



REPORT

issued by an Accredited Laboratory



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Handläggare, enhet / *Handled by, department*
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Datum / *Date*
2002-06-28

Beteckning / *Reference*
P201308

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Fire extinguishing media – Foam concentrate

Tests for compliance with EN-1568:2000, parts 3 & 4

The department of Fire Technology at SP Swedish National Testing and Research Institute has on your request performed tests of foam concentrate according to EN 1568:2000, parts 3 & 4.

Designation of foam concentrate:	ARC Miljö 3x6
Type of foam concentrate:	Synthetic AFFF/AR
Samples:	3 x 20 L cans, batch No 00002
Manufactured by:	Dafo Fomtec AB
Date of arrival at SP:	February 20, 2002
Date of tests:	February-June, 2002

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2 (10)**Total results****Compliance with EN-1568:2000, parts 3 & 4: Yes****Obtained extinguishing performance class: I (hydrocarbon)****Obtained extinguishing performance class: I (polar fuel)****Obtained burnback resistance level: B (hydrocarbon)****Obtained burnback resistance level: C (polar fuel)****SP Swedish National Testing and Research Institute
Fire Technology, Fire Protection****Hans Wetterlund
Technical manager****Magnus Bobert
Technical officer****Enclosure No. 1:** Environmental and health properties of the fire extinguishing foam
"ARC Miljö" in accordance to NT Fire 051.**Enclosure No. 2:** IR-spectrum

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3 (10)**Suppliers' recommendations and characteristic values**

According to the supplier the foam concentrate is intended for use with fresh and sea water for low expansion foam with an admixture ratio of 3 % on water-immiscible liquids and 6 % on water-miscible liquids.

According to the manufacturer the foam concentrate is not freeze protected.

Lowest temperature for use (LUT): ± 0 °C

Results

Numbering according to corresponding clause in the standard.

Introduction

The formulation of the foam concentrate fulfil the directions given in the EC Directives 67/548/EEC, 76/464/EEC and 88/379/EEC. The examination has been conducted in accordance with the Nordtest Method NT Fire 051. See further enclosure No. 1.

4, 6, 7, 8 Chemical-physical examination

Parameter	Clause in the standard	Before temperature conditioning	After temperature conditioning, Top sample	After temperature conditioning, Bottom sample
Sedimentation, vol%	4.1-4.2	< 0.05*	--	--
Dispersible through 180- μ m-sieve	4.1-4.2	Yes*	--	--
Sedimentation, vol%	4	< 0.05*	--	--
pH-value at +20 °C	6	7.2	--	--
Surface tension cyclohexane (Tc), mN/m	--	26.2	26.2	26.2
Surface tension, 3 % admixture (Ts), mN/m	7	17.8	17.8	18.0
Interfacial tension (Ti), mN/m	8	3.4	3.4	3.3
Spreading coefficient (S=Tc-Ts-Ti), mN/m	8	5.0	5.0	4.9

* Before and after conditioning for 24 h at 60 °C.

-- Not included in the standard.



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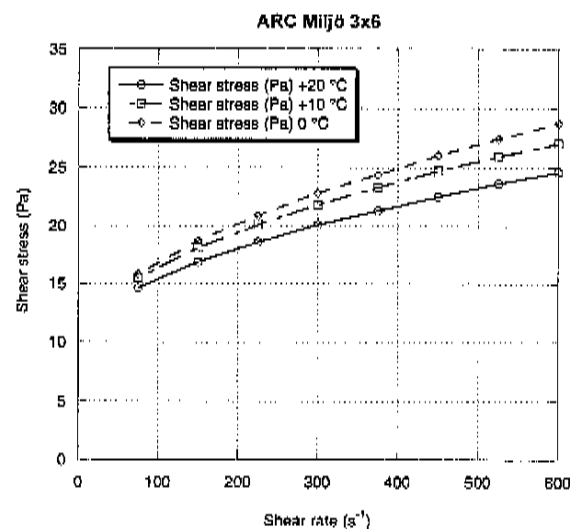
5.2. Viscosity of the foam concentrate

The foam concentrate is pseudoplastic.

The viscosity was measured with a Physica UDS 200 Rheometer. A cone and plate geometry, MK23 (50 mm diameter, 2° cone), was used.

The results are presented in a table and a diagram.

Shear rate (s ⁻¹)	Shear stress (Pa)	Shear stress (Pa)	Shear stress (Pa)	Viscosity (mPas)	Viscosity (mPas)	Viscosity (mPas)
	+20 °C	+10 °C	0 °C	+20 °C	+10 °C	0 °C
75	14.6	15.5	15.8	195	207	211
150	16.9	18.1	18.7	113	121	125
225	18.6	20.1	20.9	82.7	89.3	92.9
300	20.1	21.8	22.8	67.0	72.7	76.0
375	21.3	23.3	24.4	56.8	62.1	65.1
450	22.5	24.7	26.0	50.0	54.9	57.8
525	23.6	25.9	27.4	45.0	49.3	52.2
600	24.6	27.0	28.7	41.0	45.0	47.8



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5 (10)**9. Expansion and drainage of foam**

For foam generation the following types of water were used:

Fresh water; tap water taken from the municipal waterworks of Borås.

Sea water has been prepared by tap water and additives as specified in the standard.

Test conditions: Ambient temperature: 19 °C-20 °C

Premix temperature: 19 °C-20 °C

Fresh water, 3 % admixture, before conditioning				
Test No.	1	2	3	Mean value
Expansion ratio	5.7	5.6	5.6	5.7
Drainage 25 %, min:s	05:30	05:51	05:57	05:46
Drainage 50 %, min:s	07:32	08:50	08:47	08:23

Fresh water, 3 % admixture, top sample after conditioning				
Test No.	1	2	3	Mean value
Expansion ratio	6.1	6.0	6.3	6.1
Drainage 25 %, min:s	05:34	05:27	05:08	05:23
Drainage 50 %, min:s	09:46	09:33	09:05	09:28

Fresh water, 3 % admixture, bottom sample after conditioning				
Test No.	1	2	3	Mean value
Expansion ratio	5.9	6.0	6.0	6.0
Drainage 25 %, min:s	05:26	05:23	05:15	05:21
Drainage 50 %, min:s	09:34	09:34	09:32	09:33

Sea water, 3 % admixture, before conditioning				
Test No.	1	2	3	Mean value
Expansion ratio	7.0	7.1	6.9	7.0
Drainage 25 %, min:s	07:01	06:41	07:00	06:54
Drainage 50 %, min:s	11:02	10:50	11:10	11:01

Sea water, 3 % admixture, top sample after conditioning				
Test No.	1	2	3	Mean value
Expansion ratio	6.7	6.5	6.7	6.6
Drainage 25 %, min:s	06:23	06:23	06:04	06:17
Drainage 50 %, min:s	10:22	10:15	10:11	10:16

Sea water, 3 % admixture, bottom sample after conditioning				
Test No.	1	2	3	Mean value
Expansion ratio	6.7	6.6	6.6	6.6
Drainage 25 %, min:s	06:34	06:30	06:31	06:32
Drainage 50 %, min:s	10:36	10:37	10:22	10:32

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6 (10)**Comments to the chemical- physical examination and the expansion and drainage tests**

The surface tension after conditioning, top and bottom sample, is within ± 5 % of the value obtained before conditioning. The spreading coefficient before and after conditioning, top and bottom sample, is positive.

The requirements for the chemical- physical properties are fulfilled in accordance with the standard.

The expansion ratio after conditioning, top and bottom sample, is within ± 20 % of the corresponding value obtained before conditioning. The 25 % drainage time after conditioning, top and bottom sample, is within ± 20 % of the corresponding value obtained before conditioning.

The requirements for the expansion and drainage of foam are fulfilled in accordance with the standard.

The foam concentrate is not temperature sensitive.

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7 (10)**10. Test fire performance EN 1568-3:2000 (part 3, annex H.3)**

All fire tests were conducted indoors in the fire hall of SP.

Designation	Unit	Test No 1	Test No 2	Test No 3
Type of foam, expansion grade		Low	Low	Low
Date of test	y-m-d	2002-03-27	2002-03-27	2002-03-27
Admixture	%	3	3	3
Type of water		Fresh water	Sea water	Fresh water
Foam nozzle, UNI-86	L min ⁻¹	11.4	11.4	11.4
Air temp.	°C	16	17	17
Fuel temp.	°C	18	18	18
Water temp.	°C	20	19	19
Foam solution temp.	°C	19	19	19
Wind speed	m/s	< 1	< 1	< 1
Extinction				
Application method		Forceful	Forceful	Forceful
Type of fuel		Heptane	Heptane	Heptane
Preburn time	min	1	1	1
Application rate	L m ⁻² min ⁻¹	2.5	2.5	2.5
Start foam application	min:s	00:00	00:00	00:00
90 % control	min:s	00:41	00:50	00:43
99 % extinguished	min:s	01:57	01:14	01:46
Extinguished	min:s	02:01	01:17	02:00
Stop foam application	min:s	03:00	03:00	03:00
Burnback				
Waiting period	min	5	5	5
Start burnback	min:s	00:00	00:00	00:00
Burnback, >25 %	min:s	02:30	03:07	02:39
Extinguishing class		I	I	I
Burnback level		Not obtained	Not obtained	Not obtained

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8 (10)**10. Test fire performance EN 1568-3:2000 (part 3, annex H.2)**

All fire tests were conducted indoors in the fire hall of SP.

Designation	Unit	Test No 1	Test No 2	Test No 3
Type of foam, expansion grade		Low	Low	Low
Date of test	y-m-d	2002-03-27	2002-03-27	2002-03-27
Admixture	%	3	3	3
Type of water		Fresh water	Sea water	Sea water
Foam nozzle, UNI-86	L min ⁻¹	11.4	11.4	11.4
Air temp.	°C	16	19	17
Fuel temp.	°C	19	19	19
Water temp.	°C	20	19	20
Foam solution temp.	°C	19	19	19
Wind speed	m/s	< 1	< 1	< 1
Extinction				
Application method		Gentle	Gentle	Gentle
Type of fuel		Heptane	Heptane	Heptane
Preburn time	min	1	1	1
Application rate	L m ⁻² min ⁻¹	2.5	2.5	2.5
Start foam application	min:s	00:00	00:00	00:00
90 % control	min:s	00:57	00:41	00:44
99 % extinguished	min:s	01:31	01:50	02:09
Extinguished	min:s	01:33	01:55	02:12
Stop foam application	min:s	05:00	05:00	05:00
Burnback				
Waiting period	min	5	5	5
Start burnback	min:s	00:00	00:00	00:00
Burnback, >25 %	min:s	19:55	17:58	19:00
Extinguishing class		-	-	-
Burnback level		B	B	B

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9 (10)**10. Test fire performance EN 1568-4:2000 (part 4, annex H.2)**

All fire tests were conducted indoors in the fire hall of SP.

Designation	Unit	Test No 1	Test No 2	Test No 3
Type of foam, expansion grade		Low	Low	Low
Date of test	y-m-d	2002-03-15	2002-03-15	2002-03-15
Admixture	%	6	6	6
Type of water		Fresh water	Sea water	Sea water
Foam nozzle, UNI-86	L min ⁻¹	11.4	11.4	11.4
Air temp.	°C	20	19	20
Fuel temp.	°C	17	17	17
Water temp.	°C	-	-	-
Foam solution temp.	°C	19	18	18
Wind speed	m/s	< 1	< 1	< 1
Extinction				
Application method		Gentle	Gentle	Gentle
Type of fuel		Acetone	Acetone	Acetone
Preburn time	min	2	2	2
Application rate	L m ⁻² min ⁻¹	6.6	6.6	6.6
Start foam application	min:s	00:00	00:00	00:00
90 % control	min:s	00:36	00:36	00:35
99 % extinguished	min:s	01:04	01:58	01:55
Extinguished	min:s	01:06	02:14	02:14
Stop foam application	min:s	03:00	03:00	03:00
Burnback				
Waiting period	min	5	5	5
Start burnback	min:s	00:00	00:00	00:00
Burnback, >25 %	min:s	11:15	09:20	09:28
Extinguishing class		I	I	I
Burnback level		B	C	C

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10 (10)**11. Marking**

Marking of the containers shall be made according to clause 11 in the standard in order to fulfil the requirements.

Complementary tests for evaluation of approval in accordance with the requirements "Certification rules for fire extinguishing media-foam concentrates", SPCR 129, dated September 2001

Parameter	Result
Water content, % by weight	90
Density, kg/ m ³	1017
Refractive index, nD ₂₀	1.345
IR-spectrum	Enclosure No. 2



STATEMENT

Dafo Fomtec AB
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135 26 TYRESÖ

Handläggare, enhet / *Handled by, department*
H Gustafsson, Chemistry and
Materials Technology

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2002-06-11 KM0 F208685-1 1 (1)

RE: Properties of the fire extinguishing foam "ARC Miljö" in accordance to NT FIRE 051

On behalf of Dafo Fomtec AB (address as above) I the undersigned have examined environmental and health properties of the fire extinguishing foam "ARC Miljö" in relation to NORDTEST FIRE 051. The examination is performed under a personal confidentiality agreement.

"ARC Miljö" is an alcohol resistant-aqueous film-forming foam concentrate (AR/AFFF) and the concentration of the standard foam solution for use is 3 % or 6 %.

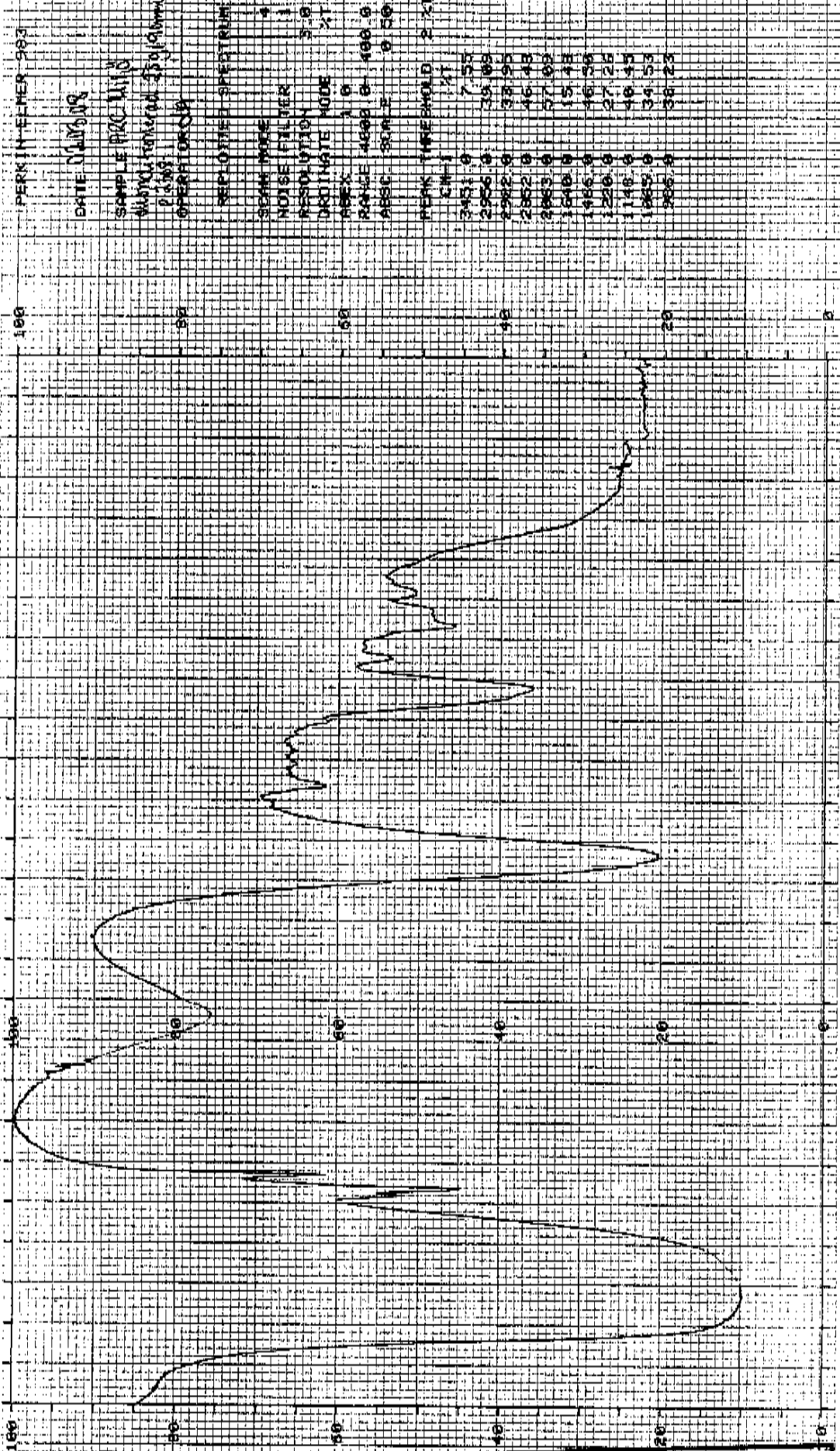
The examination was performed in accordance to NORDTEST FIRE 051, Section 7 "General requirements for all types of foams" and was based on a detailed product formulation, test reports and other data according to Section 9.

The product "ARC Miljö" fulfils the requirements in Section 7 in NORDTEST FIRE 051 and shall not be classified in categories of danger such as e.g. "Dangerous for the environment". After dilution with water to the recommended concentration/s the foam concentrate should therefore not in normal usage present a significant toxic hazard to life in relation to the environment. The current versions of EC Directives 67/548/EEC, 76/464/EEC and 1999/45/EC (former 88/379/EEC) are considered with respect on ecotoxicological properties and safety in the work environment.

The examination does not include the technical requirements of EN 1568 Fire extinguishing media – Foam concentrates.

Hans Gustafsson
M. Pharm. Sci.

	ENCLOSURE NO: <u>1</u>
	TO REFERENCE
	NO: <u>P201308</u>
	SIGN: <u>H. Gustafsson</u>
FIRE TECHNOLOGY	



PERKINELMER 987

DATE: 06/06/04

SAMPLE: POC-LIN

ANALYST: [unreadable]

OPERATOR: [unreadable]

REPL OTMISE - SPECTRUM

SCANS: 4

NOISE FILTER: 1

RESOLUTION: 5.0

DROTINGATE MODE: 2

APERT: 1.0

RANGE: 4000.0 - 500.0

ASC: 300.0 - 0.50

PEAK THRESHOLD: 2.0

3451.0	7.55
2956.0	39.80
2922.0	39.90
2852.0	15.40
2863.0	27.00
1640.0	15.40
1465.0	16.20
1220.0	27.20
1148.0	16.40
1065.0	34.50
986.0	38.20

ENCLOSURE NO: 2

TO REFERENCE

NO: P200308

SIGN: [Signature]

FIRE TECHNOLOGY