

FIREFIGHTING FOAM

TESTING: Passing vs Performing

Foam chemistry today is directed toward very distinct goals. Foam products are manufactured for application on various fire types and product chemistry, for environmental protections, and with application specific factors in mind.

Some very distinct business factors also affect foam design. These include production costs, marketability, and budgetary constraints of potential client groups.

All firefighters should also be aware of the impact that laboratory testing has on foam manufacturing. Does testing produce better and better foam products? Do standardized testing criteria challenge foam chemistry — pushing foam products to excel?

Most laboratory testing criteria focus on minimum standards. Some laboratory tests will drive product consistency regarding structural characteristics such as appearance, refractive index, density or specific gravity, pH and viscosity. “By measuring the physical characteristics, we can determine if the product has changed from when it was first manufactured,” says Joan Leedy / Laboratory Manager for the independent testing laboratory DYNE Technologies. A common problem with foam concentrate is inadvertent dilution with water. Water dilution is often the reason why the refractive index, density or viscosity is below the manufacturer's original specification.

“Another type of testing conducted by Dyne Technologies determines the performance characteristic of the

foam concentrate. The performance is determined by mixing the concentrate at its nominal concentration and measuring such things as the expansion of the foam when dispersed through a nozzle, or the time for 25% of the foam to drain back to solution,” says Leedy.



Williams' performs ongoing plunge testing of all ThunderStorm® foams.

“The difference in foam construction is based on the performance level to which the products were developed. Some foam companies do not formulate their products to put out fires. Rather, they formulate them to pass certain fire performance tests or criteria.” Mitch Hubert, ANSUL.

Industrial foams — specifically AR-AFFF class foams — brought to market are tested by standard UL 162. UL 162 protocols use a controlled extinguishment environment using Heptane — a low vapor pressure fuel that is pure in chemical structure without additives such as those associated with gasoline mixtures, and other more complex hydrocarbon flammable liquids.

It is important to note that the UL 162 is a PASS or FAIL test.

Results of UL 162 bear no indication of foam performance and efficiency. Regardless of performance or potency, a foam that extinguishes the test fire in 1 minute is viewed equally as a foam that extinguishes the fire in 2 or 3 minutes because they are all stamped as a passing grade foam.

From the perspective of the firefighter on the ground — and even the corporate procurement office— key practical components of firefighting are extinguishment time and foam efficiency. These factors affect fire brigade strength and safety, exposure potential to other structures and personnel, environmental impact, and foam stores and logistics.

An important auxiliary test that sheds light on foam performance and efficiency is the API Chevron test. This test adheres to all UL 162 protocol, while also tracking many aspects of foam performance and efficiency. In addition, various other fuels are tested along with Heptane, such as high-octane gasoline, and high-octane gasoline blends, as well as Isopropanol to test foam performance when applied other common fuels present in a refinery and/or storage environment.

These API tests reveal an interesting observation. Many AFFF foam products designed for industrial fire related emergencies involving hydrocarbons and alcohol based products

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93 OCTANE GASOLINE -- 3% PREMIX -- FOAM APPLICATION RATE=0.06 gpm/sq ft - TYPE III APPLICATION

[Note: Williams F-601A (Ansul Production) Tested at 1% Premix]

Results Listed in order of Fastest to Slowest Extinguishing Time

Test	Concentrate	Temperature (°F)				Control (min:sec)	Extinguish (min:sec)	First Torch	Second Torch	10 sq. ft. Burnback Test		Foam Quality		Pass/Fail
		Premix	Air	Water	Fuel					Area (sq. ft.)	Notes	Exp	1/4 DT (min:sec)	
August 2001	Williams F&HC - Thunderstorm ATC F - 601A ATC 1X3 Lot W111 (Ansul Production) Tested at 1%	70	72	64	60	0:51	1:14	No Ign	No Ign	Self Ext	Flashover 13:40 to 14:04. Self-extinguishment at 15:34; transitory flashover & candel to 16:04.	4:70	3:25	Pass
15 Feb-01	National Foam - Univ Gold 1 x 3 AR AFFF Lot # 1004 1/01WC	53.6	60	51.2	76.7	1:50	2:30	No Ign	No Ign	Self Ext	Walkover 14:00 - 15:45. Self Extinguished at 15:45.	6:41	11:10	Pass
16 Feb-01	Verde Environmental, Inc. Micro-Blaze Out "Plus" Lot # 010119	54.3	64	51.2	67.4	1:43	2:33	No Ign	No Ign	Self Ext	Walkover 14:00 - 14:55. Self Extinguished at 14:55.	5:50	5:15	Pass
10 Feb-01	Ansul - Ansulite 3 x 3 Lot # LV 8014	61.3	62	56.3	83.5	2:03	2:44	No Ign	No Ign	Self Ext	Walkover 14:00 - 15:06. Self Extinguished at 15:06	6:67	9:04	Pass
12 Feb-01	Buckeye - 3% - 3% AR AFFF (BFC-33) Lot # 70003	59	51	52.6	66.2	1:52	2:46	No Ign	No Ign	Self Ext	Walkover 14:00 - 15:42. Self Extinguished at 15:42.	6:52	12:55	Pass
14 Feb-01	Angus - Tridol ATF 3 x 3 Batch # 1210/01/x	60	63	52	79	1:50	2:57	Ign*	Ign*	10 @ 17:45	Walkover 14:00 - 15:36.	5:82	8:00	Fail
13 Feb-01	*** Williams F&HC - Thunderstorm ATC F - 601/ ATC Plus F Lot # J11L	59.3	52	51.8	74	1:38	2:45	No Ign	No Ign	10 @ 16:55	1st walkover 14:00 - 14:35. 2nd walkover 15:35 - 16:30.	5:20	5:55	Fail
9 Feb-01	Chemguard - 1% /3% AR AFFF C-133 Batch # 011701A	61.4	70	54	83.8	1:53	2:49	Ign*	No Ign	10 @ 16:30	Walkover at 14:00 - continued burning until 10 sq. ft. at 16:30.	5:83	9:21	Fail
11 Feb-01	Akron - Style 950 Pyrocool FEF Lot #01-84	57.2	42	51.4	67.8	2:25	3:16	Ign* See Notes	No Ign	10 @ 15:55	Walkover 14:00 - continued burning to 10 sq. ft. at 15:55.	4:18	2:12	Fail

Notes: *** Williams Thunderstorm F-601A (Ansul Production) replaces F-601/ATC Plus F which is no longer commercially available Feb-01 results are from Chevron testing at Buckeye Fire Equipment Company; Aug-01 tests were conducted at Ansul Fire Technology Center.

1. First torch test was conducted between 4:30 and 5:00 for all tests.
2. Second torch test was conducted between 11: and 11:50 for all tests.
3. Failing results listed in order of longest to shortest time to 10 sq ft burning

Figure 1

— and given a **PASSING** grade by the UL 162 — fail to extinguish fires during testing! Many other products perform very closely as they are tracked for control and extinguishment times and burnback performance during testing.

There is one exception, however ... ThunderStorm® ATC AR-AFFF. ThunderStorm is a performance based foam designed with gasoline and blends in mind. ThunderStorm 1x3 performance stands out when tracked in the API test, performing 100% better than the nearest competitor — extinguishing gasoline fires in half the time, and performing three times better when tested on blended fuels!

When 3M withdrew from AFFF foam manufacturing, Williams Fire & Hazard Control challenged the foam industry to build a superior AFFF foam that would be effective on both hydrocarbons and alcohols with proportioning requirements of 1% for hydrocarbons applications. The protocol developed for this evaluation process utilized the 3M foam concentrates as the benchmark. Products were tested on high-octane gasoline and had to meet or exceed the 3M Light Water ATC performance. The

severity of most large-scale industrial fire related emergencies easily outstrips the minimum requirements needed to be acceptable in the eyes of a laboratory.

Over 50 separate formulations offered by seven of today's top foam manufacturers (3 companies offering 12 formulations each) were tested during this intense search for the best foam concentrate. This thorough evaluation program led to a relationship between Williams Fire & Hazard Control and ANSUL. Together, Williams and ANSUL built ThunderStorm to fulfill field performance requirements based on 25 years of some of the meanest, most dangerous flammable liquid fires known to industry. The result — ThunderStorm far exceeds the performance required by UL 162. It was also formulated to pass stringent stability requirements established by Williams' own "Real World Plunge Test".

Those who make a living as firefighters, as well as protect the lives of firefighters around them will want to have the most potent blend of foam available. Greater confidence of fast knockdown, control, and extinguishment of any volatile industrial fire results in immeasurable benefits to the firefighter.

The magnitude of the increased performance of ThunderStorm can be seen when reviewing API test results. (Figure 1) In all cases, the ThunderStorm extinguished the UL fire more quickly than the other products and, also, consistently had longer burn back times than the other products.

ThunderStorm 1x3 affords many advantages never seen before in industrial firefighting. As stated, performance is unsurpassed creating a safer and much more effective response effort.

1% proportioning allows for procurement, storage, staging, application, and disposal of fully one-third (1/3) the amount of foam compared to 3 x 3! These proportions must be considered when assessing foam costs and logistics.

Since introducing ThunderStorm in 2003, Williams and ANSUL have also developed a sister product ... T-STORM.

T-STORM, initially developed primarily with training in mind, is positioned as a relative competitor with other foam products that perform below ThunderStorm's potency.

Actual raw materials used in the formulations of T-STORM and ThunderStorm are identical (fluorosurfactants, hydrocarbon surfactants, solvents and polymers). The difference is in the relative use level of each of the raw materials. The T-STORM products have less of the raw materials than do their ThunderStorm counterparts. This positions the T-STORM product in the same general price range as other foam products that were formulated merely to pass UL 162.