Our Ref: HL/M5589

9th September 2008

Dexine Rubber Co. Ltd.
Jape 2 Business Centre,
Rochdale,
OL12 6BZ

Dear Sir

WATER REGULATIONS ADVISORY SCHEME
"ITEMS WHICH HAVE PASSED FULL TESTS OF EFFECT ON WATER QUALITY - BS 6920"

We refer to your application for the material(s) described below to be approved arising from the results of the tests of effect on water quality that have been carried out on the product(s) so described, it has been decided that there is no objection to its/their use provided the source, nature and manufacturing processes of the ingredients and products are not changed. (See notes overleaf).

ETHYLENE PROPYLENE DIENE MONOMER (EPDM) - MATERIAL ONLY **5365**

Dexine E6392 (shore hardness 80) and Dexine E6029 (shore hardness 70). Black coloured, EPDM sheet material. Tested in-radius size of 1mm. For use with cold water only.

Test Report: M104231C & M104231E

0808510 **DEXINE RUBBER CO. LTD.**

An entry, as above, will accordingly be included in the Water Fittings Directory on-line, Part Two, under the section headed, "Materials which have passed full tests of effect on water quality".

Your attention is drawn to the statement overleaf. Manufacturers or applicants may only quote in their sales literature terms which are used in this letter, namely that the product as listed, having passed the tests of effect on water quality, is suitable for use in contact with potable water and that a reference to the product will be included in the Materials section, Part Two, of the Water Fittings Directory on-line: this may be abbreviated to "Water Regulations Advisory Scheme - Approved Material" or "WRAS - Approved Material". **Approval of this product does not signify the approval of its mechanical or physical properties for any use.**

The Technical Committee of the Scheme reserves the right to review approval. This product automatically becomes due for audit reassessment in August 2013.

Yours faithfully

Hannah Lewis
Materials Approval
Water Regulations Advisory Scheme

WRc-NSF

INVOICE

Dexine Rubber Company Ltd
Jape 2 Business Centre
Rochdale
OL12 6BZ

INVOICE No: **NSF714346**
TAX DATE: **10/09/2008**

Terms	Payment Due	Project	Customer no	Your Ref
30 Days	10/10/2008	900820699	00003575	

	Vat Rate	Amount
WRAS Approval of Dexine E6029 & E6392		
Test Ref : M104231C & M104231E		
M5589		
Cheque No 012611 received with thanks.		
	17.50 %	£325.00

PAID
10 SEP 2008

Sub-Total	**£325.00**
VAT Total	**£56.88**
Total	**£381.88**

Please make cheques payable to WRc-NSF Ltd (quoting invoice number) and remit to:

Finance Dept, WRc-NSF Ltd
Frankland Road, Blagrove,
Swindon, Wiltshire, SN5 8YF
England

All queries to be referred to Julie Stock

Client VAT Reg No:

VAT Reg No GB 527 1804 53

M5589.

Your Ref:

Our Ref:

Date:

WRAS
Water Regulations Advisory Scheme

Form M2

Dear Sir

APPLICATION FOR THE TESTING AND LISTING OF A MATERIAL

THIS APPLICATION FORM TO BE SUBMITTED TO THE SCHEME WITH A BS6920 (OR EQUIVALENT) TEST REPORT

1. DETAILS OF MATERIAL - GENERAL

1.1	Heading under which material is required to be included in the Materials Directory. (See page 4)	5365
1.2	Trade name of material for inclusion in the Materials Directory.	DEXINE
1.3	Material identification code.	E6392
1.4	General nature of material.	EPDM SHEET 80 HARD
1.5	Purpose for which the material/ component is designed.	SEALS
1.6	Method of application (where applicable)	N/A
1.7	Suitable surfaces onto which the material can be applied (where applicable)	N/A

2. DETAILS OF MATERIAL - PARTICULAR

2.1	Will the material be applied by the user or his contractor (e.g. paints, coatings, jointing compounds, etc.) or	~~YES~~ / NO
2.2	Will it be supplied solely as a manufactured article?	YES / ~~NO~~
2.3	If the answer to 2.1 is YES, it will be necessary for the testing laboratory to apply the material under conditions specified by the manufacturer before the tests of effect on water quality may commence.	

2.4	List of ingredients and chemical formulae if known. This information may be submitted separately, in confidence if necessary, to the testing laboratory only, or for submission to the Scientific Adviser only.	EPDM RUBBER CARBON BLACK PROCESS OIL ZINC OXIDE CURE SYSTEM
2.5	Proposed use: state whether the material is for cold, hot, or hot and cold water use. A material not 'hot' tested will be listed as for cold water use only.	COLD
2.6	Supply product literature stating application procedures and curing times where applicable.	N/A
3.	<u>Toxicity</u>	
3.1	Has the material or any ingredient used in it been submitted to any organisation for toxicological evaluation?	YES / ~~NO~~
3.2	If YES, please submit details of the tests together with copies of the results obtained.	ATTACHED
4.	<u>Extraction Tests</u>	
4.1	Has the material been subject to any extractability tests for the leaching of any ingredients into water (e.g. monomers, solvents, antioxidants etc.)?	YES / ~~NO~~
5.	<u>Biodeterioration</u>	
5.1	Has the material been submitted to any organisation for biodegradation or biodeterioration tests?	~~YES~~ / NO
5.2	If YES, please submit details of the tests together with copies of the results obtained.	
6.	<u>Biocides</u>	
6.1	Does the material contain a known biocide?	~~YES~~ / NO
6.2	If YES, please submit details of the ingredient including chemical composition and supplier.	

7. Recycled Ingredients/Materials

7.1 Does this material/product contain any recycled ingredients/materials YES/NO

7.2 If yes, give the following details, which will be held on file by the Scheme -

- sources of the recycled ingredients
- evidence to demonstrate full traceability of the recycled material, including the product formulation of the recycled material.
- any treatment given to them before re-use.
- outline of any analytical quality checks undertaken.
- details of any quality systems covering these materials.

8. Name and Address of Applicant:- (as it appears in the telephone directory).
Unless otherwise stated, the applicants name will appear in the Directory.

DEXINE RUBBER CO LTD
JAPE 2 BUSINESS CENTRE
ROCHDALE
OL12 6BZ

9. Name and address of the manufacturer of the material if different from the applicant.

N/A

10. I have read and I accept the instructions, conditions and fees as set out on Form M1

Declaration: I have attached all relevant laboratory test reports (pass/fail) which are applicable to this material/component.

dated 20/8/08 T/R M 104231C

Signed:  LMCLAWRENCE

(Signature) (Block Capitals)

Status: TECHNICAL MANAGER

Date: 21/9/08

Note 1. If insufficient space is available on this form, attach separate sheets.

Note 2. If a manufacturer wishes to consult one of the test laboratories to seek their advice on the formulation and development of a satisfactory product, further information on manufacturing processes may be required.

Note 3. Any queries that may arise from Section 1 of this form ("Details of Material - General") should be directed to the WRAS at Oakdale. Queries arising from questions 2 to 6 ("Details of Material - Particular") should be directed to the laboratory which will be carrying out the test.

WATER REGULATIONS ADVISORY SCHEME (WRAS).

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

TEST REPORT

Product : E6392/3
Report Reference : M 104231C

0808510.

Dexine Rubber Co Ltd
Jape 2 Business Centre
Rochdale
Lancashire
OL12 6BZ

Report Date : 20th August 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.

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	**EPDM**
Trade name/designation	**E6392/3**
Material manufacturer	Dexine Rubber Co. Ltd
Shore Hardness	80°Sh
Date of manufacture/production	January 2008
Production batch numbers	Lab batches
Submitting organisation	Dexine Rubber Co. Ltd
Date of receipt of test samples	3rd March 2008
Method of packaging	In paper wrapping
Condition on receipt	Satisfactory
Laboratory storage before test	Ambient temperature (21±4)°C

Description	test article	Cut sheet
	shape	Rectangular
	dimensions	120mm X 60mm X 2mm
Appearance of article	colour	Black
	surface finish	Matt
	opacity	Opaque
Surface area of one article (mm^2)		15120
Number of articles to give a surface area of 15000mm^2		1
Calibration mark of the test vessel/container in litres		1
Extraction temperature used for tests 2 & 5		(23±2)°C

2. ODOUR & FLAVOUR OF WATER TEST.

Temperature of extraction : (23±2)°C

Date test started : 11.03.08.

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	None	[redacted]
		Flavour	None/Rubber (Chemical)/None	<1/1/<1
	Chlorinated	Odour	None	[redacted]
		Flavour	Chemical/Rubber(Chemical)/None	1/1/<1
Final	Chlorine free	Odour	None	[redacted]
		Flavour	None	<1
	Chlorinated	Odour	None/None/Chemical	[redacted]
		Flavour	None/None/Rubber	<1/<1/1

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 :03.06.08.

	Colour (Hazen Units)*		**Turbidity** (Formazine Nephelometric Units)*	
	First Extract	*Final Extract*	*First Extract*	*Final Extract*
Test sample extract	**0.6**	**--**	**0.15**	**--**
Reagent blank	<0.12	--	<0.09	--
Test sample effect	***≤0.6***	**--**	***≤0.15***	**--**

[* - 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 6920-1 : Clause 5 when extracted at 23°C.

4. GROWTH OF AQUATIC MICROORGANISMS.

Temperature of test : (30±2)°C

Date test started :03.06.08.

Container	Mean Dissolved Oxygen Difference (MDOD) in mg/L
Test product (weeks 5 to 7)	**0.0**
Negative reference (glass) (weeks 5 to 7)	**-0.3**
Positive reference (wax) (weeks 5 to 7)	**6.9**
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 : 04.03.08.

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 :03.06.08

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	**2.7**	**2.9**	<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	**2.5**	**2.2**	1.2
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**	**<1.6**	<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 [method code 407].

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.

NOTE. In the Extraction of Metals Test the concentration of iron found in the reagent blank exceeded the limit of detection for this element. After investigation it was concluded, however, that the test was valid and that the results obtained for the product do conform with the requirements for this test.

CONCLUSIONS.

CONCLUSIONS.

The samples of this product meet the test criteria of BS 6920-1:2000 ("Specification") and thus DO c onform 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.

A. Maddox

Anthony Maddox
Materials Testing Analytical Consultant

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.

May 2000

Your Ref:

Our Ref:

Date:

WRAS
Water Regulations Advisory Scheme

Form M2

Dear Sir

APPLICATION FOR THE TESTING AND LISTING OF A MATERIAL

THIS APPLICATION FORM TO BE SUBMITTED TO THE SCHEME WITH A BS6920 (OR EQUIVALENT) TEST REPORT

1. DETAILS OF MATERIAL - GENERAL

1.1	Heading under which material is required to be included in the Materials Directory. (See page 4)	5365
1.2	Trade name of material for inclusion in the Materials Directory.	DEXINE
1.3	Material identification code.	E6029
1.4	General nature of material.	EPDM SHEET 70 HARD
1.5	Purpose for which the material/ component is designed.	SEALS
1.6	Method of application (where applicable)	N/A
1.7	Suitable surfaces onto which the material can be applied (where applicable)	N/A

2. DETAILS OF MATERIAL - PARTICULAR

2.1	Will the material be applied by the user or his contractor (e.g. paints, coatings, jointing compounds, etc.) or	~~YES~~ / NO
2.2	Will it be supplied solely as a manufactured article?	YES / ~~NO~~
2.3	If the answer to 2.1 is YES, it will be necessary for the testing laboratory to apply the material under conditions specified by the manufacturer before the tests of effect on water quality may commence.	

2.4 List of ingredients and chemical formulae if known. This information may be submitted separately, in confidence if necessary, to the testing laboratory only, or for submission to the Scientific Adviser only.

EPDM RUBBER
CARBON BLACK
PROCESS OIL
ZINC OXIDE
CURE SYSTEM

2.5 Proposed use: state whether the material is for cold, hot, or hot and cold water use. A material not 'hot' tested will be listed as for cold water use only.

COLD

2.6 Supply product literature stating application procedures and curing times where applicable.

N/A

3. Toxicity

3.1 Has the material or any ingredient used in it been submitted to any organisation for toxicological evaluation?

YES / ~~NO~~

3.2 If YES, please submit details of the tests together with copies of the results obtained.

ATTACHED

4. Extraction Tests

4.1 Has the material been subject to any extractability tests for the leaching of any ingredients into water (e.g. monomers, solvents, antioxidants etc.)?

YES / ~~NO~~

5. Biodeterioration

5.1 Has the material been submitted to any organisation for biodegradation or biodeterioration tests?

~~YES~~ / NO

5.2 If YES, please submit details of the tests together with copies of the results obtained.

6. Biocides

6.1 Does the material contain a known biocide?

~~YES~~ / NO

6.2 If YES, please submit details of the ingredient including chemical composition and supplier.

7. Recycled Ingredients/Materials

7.1 Does this material/product contain any recycled ingredients/materials YES/NO

7.2 If yes, give the following details, which will be held on file by the Scheme -

- sources of the recycled ingredients
- evidence to demonstrate full traceability of the recycled material, including the product formulation of the recycled material.
- any treatment given to them before re-use.
- outline of any analytical quality checks undertaken.
- details of any quality systems covering these materials.

8. Name and Address of Applicant:- (as it appears in the telephone directory).
Unless otherwise stated, the applicants name will appear in the Directory.

DEXINE RUBBER CO LTD
JAPE 2 BUSINESS CENTRE
ROCHDALE
OL12 6BZ

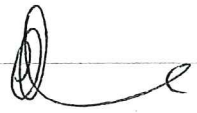
9. Name and address of the manufacturer of the material if different from the applicant.

N/A

10. I have read and I accept the instructions, conditions and fees as set out on Form M1

Declaration: I have attached all relevant laboratory test reports (pass/fail) which are applicable to this material/component.

dated 20/8/08 T/R M 104231 E

Signed:  LMCLAWRENCE

(Signature) (Block Capitals)

Status: TECHNICAL MANAGER

Date: 21/9/08

Note 1. If insufficient space is available on this form, attach separate sheets.

Note 2. If a manufacturer wishes to consult one of the test laboratories to seek their advice on the formulation and development of a satisfactory product, further information on manufacturing processes may be required.

Note 3. Any queries that may arise from Section 1 of this form ("Details of Material - General") should be directed to the WRAS at Oakdale. Queries arising from questions 2 to 6 ("Details of Material - Particular") should be directed to the laboratory which will be carrying out the test.

WATER REGULATIONS ADVISORY SCHEME (WRAS).

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

TEST REPORT

Product : E6029/2
Report Reference : M 104231E

Dexine Rubber Co Ltd
Jape 2 Business Centre
Rochdale
Lancashire
OL12 6BZ

Report Date : 20th August 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.

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	**EPDM**
Trade name/designation	**E6029/2**
Material manufacturer	Dexine Rubber Co. Ltd
Shore Hardness	70°Sh
Date of manufacture/production	January 2008
Production batch numbers	Lab batches
Submitting organisation	Dexine Rubber Co. Ltd
Date of receipt of test samples	3rd March 2008
Method of packaging	In paper wrapping
Condition on receipt	Satisfactory
Laboratory storage before test	Ambient temperature (21±4)°C

Description	test article	Cut sheet
	shape	Rectangular
	dimensions	120mm X 60mm X 2mm
Appearance of article	colour	Black
	surface finish	Matt
	opacity	Opaque
Surface area of one article (mm^2)		15120
Number of articles to give a surface area of 15000mm^2		1
Calibration mark of the test vessel/container in litres		1
Extraction temperature used for tests 2, 3, 5 & 6		(23±2)°C

2. ODOUR & FLAVOUR OF WATER TEST.

Temperature of extraction : (23±2) °C

Date test started : 11.03.08.

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	None	[redacted]
		Flavour	None	<1
	Chlorinated	Odour	None	[redacted]
		Flavour	None	<1
Final	Chlorine free	Odour	--	[redacted]
		Flavour	--	--
	Chlorinated	Odour	--	[redacted]
		Flavour	--	--

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 :03.06.08.

	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 6920-1 : Clause 5 when extracted at 23°C.

4. GROWTH OF AQUATIC MICROORGANISMS.

Temperature of test : (30±2)°C

Date test started 03.06.08.

Container	Mean Dissolved Oxygen Difference (MDOD) in mg/L
Test product (weeks 5 to 7)	**1.2**
Negative reference (glass) (weeks 5 to 7)	**0.3**
Positive reference (wax) (weeks 5 to 7)	**6.9**
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 : 04.03.08.

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 :03.06.08.

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	**1.2**	**1.0**	1.2
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**	**<1.6**	<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 [method code 407].

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.

NOTE. In the Extraction of Metals Test the concentration of iron found in the reagent blank exceeded the limit of detection for this element. After investigation it was concluded, however, that the test was valid and that the results obtained for the product do conform with the requirements for this test

CONCLUSIONS.

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.

A Maddox

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Materials Testing Analytical Consultant

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.

May 2000