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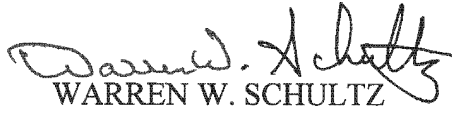
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Ser 6180/0100
- 2 MAY 2016

From: Commanding Officer, Naval Research Laboratory
To: Commander, Naval Sea Systems Command (SEA 05P5 S. Fletcher)

Subj: RESULTS OF MIL-F-24385F QUALIFICATION TESTING OF THE NATIONAL
FOAM INCORPORATED AER-O-WATER 6EM-C6/TRIDOL-C6 M6 AFFF
CONCENTRATE

Encl: (1) One copy of subject report

1. Enclosure (1) is forwarded for your information and retention.
2. This report provides results of the qualification testing for the National Foam Inc. Aer-O-Water 6EM-C6/Tridol-C6 M6 AFFF concentrate, which was evaluated against the MIL-F-24385F, "Fire Extinguishing Agent, Aqueous Film Forming Foam (AFFF) Liquid Concentrate for Fresh and Seawater" qualification standard. The Aer-O-Water 6EM-C6/Tridol-C6 M6 AFFF product met all of the fire extinguishment and burn back protection requirements of the MIL-F-24385F test standard. Based on these test results it is recommended that the Aer-O-Water 6EM-C6/Tridol-C6 M6 AFFF product be listed on the AFFF Qualified Products List (QPL).
3. The Naval Research Laboratory's point of contact is John P. Farley Code 6186, (202) 404-8459, e-mail: john.farley@nrl.navy.mil.


WARREN W. SCHULTZ
By direction

Copy to:
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6180/0100A:JPF
02 May 2016

Results of Mil-F-24385F Qualification Testing of the National Foam Inc. Aer-O-Water 6EM- C6/Tridol-C6 M6 AFFF Concentrate

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**Test results--Paragraphs denoted below refer to the applicable section
of MIL-F-24385F**

Paragraph 3.3 Chemical and Physical Requirements for Concentrates

Property:	Type 6 Criteria	Type 6 Value	Pass/ Fail
Viscosity @25 °C cSt	≥ 2	4.30	Pass
Viscosity @5 °C cSt	≤10	8.92	Pass
Hydrogen Ion (pH)	7-8.5	8.22	Pass
Spreading Coefficient on cyclohexane (dynes/cm)	≥3.0	6.27	Pass
Index of refraction	≥1.3580	1.3587	Pass
Foamability (average of two measurements for each condition):			
Fresh Water Expansion Ratio (minutes)	≥5.0	8.2	Pass
Fresh Water Drain Time (minutes)	≥2:30	5:46	Pass
Salt Water Expansion Ratio	≥5.0	7.6	Pass
Salt Water Drain Time (minutes)	≥2:30	5:45	Pass
Film Formation:			
Full Strength Fresh	No Ignition	No Ignition	Pass
Full Strength Salt	No Ignition	No Ignition	Pass
Corrosion Rate:			
steel (10 ⁻³ inches/yr)	≤1.5	0.76	Pass
Cu-Ni (10 ⁻³ inches/yr)	≤1.0	N.O.*	Pass
Ni-Cu (10 ⁻³ inches/yr)	≤1.0	N.O.*	Pass
Bronze (mg)	≤100	N.O.*	Pass
Localized pitting (Corrosion- resistant steel)	No Pits	No Pits	Pass
Total Halides (ppm)	≤250	<50	Pass
Dry Chemical Compatibility:			
Burn Back time (s)	≥360	625	Pass
Environmental Impact:			
Toxicity (LC ₅₀) mg/L	≥1000	≤2000*	Pass
COD (g O ₂ /L)	≤500	334	Pass
BOD ₂₀ /COD	≥0.65	0.88	Pass

N.O.* = None Observed

NOTE* – No fish (killifish (*Fundulus Heteroclitus*) mortality observed at concentrations ≤ 2000 mg/L for the Type 6 AFFF concentrate.

Paragraph 3.3.2 Stability

Property	Type 6 Criteria	Type 6 Value	Pass/ Fail
Spreading Coefficient on cyclohexane (dynes/cm):			
using aged concentrate mixed with fresh water	≥ 3.0	4.64	Pass
using aged premix with fresh water	≥ 3.0	5.39	Pass
using aged premix with salt water	≥ 3.0	5.70	Pass
Foamability using aged concentrate (average of two measurements):			
Fresh Water Expansion Ratio	≥ 5.0	7.8	Pass
Fresh Water Drain Time (minutes)	$\geq 2:30$	5:51	Pass
Salt Water Expansion Ratio	≥ 5.0	7.6	Pass
Salt Water Drain Time (minutes)	$\geq 2:30$	5:30	Pass
Foamability using aged premix (average of two measurements):			
Fresh Water Expansion Ratio	≥ 5.0	8.3	Pass
Fresh Water Drain Time (minutes)	$\geq 2:30$	5:10	Pass
Salt Water Expansion Ratio	≥ 5.0	7.8	Pass
Salt Water Drain Time (minutes)	$\geq 2:30$	5:37	Pass
Film Formation:			
from aged concentrate, full strength, fresh water	no ignition	no ignition	Pass
from aged concentrate, full strength, salt water	no ignition	no ignition	Pass
from aged premix, full strength, fresh water	no ignition	no ignition	Pass
from aged premix, full strength, salt water	no ignition	no ignition	Pass
Fire Performance:			
Aged Concentrate, 1/2 strength, Fresh			
Extinguishment time (s)	≤ 45	43	Pass
Burn back time (s)	≥ 300	538	Pass
Aged Concentrate, 1/2 strength, Salt			
Extinguishment time (s)	≤ 45	38	Pass
Burn back time (s)	≥ 300	420	Pass
Aged Concentrate, full strength, Fresh			
Extinguishment time (s)	≤ 30	29	Pass
Burn back time (s)	≥ 360	606	Pass
Aged Concentrate, full strength, Salt			
Extinguishment time (s)	≤ 30	28	Pass
Burn back time (s)	≥ 360	636	Pass
Aged Premix, 1/2 strength, Fresh			
Extinguishment time (s)	≤ 45	45	Pass
Burn back time (s)	≥ 360	417	Pass
Aged Premix, 1/2 strength Salt			
Extinguishment time (s)	≤ 45	45	Pass
Burn back time (s)	≥ 360	485	Pass
Aged Premix, full strength, Fresh			
Extinguishment time (s)	≤ 30	29	Pass
Burn back time (s)	≥ 360	685	Pass
Aged Premix, full strength, Salt			

Extinguishment time (s)	≤30	26	Pass
Burn back time (s)	≥360	560	Pass

Property	Type 6 Criteria	Type 6 Value	Pass/ Fail
Stratification:			
using aged concentrate mixed with fresh water	N.O.*	N.O.*	Pass
using aged premix with fresh water	N.O.*	N.O.*	Pass
using aged premix with salt water	N.O.*	N.O.*	Pass
Precipitation (vol%):			
using aged concentrate mixed with fresh water	≤0.05 mL	N.O.*	Pass
using aged premix with fresh water	≤0.05 mL	N.O.*	Pass
using aged premix with salt water	≤0.05 mL	N.O.*	Pass

N.O.* = None Observed.

Paragraph 3.3.3 Compatibility

Mixture: Aer-O-Water 6EM-C6 / National¹ (Type 6)

Requirement	Criteria	Value	Pass/ Fail
Stratification:			
using aged concentrate	N.O.*	N.O.*	Pass
Precipitation (vol%):			
using aged concentrate	≤0.05	N.O.*	Pass
Foamability using aged concentrate(average of two measurements):			
Fresh Water Expansion Ratio	≥5.0	8.8	Pass
Fresh Water Drain Time (minutes)	≥2:30	4:42	Pass
Salt Water Expansion Ratio	≥5.0	7.55	Pass
Salt Water Drain Time (minutes)	≥2:30	5:22	Pass
Film Formation:			
from aged concentrate, ½ strength, fresh water	no ignition	no ignition	Pass
from aged concentrate, ½ strength, salt water	No ignition	no ignition	Pass
Fire Performance:			
Aged Concentrate, fresh water			
Extinguishment time (s)	≤30	29	Pass
Burn back time (s)	≥360	610	Pass
Aged Concentrate, salt water			
Extinguishment time (s)	≤30	28	Pass
Burn back time (s)	≥360	603	Pass

¹ National 6%-6EM Lot L12345, 2/13

Mixture: Aer-O-Water 6EM-C6 / Ansul² (50/50) (Type 6)

Requirement	Criteria	Value	Pass/ Fail
Stratification:			
using aged concentrate	N.O.*	N.O.*	Pass
Precipitation (vol%):			
using aged concentrate	≤0.05	N.O.*	Pass
Foamability using aged concentrate(average of two measurements):			
Fresh Water Expansion Ratio	≥5.0	7.8	Pass
Fresh Water Drain Time (minutes)	≥2:30	6:15	Pass
Salt Water Expansion Ratio	≥5.0	7.5	Pass
Salt Water Drain Time (minutes)	≥2:30	5:21	Pass
Film Formation:			
from aged concentrate, ½ strength, fresh water	no ignition	no ignition	Pass
from aged concentrate, ½ strength, salt water	no ignition	no Ignition	Pass
Fire Performance:			
Aged Concentrate, fresh water			
Extinguishment time (s)	≤30	28	Pass
Burn back time (s)	≥360	495	Pass
Aged Concentrate, salt water			
Extinguishment time (s)	≤30	26	Pass
Burn back time (s)	≥360	515	Pass

*N.O. = None Observed.

Mixture: Aer-O-Water 6EM-C6 / Chemguard³ (50/50) (Type 6)

Requirement	Criteria	Value	Pass/ Fail
Stratification:			
using aged concentrate	N.O.*	N.O.*	Pass
Precipitation (vol%):			
using aged concentrate	≤0.05	N.O.*	Pass
Foamability using aged concentrate(average of two measurements):			
Fresh Water Expansion Ratio	≥5.0	8.15	Pass
Fresh Water Drain Time (minutes)	≥2:30	4:56	Pass
Salt Water Expansion Ratio	≥5.0	7.5	Pass
Salt Water Drain Time (minutes)	≥2:30	5:03	Pass
Film Formation:			
from aged concentrate, ½ strength, fresh water	no ignition	no ignition	Pass
from aged concentrate, ½ strength, salt water	no ignition	no ignition	Pass
Fire Performance:			
Aged Concentrate, fresh water			
Extinguishment time (s)	≤30	26	Pass
Burn back time (s)	≥360	515	Pass
Aged Concentrate, salt water			
Extinguishment time (s)	≤30	26	Pass
Burn back time (s)	≥360	579	Pass

² Ansul 6% AFC5, Lot 1404, 4/14

³ Chemguard 6%-C601 MS, Lot 0249113, 4/29/13

Mixture: ¼ Aer-O-Water 6EM-C6 / National / Ansul / Chemguard (Type 6)

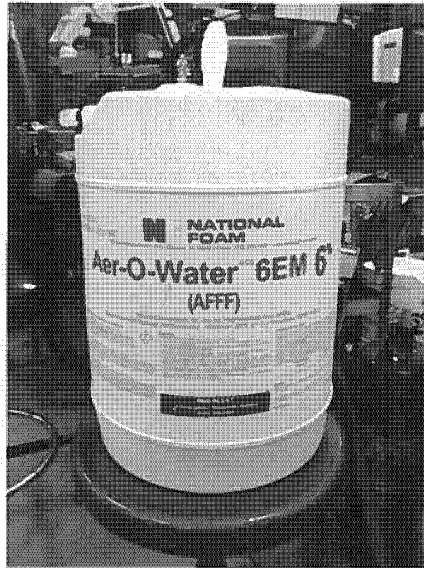
Requirement	Criteria	Value	Pass/ Fail
Stratification:			
using aged concentrate	N.O.*	N.O.*	Pass
Precipitation (vol%):			
using aged concentrate	≤0.05	N.O.*	Pass
Foamability using aged concentrate(average of two measurements):			
Fresh Water Expansion Ratio	≥5.0	7.9	Pass
Fresh Water Drain Time (minutes)	≥2:30	5:51	Pass
Salt Water Expansion Ratio	≥5.0	7.5	Pass
Salt Water Drain Time (minutes)	≥2:30	5:40	Pass
Film Formation:			
from aged concentrate, ½ strength, fresh water	no ignition	no ignition	Pass
from aged concentrate, ½ strength, salt water	no ignition	no ignition	Pass
Fire Performance:			
Aged Concentrate, fresh water			
Extinguishment time (s)	≤30	28	Pass
Burn back time (s)	≥360	589	Pass
Aged Concentrate, salt water			
Extinguishment time (s)	≤30	29	Pass
Burn back time (s)	≥360	524	Pass

Paragraph 3.4 Fire Performance

	Type 6 requirement	Type 6 Value	Pass/ Fail
28 ft² Extinguishment Time (s)			
Fresh Water ½ strength	≤45	39	Pass
Fresh Water full strength	≤30	25	Pass
Salt Water ½ strength	≤45	36	Pass
Salt Water full strength	≤30	29	Pass
Salt Water Quintuple Strength	≤55	31	Pass
Burn Back Time (s)			
Fresh Water ½ strength	≥300	410	Pass
Fresh Water full strength	≥360	605	Pass
Salt Water ½ strength	≥300	487	Pass
Salt Water full strength	≥360	560	Pass
Salt Water Quintuple Strength	≥200	429	Pass
50 ft² Fire Test (Salt Water)			
Extinguishment time (s)	≤50	38	Pass
Burn back time (s)	≥360	504	Pass
40 second summation	≥320	380	Pass

Additional Measurements:

- (1) – Container cap torque test results: Type 6 container 31 in/lbs.
- (2) – Total Fluorine: Aer-O-Water C6 6EM; 0.4485% (GLI Procedure E9-3)



National Aero-O-Water Type 6 Container