

Flr Rpt.

6180-843:HBP:EJJ:RLG:njs
NRL Problem 61C05-19J

22 Dec 1977

From: Commanding Officer, Naval Research Laboratory,
Washington, D.C. 20375
To: Commander, Naval Ship Engineering Center (6124B)
Subj: Qualification testing of aqueous film forming foam
liquid concentrate fire extinguishing agents manu-
factured by 3M Co.; results of
Ref: (a) NAVSHIPENGCECEN ltr 6124B/PAP, 4123/24385
Ser 1085 of 13 Jul 1977
(b) NAVSHIPENGCECEN ltr 6124B/PAP, 4123/24385 06N3,
Ser 324 of 15 Jul 1977
Encl: (1) Two copies of subject report.

In accordance with references (a) and (b), two formula-
tions of AFFF concentrates manufactured by the 3M Co. have
been tested in order to determine compliance with the require-
ments of MIL-F-24385A. A report covering this work is for-
warded herewith as enclosure (1).

FES.

Copy to: (w/1 copy of encl)
NAVSHIPENGCECEN, (SEC 6101F)
NAVSEASYS COM, (SEA 09G3)
NAVSEASYS COM, (SEA 06N3)
Naval Weapons Support Center, (Code 304E)
Crane, IN

6180-843A:HBP:EJJ:RLG:njs
21 December 1977

Subj: Qualification testing of 3M "FC-207" and "FC-780"
brands AFFF concentrate; results of

Ref: (a) Military Specification MIL-F-24385A, dtd 2 May 1977

1. Two formulations of AFFF concentrates as manufactured by the 3M Co. were submitted for testing in accordance with reference (a). One product, originally designated as FC-207A by 3M, was redesignated to FC-780 by 3M. The testing was done on Lot 501. The second product, FC-207, testing was done on Lot 502.

2. The test results obtained are summarized in Table 1.

3. From the test data, it was concluded that the FC-780 concentrate met the stipulated requirements, but the FC-207 was deficient in extinguishing the 28 ft² fire in a 3 percent concentration.

4. Both concentrates were submitted in SEPCO (Southeast Plastic Co) 5-gal pails. The torque required to remove the caps exceeded the maximum allowable, paragraph 5.1.1.1.1.

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Encl (1) to NRL ltr 6180-843:HBP:EJJ:RLG:njs
NRL Problem 61CO5-19J

TABLE I

PROPERTY		REQ'D MIL-F-24385A
3	Refractive index	> 1.3580
4	Viscosity	25° > 2 50 < 30
5	pH	7.0-8.5
6	Spreading coefficient	> 3.0
7	Foamability	
	fresh water expansion	> 6.0
	drainage time	> 2.5
	sea water exp	> 6.0
	drain	> 2.5
8	Film formation and sealability	no ignit
9	Fire performance	
9.2	28 square-foot	
9.2.1	3% fresh exting time, t_x	< 65
	burnback, t_{bb}	> 240
	3% sea t_x	< 65
	t_{bb}	> 240
SHEET 1 OF 5		

3M FC-207 ⁵²²	3M FC-780 ⁵⁰¹
1.3620	1.3584
2	2
3	4
7.5	7.5
4.6	4.1
8.4	9.9
3.2	3.8
—	10.3
—	3.7
no ignit	no ignit
156	64
113	
—	410
118	63
128	62
88-97	
92	
—	440
	440

NAVAL RESEARCH LABORATORY
FIRE SUPPRESSION SECTION
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	PROPERTY		REQ'D MIL-F-24385A
3.9.2.2	28 ft ² 6% fresh	t _x	< 45
		t _{bb}	> 320
	6% sea	t _x	< 45
		t _{bb}	> 320
3.9.2.3	50% sea	t _x	< 55
		t _{bb}	> 100
3.9.3	50 square-foot 6% sea	85% ext, t ₈₅	< 40
		t _{bb}	> 240
		Σ ₄₀	225
	SHEET 2 OF 5		

3M FC-207 ⁵⁴²	3M FC-780 ⁵⁸
38	38
445	485
—	32
—	410
—	48
—	210
33	23
414	390
303	335

FIRE SUPPRESSION SECTION
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	PROPERTY	REQ'D MIL-F-24305A
3.9.4	1260 square-foot	
	3% sea	$t_{85} < 40$
		$\Sigma_{40} > 285$
	6% fresh	$t_{85} < 30$
		$\Sigma_{40} > 285$
	6% sea	$t_{85} < 30$
		$\Sigma_{40} > 285$
	50% sea	$t_{85} < 55$
		$\Sigma_{40} > 225$
3.10	General corrosion	
	cold rolled steel	< 5.0
	copper-nickel	< 3.0
	monel	< 1.5
	bronze	< 300
3.11	Localized corrosion	no pits
3.12	Total halides	< 100
3.13	Dry chemical compatibility	> 320

SHEET 3 of 5

3M FC207 ⁵⁰²	3M FC780 ⁵⁰
28	25
304	305
22	24
314	320
20	20
319	326
27	18
284	347
1.21	1.19
0	0
0	0
1.3	0.4
no pits	no pits
18	37
—	395

FIRE SUPPRESSION SECTION
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PROPERTY			REQ'D MIL-T-24385A
14	Stability		
14.1	spreading coeff	conc	> 3
		fresh premix	> 3
		sea premix	> 3
14.2	foamability		
	conc/fresh	exp	> 6.0
		drain	> 2.5
	conc/sea	exp	> 6.0
		drain	> 2.5
	fresh premix	exp	> 6.0
		drain	> 2.5
	sea premix	exp	> 6.0
		drain	> 2.5
14.3	film and seal		
	conc/fresh		no ignit
	conc/sea		no ignit
	fresh premix		no ignit
	sea premix		no ignit
14.4	fire performance		
14.4.1	3% conc/fresh	t_x	< 65
		t_{bb}	> 240
	3% conc/sea	t_x	< 65
		t_{bb}	> 240
14.4.2	6% fresh premix	t_x	< 45
		t_{bb}	> 320

3M FC-207 ⁵¹²	3M FC-780 ⁵⁰¹
—	3.34
—	4.37
—	4.43
8.0	9.7
3.1	3.7
—	8.8
—	4.6
—	8.6
—	3.5
6.9	10.2
3.7	4.8
no ignit	no ignit
—	no ignit
—	no ignit
no ignit	no ignit
124	65
131	64
—	405
—	412
—	56
—	430
—	29
	570

SHEET 4 of 5

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FIRE SUPPRESSION SECTION
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PROPERTY		REQ'D MIL-F-24385A
3.14.4.2.	continued	
	6% sea premix t_x	< 45
	t_{bb}	> 320
3.14.5	stratification	
	conc	none
	fresh premix	none
	sea premix	none
3.14.6	precipitation	
	conc	< 0.05
	fresh premix	< 0.05
	sea premix	< 0.05
3.15	Compatibility	
	See Attached Sheets	
3.16	Environmental impact	
3.16.1	toxicity	> 1500
3.16.2	BOD ₂₀ ultimate	< 500K
3.16.3	chemical oxygen demand, COD	< 500K
5.1.1.1.1	Cap removal torque	< 50
	Fluorine content, percent	not req'd

3M	3M
FC207 ^{SOL}	FC780
36	42
485	480
none	none
none	none
none	none
none	none
none	none
none	none
none	none
none	none
> 5000	> 5000
334	314
338.3	318.4
—	55-10
0.660	0.700

SHEET 5 of 5

[illegible]

[illegible]

[illegible]

[illegible]

FIRE SUPPRESSION SECTION
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33/33/33 Nat'l / Ansul / FC-780 501			CONC	CONC/ FRESH	CONC/ SEA	FRESH PREMIX	SEA PREMIX
3.15	Compatibility (all samples aged)						
3.15.1	viscosity	> 2.0	2.2				
3.15.2	spreading coefficient	> 3.0		5.29		5.00	4.91
3.15.3	foamability						
	exp	> 6.0		9.2	6.5	6.0	6.7
	drain	> 2.5		4.2	4.3	3.0	4.5
3.15.4	film and seal	no ignit		no ignit	no ignit	no ignit	no ignit
3.15.5	fire performance						
	t_x	< 45		23	33	42	35
	t_{bb}	> 320		410	540	510	570
3.15.6	stratification	none	none			none	none
3.15.7	precipitation	< 0.05	none			none	none