Foam Lines

Combat Support Products
Division Of Cottrell Associates, Inc.

NATIONAL FOAM
Factory Agents Since 1988

Dan Tyrrell / Jim Cottrell - 10.2020 - Rev 1.2022

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NFPA 11 Vs. NFPA 18 - Time To Get The Facts

Matters of fact: About half of fire service runs to class B events are un-ignited. About 80% of foam used at fire department operations is at un-ignited spills or post fire security.

Often a crash with an ignited spill will burn off at about ⅛" a minute. We define a spill fire as one inch or less in depth. Do the math - in eight minutes you're likely out of fuel. To our way of thinking, un-ignited gasoline jobs are more scary than fires and could end very bad should they ignite while you are disentangling casualties or plugging the hole. Un-ignited spills require a visible blanket and should be tested with LEL gas detectors to insure operational security.

The primary difference between NF's Universal F3 Green 3% Synthetic Fluorine Free Foam and NF's Knockdown Class A/B Fluorine Free lies in the fact that NFPA 18 Wetting Agents (Knockdown, F-500®, NovaCool® and FireAde®,) have a single fire test listing on heptane at 10 gpm, no alcohol or gasoline tests (see photos above). Same test is 2 gpm for AFFF and 3 gpm for synthetic fluorine free air-foams on heptane and slightly higher on ethanol/ gasoline blends, on which wetting agents are not tested.

At the moment, there are two ways the fire service can go in terms of NFPA standards and approvals for fluorine free foams. Most well informed fire department hazmat types depend on NFPA 11, Standard for Low, Medium, and High expansion Foam, AKA the Air Foam Standard which is tested under UL 162 GFGV protocols for guidance on foam concentrate, proportioning and appliance selection for storage tank fires, process and transportation spills. Moreover, your State Fire Code refers to NFPA 11, not NFPA 18 for extinguishing systems where class B fuels are in process, storage or transportation.

Some fire departments rely on NFPA 18, Wetting Agents, which are indeed fluorine free and use on class A jobs or the rare, diesel or gasoline spill. They falsely believe they'll have success where the fuel is gasoline. They never saw a sales demonstration using straight gasoline in a pan with no water bottom and is why we write this piece.

Generally, Wetting Agents are sold on the strength of parking lot or online video demonstrations in pans with gasoline goosed diesel fuel. KoolAid will put out that fire if fuel temperature is reduced to 130 degrees. Gasoline needs to be cooled to -49 °F (45C), can't do that with water.

Wetting Agents have an American National Standards Institute and Underwriters Laboratories 162 test protocol, which is UL 162 GOHR, very different than UL 162 GFGV as referred to by NFPA 11. Although both GOHR and GFGV test protocols use heptane to simulate a range of hydrocarbon fuels, this is where the similarity ends in terms of the two test protocols.

NFPA 18 Wetting Agents (industrial strength degreasers or detergents) rely on mixing strong industrial strength detergents and water with ignited heptane. This is why sales demonstrations use an otherwise unsafe plunging technique in an effort to blend the detergent with diesel fuel mixed with a little gasoline. If two inches of gasoline with no water bottom were substituted in the test pan for the diesel or heptane, the fire would not likely extinguish, and more likely overflow the pan and is why I encourage fire department officials and dealers to test any agent they intend to change to on the more likely, real world circumstance of E-10 gasoline with no water bottom or diesel mixes.

Test Fuels
Heptane, a hydrocarbon is a fairly docile fuel in terms of volatility compared to E-10 or E-15 gasoline, now blended in northern latitudes with butane in winter months to raise volatility (vapor pressure) which is twelve times greater than heptane. Both Heptane and gasoline are hydrocarbon fuels defined by NFPA 30 as "flammable liquids" because both have flash points below 100 °F (38 °C). Combustible fuels are those having flash point above 100 °F (38C) and is why some say fluorine free Wetting Agents are a good choice because they have hydrocarbon fuel listings. They do, but do not pass the gasoline or ethanol test, which are the more likely fuels fire departments will see in the street. NFPA 18 Wetting Agent test link 1 NFPA 18 Wetting agent test link 2.

In UL 162 GOHR Wetting Agent test, the mechanism of extinguishment is mixing or blending of fuel, water and agent, technically known as emulsifying. It works on heptane but not likely gasoline. Although the test fuel for both Wetting Agents and Air Foams is heptane, technically termed a flammable hydrocarbon fuel.

Moreover, fuel spills soaked into terrain will not mix as they must in a test pan and is why an air excluding class B blanket is, to our way of thinking, the safest application measure. In this connection Universal F3 Green has a two to three hour quarter life depending on fuel, water temperature and finished foam quality. Note: Most wetting agents do not foam and show no evidence of security.

NFPA 11 Air Foams rely on shutting off oxygen by way of a fast spreading foam blanket on hydrocarbon as well as polar solvent fuels (alcohols); they must hold for long periods against a torch test be they the now banned AFFFs or approved Synthetic Fluorine Free Air Foams; soon to be known in the 2021 edition of the NFPA 11 as SFFFs.

The Fire Service issue that concerns us is E-10 gasoline having a flash point of -49 °F (-45 C) and boiling point of +/- 110 °F has vapor pressure (volatility) nearly twelve times greater than heptane with boiling point at +200 °F . Although once ignited, both fuels take on similar energy release (burn) characteristics. Un-ignited spills, so called hot road spills possess completely different safety risks for firefighters where environmental or fuel temperature is approaching gasoline or alcohol's boiling point.

Here's where we worry about bad things happening if using a wetting agent to shut off fuel vapor because fuel must be completely mixed with water and agent. In combat, all that's likely to happen is you'll flush the fuel under an adjacent vehicle that has no fuel leak or simply wash it into a storm drain or ditch. Its our experience with Wetting Agents that diesel needs six times dilute to safe with a wetting agent and will not touch un-ignited gasoline. These are cases where a visible foam blanket needs to be maintained. Note: most wetting agents don't foam because their mechanism of extinguishment is emulsification (encapsulation).

Regarding polar solvents (water miscible fuels). Wetting agents are not effective, as their mechanism of extinguishment is mixing hydrocarbon (non-miscible) fuel and water in presence of a detergent surfactant. Irrespective of manufacturer's claims, UL certification language for wetting agents says "not for use on water miscible fuel". Water is the a wetting agent's vehicle and it will dilute water miscible fuel to a point of extinguishment. Claims of being alcohol resistant or for use on polar fuels are misleading marketing tactics. More ethanol training

Using fresh or sea water, success can be achieved by adding water to a static, contained polar solvent spill. It will require enough water to adjust polarity to the point that flame is not supported and has nothing to do with the super soap in the agent. In the case of ethanol or methanol, water dilute of four to five to one (4-5:1) will usually see success. Therefore, a 100 gallon container of ethanol will need about 400 to 500 gallons of water to extinguish its fire. Make sure the container will hold the additional water or you'll be chasing the fire all the way to Hackensack. A unconfined, running spill fire may never get to dilute requirements as the dynamics of the event will send burning fuel to places that cannot be protected before flames are extinguished.

Regarding metal fires: There are no UL or FM approved air foams or wetting agents that are suitable for class D fires. Claims to the contrary should be supported by peer reviewed scientific data, not sales literature. The good old boy endorsement network is alive on this subject with anecdotal evidence that usually doesn't pass the sniff test of professional fire protection engineers.

Be ware of products with cool in their name. Since use concentration of agent is less is 6% or less, it means 94% or more of the agent being applied is water. Water is therefore the cooling agent. Adding detergent surfactants to water does not affect water's ability to change phase, which is the basis of evaporative cooling, otherwise known as refrigeration. If the fire goes away so will the heat and smoke - hello!

Finally, Universal ^{F3} Green 3% AR-SFFF has a UL pedigree of fuel specific, fire tested listings, which include: isopropyl alcohol, ethanol, methanol and ethanol-gasoline blends up to 15% using fresh or sea water, which is not the case with any Wetting Agent that I am aware now …. 10-18-2021. We encourage you to conduct your own tests - See FD Test - Jacksonville/Orlando Nashua New Hampshire

A word about Lithium-Ion battery fires:
Sealed containers from AAA size to electric car size. All have the following in common:

Lithium-ion battery or Li-ion batteries are types of rechargeable batteries. The functional mechanisms are such that lithium ions move from the negative (anode) through an often combustible electrolyte to the positive electrode (cathode) during discharge and back again when charging.

A short will produce tremendous heat inside sealed cells allowing pressure to rise and eventually relieve, or not, causing the casement to fail allowing electrolyte, usually a combustable liquid to escape with tremendous or perhaps explosive force. The resulting pressurized fire may heat adjacent cells in a cascading effect. If electrolyte is pooled a very simple fire continues to burn, which is not likely. Extinguishing agents for burning electrolyte can be water, dry powder, CO_2 or air-foam.

The lithium component is combustible. Given enough heat it will too be part of the fire problem. Cooling, if possible will bring lithium to a more controlled state.

In a semi-sealed state the electrolyte in the +/-6000 cells of a Tesla EV will expand and discharge under pressure through the failed enclosure(s) causing a dramatic fire event that is for the most part un-controllable as cooling the battery case and individual cells is not likely, simply because access is near impossible while heating is taking place inside the container case. Decomposing cathodes may liberate oxygen, creating a runaway thermal event that isn't likely to be controlled by fire streams of any kind to include NFPA 18 wetting agent products, since 94 to 99% of finished agent is water…

For more information see UL 9540A - A test method for evaluating thermal runaway fire propagation in Battery Energy Storage Systems (BESS) and newly forming NFPA 855.