THE WATER QUALITY CENTRE | (Materials Testing)

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WATER REGULATIONS ADVISORY SCHEME (WRAS).

TESTING OF NON-METALLIC MATERIALS FOR USE WITH DRINKING WATER (BS 6920 : 2000)

TEST REPORT

Product : Dryflex I/II
Report Reference : M 104285

Drytech Italia s.r.l.
Via Ravona, 1h
22020 San Fermo della Battaglia (CO)
ITALY

Report Date : 21st July 2008

Executive Summary - this product has met the requirements of the Water Regulations Advisory Scheme (WRAS) Tests of Effect on Water Quality/BS 6920:2000 /Cold Water Use.

NOTES.
1. The results given in this report relate only to the items tested, and not necessarily to the bulk from which they were taken.
2. This test work was undertaken in the UKAS accredited Spencer House laboratory of Thames Water Utilities Ltd., UKAS registration number 0677, unless otherwise stated.
3. Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.
4. This test report shall not be reproduced, except in full, without our prior written approval.

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   (iv)The liability of WQC, if any, shall be limited to the sum of the Contract Price plus 25% thereof.
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11. **Jurisdiction.** This Agreement shall be interpreted in accordance with the Laws of England and Wales and any dispute arising under it shall be submitted to the non- exclusive jurisdiction of the courts in England and Wales.

30th September 2003

TESTING OF NON-METALLIC MATERIALS FOR USE WITH DRINKING WATER. WATER REGULATIONS ADVISORY SCHEME TESTS OF EFFECT ON WATER QUALITY (BS 6920:2000).

0. INTRODUCTION.

The samples of the product referred to in this report have been tested in accordance with the methods of the Water Regulations Advisory Scheme (WRAS) Tests of Effect on Water Quality/BS 6920-2:2000 "Suitability of non-metallic products for use in contact with water intended for human consumption with regard to their effect on the quality of the water : Methods of Test".

1. TEST SAMPLES.

General composition of product	**Gel Sealant**
Trade name/designation	**Dryflex I/II**
Material manufacturer	Dryflex Italia
Samples prepared by	WQC Staff
Date of manufacture/production	January 2008
Production batch numbers	LQ12A1214
Submitting organisation	Drytech Italia s.r.l.
Date of receipt of test samples	7th May 2008
Method of packaging	In product container
Condition on receipt	Satisfactory
Laboratory storage before test	Ambient temperature (21±4)°C

Description	test article	Moulded piece
	shape	Rectangular
	dimensions	20mm X 10mm X 10mm
Appearance of article	colour	Straw
	surface finish	Glossy
	opacity	Opaque
Surface area of one article (mm^2)		1000
Number of articles to give a surface area of 1000mm^2		1
Calibration mark of the test vessel/container in litres		1
Extraction temperature used for tests 2, 3, 5 & 6		(23±2)°C

1.1 SITE APPLIED PRODUCTS.

Typical uses of the product	Not supplied
Batch numbers of materials used	LQ012A1214
Appearance of product/component parts before mixing	Solution A (ACC/Dryflex): Straw Solution B (APS/Water) : Clear
How cure conditions will be achieved on site	
Method of test sample preparation	12g Accelerator + 600g Dryflex I/II and 12g APS + 500ml water were prepared and 100ml volumes of each were hand-mixed together and poured into a plastic mould. After the gel had set (approximately three minutes) and cooled (approximately 15 minutes) it was cut into 1000mm^2 sections and curing commenced.
Mix ratio (mass : mass)	1:1 Solution:Solvent
Number of coats used	1
Coat 1 = Curing (time and temperature)	7 days at (7±2)°C
Location of sample preparation	Spencer House Laboratories
Total curing (time and temperature)	7days at (7±2)°C

2. ODOUR & FLAVOUR OF WATER TEST.

Temperature of extraction : (23±2)°C

Date test started :27.05.08 .

The extracts detailed below were compared with the procedural blank test waters by a panel of 3 testers. The following results were obtained for the test extracts.

Extract	Test water	Test	Descriptors	Threshold dilutions
First	Chlorine free	Odour	Not Tested -	[redacted]
		Flavour	See Note to WRAS	
	Chlorinated	Odour	Not Tested	[redacted]
		Flavour	See Note to WRAS	
Final	Chlorine free	Odour	None	[redacted]
		Flavour	None	<1
	Chlorinated	Odour	None	[redacted]
		Flavour	None	<1

COMMENT. On the basis of these results the samples of this product have been found ***to conform*** with the requirements of BS 6920-1 : Clause 4 when extracted at 23°C.

3. APPEARANCE OF WATER.

Temperature of extraction : (23±2)°C

Date test started : 27.05.08.

	Colour (Hazen Units)*		**Turbidity** (Formazine Nephelometric Units)*	
	First Extract	*Final Extract*	*First Extract*	*Final Extract*
Test sample extract	**<0.6**	--	**<0.09**	--
Reagent blank	<0.6	--	<0.09	--
Test sample effect	***<0.6***	--	***<0.09***	--

[* - method code 321]

COMMENT. On the basis of these results the sample of this product has been found ***to conform*** with the requirements of BS extracted at 23°C.

4. GROWTH OF AQUATIC MICROORGANISMS.

Temperature of test : (30±2)°C

Date test started :27.05.08 .

Container	Mean Dissolved Oxygen Difference (MDOD) in mg/L
Test product (weeks 5 to 7)	**0.4**
Negative reference (glass) (weeks 5 to 7)	0.2
Positive reference (wax) (weeks 5 to 7)	7.5
Special positive reference	n/a
Negative control - Mean dissolved oxygen concentration (weeks 5 to 7)	7.3

COMMENT. On the basis of these results the sample of this product has been found ***to conform*** with the requirements of BS 6920-1 : Clause 6.

At the end of this test the test pieces showed no changes in colour and appearance.

5. THE EXTRACTION OF SUBSTANCES THAT MAY BE OF CONCERN TO PUBLIC HEALTH.

Temperature of extraction :(23±2)°C

Date test started : 27.05.08.

The extracts from the product and the blank were used to prepare culture media for use with a monkey kidney cell line (VERO ATCC CCL 81) - [method code 256].

Attribute	**Test sample extract**	Reagent blank	Zinc sulfate solution
Cell morphology (Microscopy)	**Satisfactory**	Satisfactory	Cell death
Culture medium (colour)	Normal	Normal	Abnormal (alkaline)
Monolayer confluence (approx %)	**100%**	100%	0%

COMMENT. On the basis of these test results the extract of this product has been found to give a non-cytotoxic response, and therefore it has been found ***to conform*** with the requirements of BS 6920-1 : Clause 7 when extracted at 23°C.

6. EXTRACTION OF METALS.

Temperature of extraction :(23±2)°C

Date test started : 27.05.08.

The results obtained for the first extract are given below -

Element		Unit	MAC	Reporting limit	Sample 1	Sample 2	Reagent blank
Aluminium	Al	µg/L	200	6.5	<6.5	<6.5	<6.5
Antimony	Sb	µg/L	5	0.2	<0.2	<0.2	<0.2
Arsenic	As	µg/L	10	0.3	0.3	0.3	<0.3
Barium	Ba	µg/L	1000	1.3	<1.3	<1.3	<1.3
Cadmium	Cd	µg/L	5	0.2	<0.2	<0.2	<0.2
Chromium	Cr	µg/L	50	1.4	<1.4	<1.4	<1.4
Iron	Fe	µg/L	200	1.0	3.9	2.4	<1.0
Lead	Pb	µg/L	25	0.3	<0.3	<0.3	<0.3
Manganese	Mn	µg/L	50	1.5	<1.5	<1.5	<1.5
Mercury	Hg	µg/L	1	0.12	<0.12	<0.12	<0.12
Nickel	Ni	µg/L	20	1.6	<1.6	<1.5	<1.6
Selenium	Se	µg/L	10	0.8	<0.8	<0.8	<0.8

Extract Analytical.

The metal elements are currently pending UKAS accreditation.

Aluminium, antimony, arsenic, barium, cadmium, chromium, iron, lead, manganese, mercury, nickel, and selenium - inductively coupled plasma mass spectrometry or inductively coupled plasma optical emission spectrometry [method code 563].

Analytical Control Data - this technique is in continuous use for analysis of drinking water metals; this technique is fully validated to the requirements of "A Manual on Analytical Quality Control for the Water Industry" (NS 30) and the requirements laid down by the Drinking Water Inspectorate. The technique has a comprehensive AQC protocol including control solutions and spike recovery testing with each batch of samples for analysis; full details available upon request.

COMMENT. On the basis of these results the samples of this product have been found ***to conform*** with the requirements of BS 6920-1 : Clause 8 when extracted at 23°C.

CONCLUSIONS.

The samples of this product meet the test criteria of BS 6920-1:2000 ("Specification") and thus DO conform with the requirements of the Water Regulations Advisory Scheme (WRAS) Tests of Effect on Water Quality, and is suitable for use with cold but not hot water.

NOTE : materials and products intended for use by a public water supply company in the preparation or conveyance of water may need to satisfy more comprehensive toxicological requirements as specified by the Drinking Water Inspectorate. These additional requirements are necessary to ensure water company usage complies with Regulation 31 of the Water Supply (Water Quality) Regulations 2000.

NOTES -
1. The results specified in this report relate only to the sample(s) submitted for testing. Any changes in the nature or source of ingredients and the process of manufacture or application could affect the suitability of this product for use in contact with drinking water.
2. We would draw to your attention that reports issued by the accredited test laboratories do not of themselves constitute approval by the Water Regulations Advisory Scheme (WRAS) or the test laboratory. Only a letter from the Scheme, citing a Directory Reference Number, can be regarded as indicating approval.

Note for the Water Regulations Advisory Scheme (WRAS) : The first extract in the Odour and Flavour of Water Test is not assessed until a satisfactory test result has been obtained in the Cytotoxicity Test.

Helen Bala
Materials Testing Manager

WATER REGULATIONS ADVISORY SCHEME (WRAS) TESTS OF EFFECT ON WATER QUALITY : TEST CRITERIA (BS 6920:2000).

The following test criteria are used to determine whether your product(s) complies with the requirements of the Water Regulations Advisory Scheme (WRAS) Tests of Effect on Water Quality.

1. ODOUR & FLAVOUR OF WATER. (BS 6920-1 : Clause 4)
Off-odours and off-flavours of water are the most usual causes of customer complaints about water quality. On test the material is exposed, under controlled conditions (surface area to volume (S/V) test ratio, duration, temperature) to the test water (with and without free-chlorine); it is subsequently diluted twice on a 1 to 1 basis and assessed by a test panel.

The test sample leachates must be free from odour and, after dilution, free from flavour in the first 1:1 dilutions of them. If, after 7 sequential leaching periods, any odour is detected in the sample leachates or any flavour detected in the first dilution of these leachates by any of the three panellists, then the product fails to meet this test criterion *unless* two further sets of test samples are assessed and no odour is reported in the leachates and no flavour is reported in the first dilutions of the final (i.e. seventh) leachates from these additional test samples.
Materials meeting these test criteria do not usually give rise to off-odours and off-flavours in-service.

2. APPEARANCE OF WATER. (BS 6920-1 : Clause 5)
Any increase in the colour and turbidity of the final (i.e. seventh) leachate from the sample of the product must be less than 5 Hazen units and 0.5 FNU respectively. If any colour or turbidity is detected in the final extract, then the product fails to meet the test criteria *unless* two further samples are tested and the mean of the colour and turbidity measurements of the final extracts of *all* of the samples meet the test criteria.
Materials meeting these test criteria do not usually give rise to in-service changes in the appearance of water.

3. GROWTH OF AQUATIC MICROORGANISMS. (BS 6920-1 : Clause 6)
The original methods were based on microbiological counting techniques and the test took a longer time period and cost considerably more (in real terms) than the present test. In an attempt to improve the performance of the test, including duration, other techniques were evaluated for assessing materials for the supports of biofilms and overall growth in water. Work using dissolved oxygen depletion measurements as a surrogate measure of microbial growth in water showed improved reproducibility and repeatability compared with bacterial counts. The mean dissolved oxygen difference (MDOD) value obtained for the product is a surrogate measure of its ability to support the growth of microorganisms - as the growth of the organisms increases oxygen is removed from the test system; thus the greater the loss of dissolved oxygen caused by the product, the greater the MDOD value. This work was subsequently published (Colbourne and Brown, 1979) and incorporated into BS 6920 : Section 2.4:1988.

The mean dissolved oxygen difference between the water in contact with the sample of the product and the negative control system must be less than 2.4 mg/l; two further test samples of products giving a value in the range 1.7 to 2.9 mg/L are tested and the mean of the three readings used to show conformity with the test requirement s(<2.4 mg/l).
The pass/fail criterion was set after consideration of results obtained from materials using microbial counts and evaluation of materials associated with biofilm development and/or microbial deterioration in water quality in-service.

4. THE EXTRACTION OF SUBSTANCES.... (CYTOTOXICITY TEST) (BS 6920-1 : Clause 7)
If the first aqueous extract from the sample of the product is free from toxicity to the test cell line, it can be regarded as suitable for use in contact with potable water in relation to this particular test. If any toxicity is detected in this extract, then the product fails to meet the test criteria *unless* two further samples are tested and found to be free from any toxic response.
A failure in this test is indicative only of a possible public health issue and NOT necessarily of a real concern.

5. THE EXTRACTION OF METALS. (BS 6920-1 : Clause 8)
Any metal present in the final duplicate extracts obtained from the samples of the product must be at levels less than Maximum Admissible Levels (MACs) based on both the first and subsequent EU Drinking Water Directives. If the MACs of any metal is exceeded in either of the final extracts from the samples of the product then the product fails to meet this test criterion *unless* three further samples of the product are tested and the levels of the specified metals in the extracts from all of these additional samples do not exceed the MACs.
Materials meeting these test criteria do not usually give rise to significant in-service changes in the concentrations of metals in water.

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