

6160-1181:EOJ:JTH:R

30 NOV 1983

From: Commanding Officer, Naval Research Laboratory
To: Commander, Naval Sea Systems Command (Code 5523)
Subj: Qualification of AFFF Liquid Concentrate Fire Extinguishing
Agents Manufactured by the Lorcen Company; results of

Ref: (a) NAVSEASYSCON for "Qualification Testing of Aqueous Film
Forming Foam Liquid Concentrate Fire Extinguishing
Agents Manufactured by the Lorcen Company, Concession
Road, Thurso, Quebec, Canada; Authorization of SEA
55231/PAT 4123/24385 Ser 7, dated 13 Jan 1982.

Encl: (1) Two copies of subject report

1. In accordance with reference (a), the subject products have been
tested in order to determine compliance with the requirements of
MIL-F-24385C. A report covering the work is forwarded herewith as
enclosure (1).

H. W. CARMART
By direction

Copy to: (w/1 copy encl (1))
NAVSEASYSCON (Code 5532)
(Code 996)
(Code 05DC4)
NAVSEUPCON (Code 304R)
NAVMAT (Code 04P)

6180-1181:EJJ:JTL:ara
1 December 1983

Subj: Qualification Testing of AFFF Liquid Concentrate Fire
Extinguishing Agents Manufactured by the Lorcon Company;
results of

Ref (a) Military Specification MIL-F-24385C with Amendment 2

1. AFFF concentrates made by the Lorcon Company and designated as 3% AFFF/C and 6% AFFF/C were tested in accordance with the procedures of and compliance with the requirements of reference (a).
2. The test data obtained are summarized in the attached tables.
3. There were four (4) instances where the candidate materials failed to meet the requirements of MIL-F-24385C and they are as follows:
 1. The 6% AFFF/C as received when mixed with fresh water did not extinguish the 28 ft² fire within 45 sec. - (47 sec).
 2. The 3% AFFF/C (Aged for Stability tests) when mixed with sea water did not extinguish the 28 ft² fire.
 3. The 6% AFFF/C (Aged from Stability Tests) did not extinguish the 28 ft² fire within 45 sec - (56 sec).
 4. The 3% AFFF/C when mixed with sea water and tested on the 50 ft² fire did not meet the burnback resistance requirement of 350 sec - (360 sec) and also the 40 sec summation requirement of 280 sec - (320 sec).

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NAVAL RESEARCH LABORATORY
FIRE SUPPRESSION SECTION
WASHINGTON, D.C. 20375

MLI-F-24385C Qualification Test Results

Submitted by: LORCON 3% TYPE 3AFF-C Lot 3AF-2015
6% TYPE 6AFF-C Lot 6AF-2013

Para 3.3 Chemical & Physical Requirements for Concentrates

Requirement	Value	Results	
		3AFF-C	6AFF-C
Refractive index, minimum 3% type	1.3630	1.3829	
6% type	1.3580	X	1.3583
Viscosity, centistokes			
maximum, 5°C, 3% Type	20	10.74	X
minimum, 25°C, 3% Type	2	4.88	X
maximum, 5°C, 6% Type	10	X	7.20
minimum, 25°C, 6% Type	2	X	2.12
hydrogen ion concentration (pH)	7.0-8.5	7.5	7.1
Spreading coefficient, minimum	3	6.9	6.8
Foamability			
fresh water, minimum expansion	6.0	8.6	8.4
minutes, minimum drain time	2.5	3.6	4.0
sea water, minimum expansion	6.0	8.2	7.8
minutes, min drain time	2.5	3.8	4.0
Corrosion rate			
General, maximum			
steel, milli inches/yr	1.5	0.54	0.63
Cu-Ni, milli inches/yr	1.0	0.20	0.26
Ni-Cu, milli inches/yr	1.0	0.006	0.001
Bronze, milligrams	100	28	45
Localized CRES	No pits	No pits	No pits
Total halides, ppm, maximum, 3% type	500	79-84	X
6% type	250	X	118
Dry chemical compatibility,			
seconds, minimum	360	453	460
Environmental impact			
Toxicity, TC, mg/L, minimum			
50			
3% type	500	>500	X
6% type	1000	X	>1000
COD, mg/L, maximum, 3% type	1000K	770	X
6% type	500K	X	410
BOD /COD, minimum	0.9	0.93	0.975
20			

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MIL-F-24385 Qualification Test Results

Submitted by LORCON

Para 3.3.2 Stability

Requirement	Value	Results	
		3AFF-F-C	6AFF-F-C
(a) Spreading coefficient, minimum			
from concentrate	3	6.7	6.4
fresh water premix	3	6.8	6.7
sea water premix	3	5.9	6.4
(b) Foamability			
fresh water expansion, min	6.0	10.4	8.2
drain time, minutes, min	2.5	3.9	4.8
sea water expansion, min	6.0	7.6	7.7
drain time, min, min	2.5	4.0	4.7
(c) Film Formation			
concentrate, half strength, fresh	No ignit.	No Ign	No Ign
sea	No ignit.	No Ign	No Ign
premix, full strength, fresh	No ignit.	No Ign	No Ign
sea	No ignit.	No Ign	No Ign
(d) Fire performance			
concentrate, half strength			
fresh, ext time, sec, maximum	45	41	40
burnback, sec, minimum	300	42.5	53.9
sea, ext time, sec, maximum	45	NO EXT	53.2
burnback, sec, minimum	300		
premix, full strength			
fresh, ext time, sec, maximum	30	26	25
burnback, sec, minimum	360	50.5	47.5
sea, ext time, sec, maximum	30	30	26
burnback, sec, minimum	360	42.0	41.1
(e) Stratification			
concentrate	None	None	None
fresh water premix	None	None	None
sea water premix	None	None	None
(f) Precipitation, volume percent, max			
concentrate	< 0.05	< 0.05	< 0.05
fresh water premix	< 0.05	< 0.05	< 0.05
sea water premix	< 0.05	< 0.05	< 0.05

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MIL-F-24385C Qualification Test Results

Submitted by: LORCON

Para 3.4 Fire Performance

Requirement	Value	Results	
		30111-0	10111-0
28 ft ² fire test			
extinguishing time, seconds, maximum			
fresh water, half strength	45	41	47
full strength	30	24	21
sea water, half strength	45	45	41
full strength	30	26	25
quintuple strength	55	38	31
burnback time, seconds, minimum			
fresh water, half strength	300	475	430
full strength	360	424	445
sea water, half strength	300	392	402
full strength	360	363	385
quintuple strength	200	282	191
50 ft ² fire test			
extinguishing time, seconds, maximum	50	47	45
burnback time, sec, minimum	360	350	440
40-sec summation, minimum	320	280	322

3.3.4	Total fluorine, percent		0.829	0.53
5.1.1.1	(f) Cap removal torque,			
	in-lbs, maximum	50	40-75	40-15

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MIL-F-24385C Qualification Test Results

Submitted by LORCON 3AFFE-C

Para 3.33 Compatibility

Mixture 30/50 LORCON 3AFFE-C / AN-512 AF 2-511

Requirement	Value	Liquid				
		Conc	Conc/ Fresh	Conc/ Sea	Fresh Premix	Sea Premix
(a) Foamability						
expansion, minimum	6.0	X	8.2	7.8	8.5	7.0
drain time, min, minimum	2.5	X	4.5	5.4	4.5	5.6
(b) Film formation	no ignit.	X	No ignit	No ignit	No ignit	No ignit
(c) Fire performance						
full strength						
ext time, sec, max	30	X	2.4	2.4	2.6	3.0
burnback, sec, min	360	X	4.3	4.4	5.7	5.2
(d) Stratification	none	None	X	X	None	None
(e) Precipitation,						
volume percent, max	< 0.05	< 0.05	X	X	< 0.05	< 0.05

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MIL-F-24385C Qualification Test Results

Submitted by LORCON 3AFFE-C

Para 3.33 Compatibility

Mixture 50/50 LORCON 3AFFE-C / NATIONAL ACQU-5

Requirement	Value	Liquid				
		Conc	Conc/ Fresh	Conc/ Sea	Fresh Premix	Sea Premix
(a) Foamability						
expansion, minimum	6.0		1.7	6.2	7.6	6.0
drain time, min, minimum	2.5		4.3	4.8	7.4	7.1
(b) Film formation	no ignit.		no ignit.	no ignit.	no ignit.	no ignit.
(c) Fire performance						
full strength						
ext time, sec, max	30		28	23	24	30
burnback, sec, min	360		499	492	563	580
(d) Stratification	none	none			none	none
(e) Precipitation,						
volume percent, max	< 0.05	< 0.05			< 0.05	< 0.05

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MIL-F-24385C Qualification Test Results

Submitted by LORCON 3AFFE-C

Para 3.33 Compatibility

Mixture 50/50 LORCON 3AFFE-C / 3M FC-203C

Requirement	Value	Liquid				
		Conc	Conc/ Fresh	Conc/ Sea	Fresh Premix	Sea Premix
(a) Foamability						
expansion, minimum	6.0	X	8.3	7.7	8.2	8.1
drain time, min, minimum	2.5	X	4.4	5.5	4.5	4.8
(b) Film formation	no ignit.	X	No ignit	No ignit	No ignit	No ignit
(c) Fire performance						
full strength						
ext time, sec, max	30	X	2.1	30	2.7	2.6
burnback, sec, min	360	X	4.48	4.52	4.26	4.73
(d) Stratification	none	none	X	X	none	none
(e) Precipitation,						
volume percent, max	< 0.05	< 0.05	X	X	< 0.05	< 0.05

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MIL-F-24385C Qualification Test Results

Submitted by LORCON 3AFFF-C

Para 3.33 Compatibility

Mixture 25/25/25/25 LORCON 3AFFF-C / 3A1 FC-203C
NATIONAL ACU-3 / ANSUL APL-5A

Requirement	Value	Liquid				
		Conc	Conc/ Fresh	Conc/ Sea	Fresh Premix	Sea Premix
(a) Foamability						
expansion, minimum	6.0	X	8.0	7.0	8.0	7.2
drain time, min, minimum	2.5	X	4.5	4.4	4.7	4.4
(b) Film formation	no ignit.	X	no ignit.	no ignit.	no ignit.	no ignit.
(c) Fire performance						
full strength						
ext time, sec, max	30	X	23	25	25	27
burnback, sec, min	360	X	450	533	565	514
(d) Stratification	none	none	X	X	none	none
(e) Precipitation,						
volume percent, max	< 0.05	< 0.05	X	X	< 0.05	< 0.05

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MIL-F-24385C Qualification Test Results

Submitted by LORCON GAFF-C

Para 3.33 Compatibility

Mixture 50/50 LORCON GAFF-C / ANSUL AFB-5

Requirement	Value	Liquid				
		Conc	Conc/ Fresh	Conc/ Sea	Fresh Premix	Sea Premix
(a) Foamability						
expansion, minimum	6.0	---	8.1	7.8	8.2	7.7
drain time, min, minimum	2.5	---	4.7	4.6	4.3	4.1
(b) Film formation	no ignit.	---	no ignit	no ignit	no ignit	no ignit
(c) Fire performance						
full strength						
ext time, sec, max	30	---	28	23	27	26
burnback, sec, min	360	---	445	465	510	455
(d) Stratification	none	none	---	---	none	none
(e) Precipitation,						
volume percent, max	< 0.05	< 0.05	---	---	< 0.05	< 0.05

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MIL-F-24385C Qualification Test Results

Submitted by LORCON GAFFC - C

Para 3.33 Compatibility

Mixture 50/50 LORCON GAFFC - C / ANSUL AFC - 3

Requirement	Value	Liquid				
		Conc	Conc/ Fresh	Conc/ Sea	Fresh Premix	Sea Premix
(a) Foamability						
expansion, minimum	6.0	X	8.0	7.5	6.88	7.5
drain time, min, minimum	2.5	X	4.0	4.8	4.0	3.7
(b) Film formation	no ignit.	X	no ignit	no ignit	no ignit	no ignit
(c) Fire performance						
full strength						
ext time, sec, max	30	X	27	26	23	27
burnback, sec, min	360	X	472	383	530	433
(d) Stratification	none	none	X	X	none	none
(e) Precipitation,						
volume percent, max	< 0.05	< 0.05	X	X	< 0.05	< 0.05

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MIL-F-24385C Qualification Test Results

Submitted by LORCON 6AFFF-C

Para 3.33 Compatibility

Mixture 50/50 LORCON 6AFFF-C / NATIONAL AQUA-GUM

Requirement	Value	Liquid				
		Conc	Conc/ Fresh	Conc/ Sea	Fresh Premix	Sea Premix
(a) Foamability						
expansion, minimum	6.0	✓	7.9	6.5	2.5	5.6
drain time, min, minimum	2.5	✓	4.2	4.5	3.0	3.5
(b) Film formation	no ignit.	✗	No ignit	No ignit	No ignit	No ignit
(c) Fire performance						
full strength						
ext time, sec, max	30	✓	24	23	30	24
burnback, sec, min	360	✓	144	588	547	545
(d) Stratification	none	none	✗	✗	none	none
(e) Precipitation,						
volume percent, max	<0.05	<0.05	✓	✓	<0.05	<0.05

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MIL-F-24385C Qualification Test Results

Submitted by LORCON 6 AFFE-C

Para 3.33 Compatibility

Mixture 50/50 LORCON 6 AFFE-C / 3M FC-120B

Requirement	Value	Liquid				
		Conc	Conc/ Fresh	Conc/ Sea	Fresh Premix	Sea Premix
(a) Foamability						
expansion, minimum	6.0		8.6	7.5	8.0	8.2
drain time, min, minimum	2.5		4.4	4.6	4.4	4.2
(b) Film formation	no ignit.		no ignit.	no ignit.	no ignit.	no ignit.
(c) Fire performance						
full strength						
ext time, sec, max	30		30	24	25	30
burnback, sec, min	360		392	365	499	422
(d) Stratification	none	none			none	none
(e) Precipitation,						
volume percent, max	<0.05	<0.05			<0.05	<0.05

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MIL-F-24385C Qualification Test Results

Submitted by LORCON 6AFF-C

Para 3.33 Compatibility

Mixture 50/50 LORCON 6AFF-C / 3M FC-206C

Requirement	Value	Liquid				
		Conc	Conc/ Fresh	Conc/ Sea	Fresh Premix	Sea Premix
(a) Foamability						
expansion, minimum	6.0	✓	8.1	7.7	10.2	8.7
drain time, min, minimum	2.5	✓	4.7	4.9	4.6	4.3
(b) Film formation	no ignit.	X	no ignit.	no ignit.	no ignit.	no ignit.
(c) Fire performance						
full strength						
ext time, sec, max	30	✓	2.8	2.7	2.2	2.4
burnback, sec, min	360	✓	42.7	46.4	135	125
(d) Stratification	none	None	✓	✓	None	None
(e) Precipitation,						
volume percent, max	< 0.05	< 0.05	✓	✓	< 0.05	< 0.05

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MIL-F-24385C Qualification Test Results

Submitted by LORCON GATFF-C

Para 3.33 Compatibility

Mixture 2000/25/25 LORCON GATFF-C / 3M FC200C
2000/25/25 National Foam Corp / Polysil-AFC-5

Requirement	Value	Liquid				
		Conc	Conc/ Fresh	Conc/ Sea	Fresh Premix	Sea Premix
(a) Foamability						
expansion, minimum	6.0		2.1	2.2	8.0	6.1
drain time, min, minimum	2.5		2.1	5.5	4.8	4.1
(b) Film formation	no ignit.					
(c) Fire performance						
full strength						
ext time, sec, max	30		2.8	2.7	2.0	2.6
burnback, sec, min	360		472	560	592	497
(d) Stratification	none					
(e) Precipitation,						
volume percent, max	< 0.05				< 0.05	< 0.05