, Ilmoitettu laitos nro 0403
Department of Physics, Notified Body No. 0403

Testing of chemical protective clothing

Test item	Chem suit
Type	Chemical protective clothing with spray-tight connections (Type 4 Equipment)
Customer	Helly-Hansen Spesialprodukter AS P.O. Box 218 N-1501 Moss Norway
Applied methods	EN 465: 1995

Helena Mäkinen
Senior Researcher

Samna Raivo
Assistant Researcher

T013 (EN45001)

Fysiikan osasto
Department of Physics
Laajaniityntie 1
FIN-01620 Vantaa
Finland
Puh. 09-47 471
Tel. +358-9-47 471
Internet: www.occuphealth.fi
Fax 09-47 47 805
Fax +358-9-47 47 805
E-mail: firstname.surname@occuphealth.fi

1. Description and identification of test items

Test item	Chem suit
Type	Chemical protective clothing with spray-tight connections between different parts of the clothing (Type 4 Equipment)
Size range	XS-XXL
Description	Material of the product is NX 65 (made by AS Norsk Titanduk), texturized polyester base cloth coated with PVC, 340 g/m²
Manufacturer	Helly-Hansen Spesialprodukter AS

2. Scope of testing

Property	Requirement	Method / Testlab.
Seam strength	EN 465; 5.2	ISO 5082 /FIOH
Resistance to penetration by spray	EN 465; 6.2	EN 468 / ITF

Testing of resistance to penetration by spray was subcontracted from ITF, France 98-01-23. Seam strenth test was carried out at FIOH at 1998-02-06.

3. Sampling and conditioning

Three suits, samples of material and seam construction were supplied by the customer 97-12-22. Test samples were conditioned at least 24 hours in an atmosphere having a temperature of (20 ± 2)°C and a relative humidity of (65 ± 5) %.

4. Test results

4.1 Seam strength

Seam strength was tested according to standard ISO 5082.

Sample	Maximum load [N]
1	367
2	362
3	358
4	364
5	344
Mean	359

4.2 Resistance to penetration by spray (spray test)

Test was carried out according to EN 468 at ITF in France, Test report 980258 page 2/8, Annex 1. Suit passed the test.

5. Summary of the test results

Property	Requirement	Result
Seam strength ISO 5082	EN 465; 5.2	359 N *Class 5*
Resistance to penetration by spray, EN 468	EN 465; 6.2	*Passed*

End of test report no. 98413T01.

Annex 1 of test report 47413701

DETERMINATION DE LA RESISTANCE A LA PENETRATION PAR UN BROUILLARD

(Essai au brouillard) NF EN 468 (Décembre 1994)
Essai appartenant au Pr 123 du COFRAC

Conditions opératoires pour vêtement de type 4

Essais effectués à la demande des Ets : **FIOH**

Référence de l'échantillon : **97413**

Taille du vêtement : M

Nombre de vêtements testés : 3

Date de l'essai : 2/2/98

RESULTATS

ETANCHE

CONFORME

Observations : Sur les trois combinaisons, il y a une légère pénétation au bas du rabat mais d'une dimension inférieure à la tache étalon.

CONFIDENTIAL TEST REPORT

Shirley Testing Services

Ref. No. 08/3873/MGL/SEC/C5

Date: 13 September, 1995

Client: Mr Per Erland Nøkleby
AS Norsk Titanduk
Industriveien 5
N-3080 Holmestrand
Norway

Job Title: **TESTING TO PREN 467, FINAL DRAFT, APRIL 1994 - Measurement of chemical breakthrough time after washing, classification - comments on seam strength testing.**

Client's order or ref. no: -

Date of receipt: 9/3/95

Description of sample(s): Orange NX 65 fabric

Work requested: **Chemical breakthrough times after washing, classification - unleaded petrol, modification of EN 369:1993, not NAMAS - comments on seam strength testing.**

Ref. No. 08/3873/MGL/SEC/C5

Mr Per Erland Nøkleby
AS Norsk Titanduk
Norway

TESTING TO PREN 467, FINAL DRAFT, APRIL 1994 - Measurement of chemical breakthrough time after washing, classification - comments on seam strength testing.

I. Measurement of chemical breakthrough time in accordance with EN 369 : 1993 after washing. (Unleaded petrol - modification of EN 369 : 1993, not NAMAS). Classification in accordance with prEN 467.

The greater the degree of distortion of the specimen through absorption of the test liquid the greater is likely to be the variation between the results from repeat tests.

Introduction

Samples of NX65 fabric supplied by the client were subject to 5 cycles of cleaning according to the manufacturers instructions at 60°C with a normal detergent. The method was BS EN26330 : 1994 at 60°C using ECE reference detergent. After storing at 20±2°C and 65±5% r.h. for 24h samples of the fabric were tested against the chemicals listed below. NX 65 is also distributed under the trademark decontex™ concept.

Chemical	Purity	Source
Hydrochloric acid	10 and 30wt%	36wt%, Aldrich Chemical Co. Ltd.
Acetic acid	10 and 30wt%	99.8wt%, Aldrich
Sodium hydroxide soln in water	10 and 50wt%	97+wt% pellets, Aldrich
Sodium hypochlorite	ca 14wt%	BDH, (Merck Ltd)
Sulphuric acid	10 and 50wt%	98wt%, BDH, (Merck Ltd)
Ethanol	90wt%	99.7%(v/v), Hayman Ltd.
Ammonia soln. in water	ca 35wt%	BDH, (Merck Ltd)
Xylenes (mixed)	≥75wt% + ≤25wt% ethylbenzene	Aldrich
Phenol / NaOH 1:1	40wt% : 40wt%	Phenol: 99.5wt%, BDH, (Merck Ltd). NaOH above
Methyl ethyl ketone, (butanone)	99+wt%	BDH, (Merck Ltd)
Acetone	99+wt%	Aldrich
Unleaded petrol	BS 7070	Texaco Ltd

Ref. No. 08/3873/MGL/SEC/C5

Mr Per Erland Nøkleby
AS Norsk Titanduk
Norway

Experimental

For hydrochloric acid, acetic acid, sulphuric acid, sodium hydroxide, ammonia soln., sodium hypochlorite and phenol / NaOH a closed loop system of fixed volume was used with collection of any permeating chemical by deionised water. The change in conductivity with time was monitored with a conductivity meter attached to a chart recorder.

Ammonia soln. could be analysed because any ammonia which permeated would dissolve in the water according to the following equilibria:

$$NH_3 + H_2O \rightleftharpoons NH_4^+ + OH^-$$

Phenol / NaOH 1 : 1 was analysed on the basis of the formation of sodium phenoxide ions in soln:

$$C_6H_5OH + Na^+ + OH^- \rightarrow C_6H_5O^- + Na^+ + H_2O$$

The breakthrough time to the nearest minute is the time when the permeation rate reaches 1.0µg/cm^2/min. This rate is determined from the slope of the accumulated mass/unit area vs time curve obtained from the chart recorder after using mass vs conductivity calibration curves for each system.

For the other chemicals an open loop system was used with collection of permeating chemical by nitrogen gas. Gas samples were taken and analysed by gas chromatography with flame ionisation detectors. The GC columns, flow rates and temperatures were chosen to enable samples to be taken every 2 - 4 min. for each chemical.

The GC peak area is proportional to the mass of the chemical which is converted to the permeation rate by the following formula:-

$$\text{Permeation rate} = \frac{\text{mass}}{\text{volume of sample}} \times \frac{\text{collection flow rate}}{\text{area of sample}}$$

The breakthrough time is the time when the permeation rate of each chemical reaches 1.0µg/cm^2/min and is determined by plotting the permeation rates against time and then interpolating.

Ref. No. 08/3873/MGL/SEC/C5

Mr Per Erland Nøkleby
AS Norsk Titanduk
Norway

The analysis of xylenes (mixed) was based on calibration with m-xylene alone. (Under the conditions used only one GC peak is seen for all isomers and they should give an equal response on the GC).

The breakthrough time for unleaded petrol was the first appearance of any component of petrol. The permeation rate at 1.0µg/cm^2/min could not be determined since petrol is a complex mixture. However, the GC peak areas increase rapidly and the rate of 1.0µg/cm^2/min is likely to be reached shortly after the first appearance. This constitutes a modification of EN 369 : 1993 and is not NAMAS accredited.

The sensitivity of the systems for each chemical was <1.0µg/cm^2/min. For unleaded petrol it was assumed to be <0.1 µg/cm^2/min for the volatile components. This was based upon past experience with testing hydrocarbons such as hexane and benzene.

The temperature of the tests was kept at 20±1°C, with water baths if necessary, and was monitored with maximum/minimum digital thermometers.

The thickness of the material was not required by the client.

Results

The breakthrough times and classifications in accordance with prEN 467 are given in Table 1. Comments on any signs of visible degradation are given in Table 2.

Ref. No. 08/3873/MGL/SEC/C5

Mr Per Erland Nøkleby
AS Norsk Titanduk
Norway

II. Comments on seam strength testing

According to prEN 467 any garment made from the fabric which contains straight seams joining two pieces of material shall have the seams tested in accordance with Annex A2 of ISO 5082. It should be noted that paragraph 1.2 states that ISO 1421 is the method applicable to fabrics coated with rubber or plastics such as NX65 which has a PVC coating. However, paragraph 1 of ISO 1421 states:

"The method is not suitable for use with products of which the base cloth is of a mesh construction or with knit fabrics"

The base cloth of NX65 is a knitted fabric.

Reported by:..... M G Little

Laboratory Manager:..... Dr S G Graham

Business Manager:..... Dr A J G Sagar
Materials Science

Enquiries concerning the technical content of this report should be addressed to the Laboratory Manager named above.

Terms and conditions applying to the operations of Shirley Testing Service are printed on the back of the cover page of this report

TABLE 1

Chemical	Conc. Wt%	B.T. (min)	Average B.T. (min)	Classification prEN 467
Hydrochloric acid	10	>480, >480, >480	>480	6
	30	>480, >480, >480	>480	6
Acetic acid	10	>480, >480, >480	>480	6
	30	>480, >480, >480	>480	6
Sodium hydroxide	10	>480, >480, >480	>480	6
	50	>480, >480, >480	>480	6
Sodium hypochlorite	ca 14	>480, >480, >480	>480	6
Sulphuric acid	10	>480, >480, >480	>480	6
	50	>480, >480, >480	>480	6
Ethanol	90	6, 6, 6	6	Unclassified
Ammonia soln.	ca 35	6, 8, 6	7	Unclassified
Xylenes (mixed)	≥75	2, 2, 2	2	Unclassified
Phenol / NaOH 1:1	40 : 40	>480, >480, >480	>480	6
Methyl ethyl ketone	99+	2, 2, 2	2	Unclassified
Acetone	99+	2, 2, 2	2	Unclassified
Unleaded petrol #	-	3, 2, 3	3	Unclassified

First Appearance - see Experimental Section

TABLE 2

Chemical	Conc. Wt%	Comments
Hydrochloric acid	10	Degradation
	30	Degradation
Acetic acid	10	No Visible Degradation
	30	No Visible Degradation
Sodium hydroxide	10	No Visible Degradation
	50	No Visible Degradation
Sodium hypochlorite	ca 14	No Visible Degradation
Sulphuric acid	10	No Visible Degradation
	50	No Visible Degradation
Ethanol	90	Slight Degradation
Ammonia soln.	ca 35	No Visible Degradation
Xylenes (mixed)	≥75	Degradation
Phenol / NaOH 1:1	40 : 40	No Visible Degradation
Methyl ethyl ketone	99+	Severe Degradation
Acetone	99+	Severe Degradation
Unleaded petrol	-	Degradation

FIRE TECHNOLOGY SERVICES

Date: 13 February 1996

Client: AS Norsk Titanduk
Industriveien 5
N-3080 Holmestrand
Norway

Job title: Flammability testing of one coated fabric

Client's order or ref no: Fax 22 January 1996

Date of receipt: 23 January 1996

Description of sample(s): One coated fabric
Reference NX65
Fl. Yellow (3013)

Work requested: Flammability testing to prEN 533: 1995

FIRE TECHNOLOGY SERVICES

AS Norsk Titanduk
Industriveien 5
N-3080 Holmestrand
Norway

FLAMMABILITY TESTING OF ONE COATED FABRIC

REFERENCE NX65

1. Method of Test

The fabric submitted was tested for flammability according to EN 532: 1994 using a flame application time of 10 seconds with the test flame applied to the coated face of the fabric. Tests were carried out both in the "as received" state and after 12 cycles of washing according to EN ISO 10528: 1995 using the Standard Washing Procedure: Automatic Machines (Type A) with the wash temperature set at 60°C as specified by the client, followed by tumble drying according to ISO 6330, Procedure E.

The results obtained were assessed against the limited flame spread indices given in the March 1995 version of prEN 533.

Note:

The washing was carried out at BTTG Shirley Testing Services (non-NAMAS accredited test).

2. Summary of Results

2.1 Before washing

Specimen	1↑	2↓	3↑	4→	5←	6→
Flaming to edge	No	No	No	No	No	No
Hole formed	Yes	Yes	Yes	Yes	Yes	Yes
Hole to edge	No	No	No	No	No	No
Flaming or molten debris	No	No	No	No	No	No
Afterglow spreads	No	No	No	No	No	No
Afterflame time, sec	0	0	0	0	0	0
Afterglow time, sec	9	15	11	3	5	5

FIRE TECHNOLOGY SERVICES

AS Norsk Titanduk
Industriveien 5
N-3080 Holmestrand
Norway

2. Summary of Results (continued)

2.2 After washing

Specimen	1↑	2↓	3↑	4→	5←	6→
Flaming to edge	No	No	No	No	No	No
Hole formed	Yes	Yes	Yes	Yes	Yes	Yes
Hole to edge	No	No	No	No	No	No
Flaming or molten debris	No	No	No	No	No	No
Afterglow spreads	No	No	No	No	No	No
Afterflame time, sec	0	0	0	0	0	0
Afterglow time, sec	10	4	2	6	11	2

3. Assessment

This coated fabric, Reference NX65, achieved a Limited Flame Spread Index 1 of prEN 533: 1995 both before and after 12 cycles of washing according to the Standard Washing Procedure: Automatic Machines (Type A) of EN ISO 10528: 1995 using a wash temperature of 60°C i.e. Durability Index 12X60 as defined in prEN 533: 1995.

Reported by..... P M Eaton .....

Laboratory Manager..... P M Eaton .....

Notified Body for PPE Testing & Certification I.D. No. 0339

NAMAS TESTING No 1066

CONFIDENTIAL REPORT
07/2256/PH/SAM/C2 Page 1 of 2

Mr P.E. Nøkleby
AS Norsk Titanduk
Industriveien5
N-3080 Holmestrand
Norway

8 August, 1995

EN 1149:1 Surface Resistivity Tests On Fabric Ref. NX 65

The sample rests on an insulating base plate and a pair of type A concentric electrodes are placed on the surface of the sample. The electrical resistance across the annular strip of fabric between the electrodes is determined by using a 20 million megohmmeter under an applied potential of 100 V d.c.

Measurements are made on both sides of five specimens taken from different locations on the fabric sample. The mean values are recorded.

The surface resistivity is obtained by multiplying the measured resistance by a factor of 19.8, which is a function of the radii of the electrodes.

The sample is conditioned for at least 24 hours at 23 ± 1°C and 25 ± 2% relative humidity before testing is done under the same conditions.

Results

Fabric	Side Tested	Surface Resistivity, Ω
NX 65	Yellow	1.1×10^{10}
		8.9×10^{9}
		9.5×10^{9}
		9.5×10^{9}
		9.9×10^{9}
		Mean 9.8×10^{9}
	White	1.1×10^{12}
		1.1×10^{12}
		8.7×10^{11}
		8.9×10^{11}
		1.1×10^{12}
		Mean 1.0×10^{12}

CONFIDENTIAL REPORT
07/2256/PH/SAM/C2

Mr P.E. Nøkleby
AS Norsk Titanduk

Discussion

The performance requirement specified in EN 1149:1 is that at least one surface of a coated fabric shall have a resistivity less than $5.0 \times 10^{10}\Omega$. The resistivity measured on the yellow coated surface of this sample is below this maximum limit. NX 65, therefore, meets the requirements of EN 1149:1.

Reported by:.....P HOLDSTOCK

Laboratory Manager:.....P HOLDSTOCK.....

Business Manager:.....B C BURDETT
TEXTILE SCIENCE

Enquiries concerning the technical content of this report should be addressed to the Laboratory Manager named above.

Terms and conditions applying to the operations of Shirley Testing Service are printed on the back of the cover page of this report

CONFIDENTIAL TEST REPORT

Ref. No. 16/4214/AGB/C4

Date: 3rd August 1995

Client: Mr Erland Nakleby
Norsk Titanduk
Industriveien 5
Holmestrand
Norway
N-3080

Job Title: Tests to prEN 467 final draft

Client's order or ref. no:

Date of receipt: 19th June 1995 (via our Mr G Little)

Description of sample(s):

Orange coated fabric with lightweight knitted base fabric, referred to as NX65 Washed.

Work requested:

prEN 467 Final Draft tests to determine:

Abrasion resistance
Stability to Heat (Blocking Resistance)
Flex Cracking Resistance
Puncture Resistance
Tear Resistance
Coating Adhesion Strength

Ref. No. 16/4214/AGB/C4

Norsk Titanduk
Norway

3rd August 1995

Lab Work

The various parameters were tested using the procedures called for in prEN 467 Final Draft, i.e.

Abrasion Resistance

The prEN 530 procedure (Method 1) was followed, using a Martindale Abrasion Tester and 00 abrasive paper (BS871: 1981).

The 12kPa head pressure condition was used; the specimens were abraded on the coated face, with the end point being the stage when the base fabric was exposed by removal of the coating.

Stability to Heat ISO5978: 1990

Flex Cracking Resistance ISO7854: 1984 Method B using a Schildknecht machine.

Puncture Resistance DIN4841: 1 (Not NAMAS Accredited)

Tear Resistance ISO4674: 1977: Method A1

Coating Adhesion ISO2411: 1991 procedure was used.

Where relevant, the tests were made in an atmosphere of 65 ± 2% RH at 20 ± 2°C, the specimens at the appropriate stage having been exposed to that atmosphere for at least 24 hours prior to testing.

Results

The results obtained are shown in the table below, together with the classifications for the values as given in prEN 467 Final Draft.

Ref. No. 16/4214/AGB/C4

Norsk Titanduk
Norway

3rd August 1995

PARAMETER	RESULT	CLASSIFICATION
Abrasion Resistance (cycles)	1750	5
Stability to Heating		
Fabric to Fabric	No blocking	2
Fabric to Coating	No blocking	2
Coating to Coating	Slight blocking	1
Flex Cracking Resistance	>300000*	5
Puncture Resistance (N)	28	2
Tear Strength (N)		
Across wales of substrate	54	3
Across courses of substrate	76	3
Coating Adhesion Strength (N)		
Peel in wale direction	53	1
Peel in course direction	53	Below minimum classification of >50N.

This test was terminated at value shown since level had been reached which complied with the highest classification given for that test.

Reported by:.....A G BARNES

Laboratory Manager:.....A G BARNES

Business Manager:.....DR D I COOK
TECHNICAL SERVICES

Enquiries concerning the technical content of this report should be addressed to the Laboratory Manager named above.

Terms and conditions applying to the operations of Shirley Testing Service are printed on the back of the cover page of this report.

CONFIDENTIAL
TEST REPORT

SHIRLEY
TESTING SERVICES

BTTG

Date: 22 September, 1998

Our Ref : 08/7083/MGL/SEC
Your Ref : -

Client:

Mr Per Erland Nøkleby
AS Norsk Titanduk
Industriveien 5
N-3080 Holmestrand
Norway

Job Title: Measurement Of Chemical Breakthrough Times

Client's order no: -

Description of sample(s): Green NX 28 Fabric

Work requested: BS EN 369 : 1993 Tests.
Modified BS EN 369 : 1993 Tests (not UKAS accredited)

NAMAS TESTING No. 0435

Date: 22 September, 1998

Our Ref : 08/7083/MGL/SEC
Your Ref : -

AS Norsk Titanduk

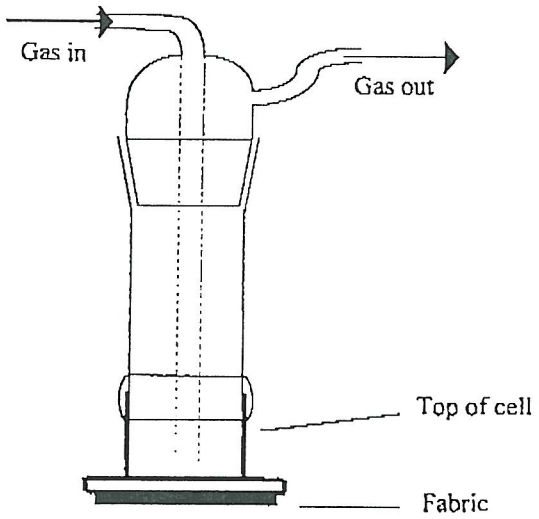
Measurement Of Chemical Breakthrough Times

Test Methods:	BS EN 369 : 1993 Modified BS EN 369 : 1993 (not UKAS accredited)
Test Material:	Green NX28 Fabric
Test Temperature:	20±1°C
Thickness of samples:	Not required
Pre-treatments / Pre-conditioning:	Conditioned at 20±2°C and 65±5° % r.h. for ≥24 hours

Tests marked "Not UKAS Accredited" in this Report/Certificate are not included in the UKAS Accreditation Schedule for our laboratory.

The greater the degree of distortion of the specimen through absorption of the test liquid the greater is likely to be the variation between the results from repeat tests.

Carbon disulphide was tested using a closed-loop gaseous system which is a non-UKAS modification of BS EN 369 : 1993. Ammonia and hydrogen chloride gases were tested using a modification of the test cell (see analytical procedures and diagram below), which is a non-UKAS modification of BS EN 369 : 1993.



Modified BS EN 369 :1993 Permeation Test Cell For Gases

Date: 22 September, 1998

Our Ref : 08/7083/MGL/SEC
Your Ref : -

AS Norsk Titanduk

Chemical	Analytical Procedure	Sensitivity
Acetic acid, nitric acid, ammonia solution, sulphuric acid, dichlorprop, glyphosate	Closed-loop deionized water collection system, flow rate 200ml/min. Continuous analysis by electrical conductivity.	< 1.0µg/cm²/min
Methanol, m-cresol, dimethylformamide, aniline, diethylamine, dichloromethane, chlorobenzene, methyl acetate, tetrahydrofuran, n-hexane, benzene, acetonitrile, nitromethane, nitrobenzene	Open-loop nitrogen gas collection system, flow rate 500ml/min. Discrete samples analysed by gas chromatography with flame ionization detector.	< 1.0µg/cm²/min
Diazinon	Closed-loop deionized water collection system, flow rate 200ml/min. Discrete samples analysed by gas chromatography with flame ionization detector.	< 1.0µg/cm²/min
Carbon disulphide	Modified BS EN 369: Closed-loop air collection system, flow rate > 500ml/min. Continuous analysis by infra-red gas analyser. Non-UKAS method	< 1.0µg/cm²/min
Ammonia gas, hydrogen chloride gas	Modified BS EN 369: Modified test cell used, see diagram. Test gas flushed through at ca 50ml/min for 5 min. and very slowly thereafter. Closed-loop deionized water collection system, flow rate 200ml/min. Continuous analysis by electrical conductivity. Non-UKAS method	< 1.0µg/cm²/min
Precision:	Acetone / Standard neoprene (0.41mm): Average Breakthrough Time = 12, s.d.= 1	
Source of chemicals:	Aldrich Chemical Co. Ltd., Prolabo, BDH (Merck) Ltd, Fisher Scientific UK Ltd.	

The tables include previous results on NX28 (our report ref: 08/2834/MGL/MJ/C3 - non UKAS)

Date: 22 September, 1998

Our Ref : 08/7083/MGL/SEC
Your Ref : -

AS Norsk Titanduk

ACIDS

Chemical Class	Chemical	Conc. (wt%)	Our Ref.	Breakthrough Time, B.T. (min)	Mean B.T. (min)	Physical Changes
Carboxylic acid (organic)	Acetic acid	10	08/2834	>480, >480, >480	>480	-
		50	08/2834	>480, >480, >480	>480	-
		99.9	08/7083	9, 5, 5	6	Slight degradation
Inorganic acid	Hydrochloric acid	10	08/2834	>480, >480, >480	>480	Degradation
		30	08/2834	>480, >480, >480	>480	Degradation
Inorganic acid gas	Hydrogen chloride GAS (1 atmosphere pressure)	99.9	08/7083	33, 25, 23	27	Degradation, discolouring
Oxidising Inorganic acid	Nitric acid	35	08/7083	>480, >480, >480	>480	Degradation
		70 (conc)	08/7083	30, 29, 33	31	Degradation
Inorganic acid	Sulphuric acid	10	08/2834	>480, >480, >480	>480	-
		50	08/2834	>480, >480, >480	>480	-
		98 (conc)	08/7083	13, 15, 15	14	Severe degradation, discolouring

BASES

Chemical Class	Chemical	Conc. (wt%)	Our Ref.	Breakthrough Time, B.T. (min)	Mean B.T. (min)	Physical Changes
Inorganic basic gas	Ammonia GAS (1 atmosphere pressure)	99.99+	08/7083	5, 2, 4	4	Slight degradation
Inorganic basic gas solution	Ammonia soln.	10	08/7083	20, 15, 27	21	-
		35	08/2834	8, 6, 8	7	-
Organic amine (aliphatic)	Diethylamine	99.5	08/7083	1, 2, 2	2	Degradation, discolouring, hardening
Inorganic base	Sodium hydroxide	10	08/2834	>480, >480, >480	>480	-
		50	08/2834	>480, >480, >480	>480	-
Inorganic / Organic base	Sodium hydroxide / Phenol	40 : 40	08/2834	>480, >480, >480	>480	-

Date: 22 September, 1998

Our Ref: 08/7083/MGL/SEC
Your Ref: -

AS Norsk Titanduk

SOLVENTS & OTHER ORGANICS

Chemical Class	Chemical	Conc. (wt%)	Our Ref.	Breakthrough Time, B.T. (min)	Mean B.T. (min)	Physical Changes
Amide	Dimethylformamide	99.9+	08/7083	4, 5, 4	4	Severe degradation
Amine (aromatic)	Aniline	99	08/7083	7, 6, 6	6	Degradation Hardening
Chlorinated Hydrocarbon (aliphatic)	Dichloromethane	99.6	08/7083	2, 2, 1	2	Degradation Hardening
Chlorinated Hydrocarbon (aromatic)	Chlorobenzene	99	08/7083	2, 2, 2	2	Degradation Hardening
Ester	Methyl acetate	99	08/7083	1, 2, 2	2	Degradation Hardening
Ether	Tetrahydrofuran	99+	08/7083	1, 1, 1	1	Degradation Hardening
Hydrocarbon (aliphatic)	n-Hexane	99+	08/7083	3, 2, 3	3	Degradation Hardening
Hydrocarbon (aromatic)	Benzene	99+	08/7083	2, 2, 2	2	Degradation Hardening
Hydrocarbon (aromatic)	Xylenes - mixed (+ethylbenzene)	80 (20)	08/2834	4, 6, 4	5	Degradation Hardening
Hydrocarbon (mainly) mixture	Unleaded petrol	-	08/2834	4, 4, 6	5	Degradation Hardening
Ketone	Acetone	99+	08/2834	2, 4, 2	3	Severe degradation Hardening
Ketone	Methyl ethyl ketone	99+	08/2834	2, 2, 2	2	Severe degradation Hardening
Nitrile	Acetonitrile	99.9+	08/7083	2, 2, 4	3	Degradation Hardening
Nitro-hydrocarbon (aliphatic)	Nitromethane	95	08/7083	3, 2, 4	3	Degradation
Nitro-hydrocarbon (aromatic)	Nitrobenzene	99+	08/7083	8, 9, 7	8	Degradation Hardening

Date: 22 September, 1998

Our Ref: 08/7083/MGL/SEC
Your Ref: -

AS Norsk Titanduk

ALCOHOLS

Chemical Class	Chemical	Conc. (wt%)	Our Ref.	Breakthrough Time, B.T. (min)	Mean B.T. (min)	Physical Changes
Aliphatic	Methanol	99+	08/7083	6, 4, 5	5	Slight degradation
Aliphatic	Ethanol	90	08/2834	2, 2, 2	2	Degradation
Aromatic	m-Cresol	97	08/7083	6, 7, 8	7	Degradation

INORGANICS

Chemical Class	Chemical	Conc. (wt%)	Our Ref.	Breakthrough Time, B.T. (min)	Mean B.T. (min)	Physical Changes
Sulphur compound	Carbon disulphide	99.9+	08/7083	3, 4, 4	4	Slight degradation
Hypochlorite (Bleach)	Sodium hypochlorite solution	ca 14 (avail Cl_2)	08/2834	>480, >480, >480	>480	-

PESTICIDES

Chemical Class	Chemical (Trade Name)	Conc. (wt%)	Our Ref.	Breakthrough Time, B.T. (min)	Mean B.T. (min)	Physical Changes
Herbicide	Dichlorprop (Herbamix DPD 667)	Saturated solution	08/7083	>480, >480, >480	>480	-
Herbicide	Glyphosate (Round-Up)	Saturated solution	08/7083	>480, >480, >480	>480	-
Insecticide (Sheep Dip)	Diazinon (Diazadip)	60	08/7083	>480, >480, >480	>480	-

Reported by: ..... M G Little

Laboratory Manager: ..... Dr S G Graham

Business Manager: ..... Dr A J G Sagar
Materials Science

Enquiries concerning the technical content of this report should be addressed to the Laboratory Manager named above.
Terms and conditions applying to the operations of Shirley Testing Service are printed on the back of the cover page of this report.

TOTAL SIDER11