Foam System Proportioning & Testing

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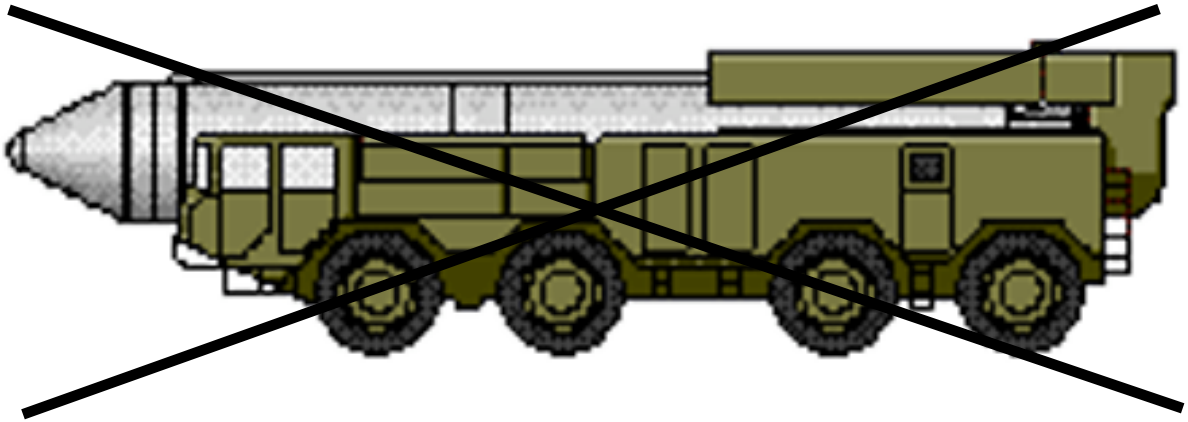
National Foam

RELAX!



This isn’t rocket science

Task Force Tips

Cottrell Associates, Inc.

Product Development, Tech Services, Manufacturing & Distribution Mgt.

National Foam

Factory Representatives Since 1988

For most FD customers, if it makes bubbles, you're good to go… NOT!

The Foam Rule Books

NFPA 11, 1901, 1911, 1145, 1150, 18, 414, 412

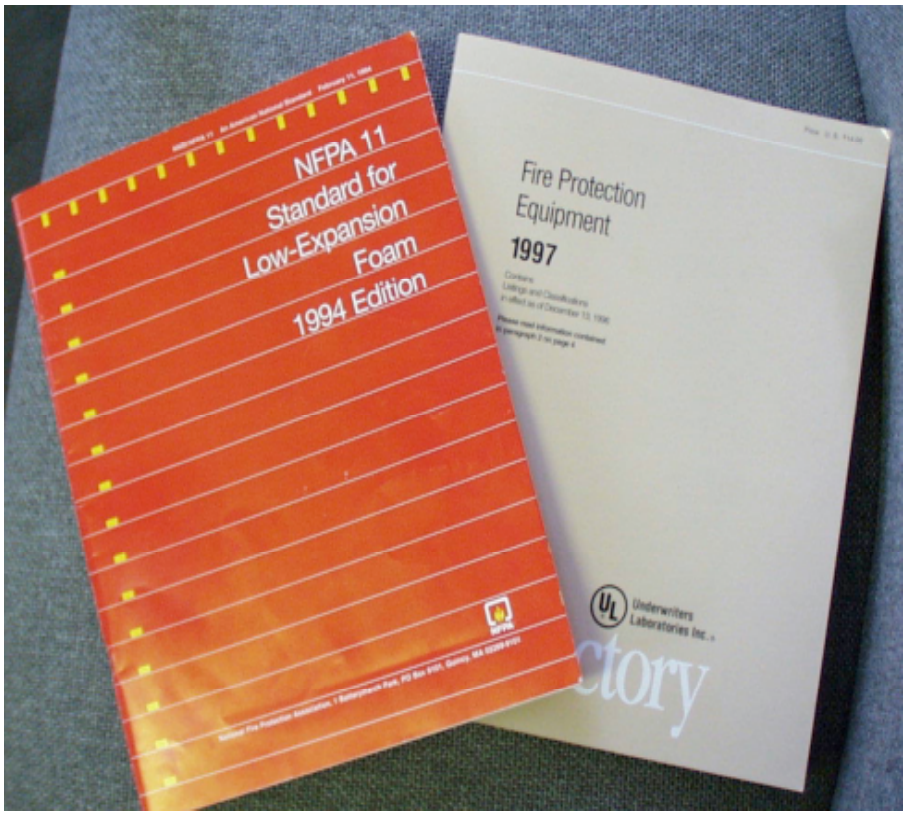
U.L. Fire Protection Equipment Directory

FAA regulations

(training)

IFSTA Principles Of Foam Fire Fighting 2nd ediion

www.ul.com



Engineered Systems

Not a crap shoot...

In the class B world, everything depends on proportioning accuracy.

At crash scenes, lives depend on proportioning accuracy.

Proportioning accuracy is mission critical in terms of extinguishing liquid fires.

Proportioning accuracy is mission critical in terms of protecting crash scene spills.

Proportioning accuracy is critical to foam use economics $$$

Class A Proportioning Accuracy

Nobody dies if your class A system proportions lean, or quits all-together…

CAFS Accuracy

On the other hand, there could be a problem if the compressor fails or the foam system stops proportioning; especially when you're inside with 70 gpm pouring from an 1-1/4 or 1-3/8" hole.

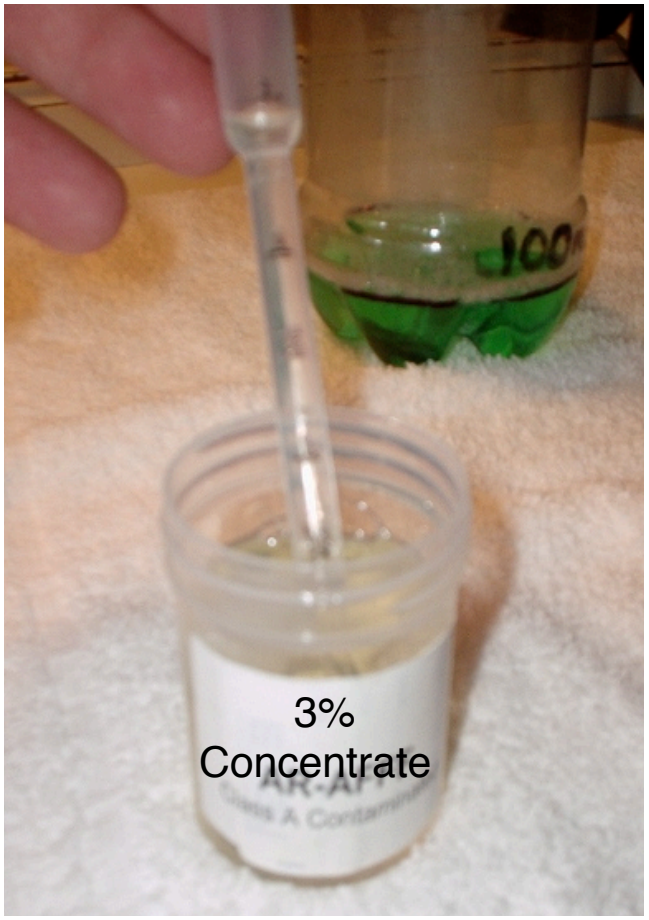
Systems Make Foam Solution

Concentrate added to water makes *Foam Water Solution*

Foam systems do this on the fly

Adding 3 ml. of foam concentrate to 97 ml. water, makes 100 ml of foam / water solution.

Make 3% Foam Solution



Draw up 3 mils. of foam concentrate using a graduated eye dropper or a plastic, medication syringe.

Add concentrate to the 97 ml. of green colored water.

Make Finished (expanded) Foam

Aerate the solution sample by vigorously shaking for about fifteen seconds. This sample has expanded to the 750 ml. line, which is a 7.5:1 expansion ratio.

More On Foam Solution

Ratios

1% - 99:1 = 99 parts water - 1 part concentrate

3% - 97:3 = 97 parts- water 3 parts concentrate

6% - 94:6 = 94 parts- water 6 parts concentrate

NFPA 1901

Foam System Solution Testing

At minimum, the foam proportioning system shall be tested annually.

The system output shall be measured to determine calibration accuracy.

NFPA 1901

System Proportioning Validation

Testing Methods.

One of the following four methods for testing a foam proportioning system for calibration accuracy shall be used:

(1) Substituting water for foam concentrate

(2) Measuring foam concentrate pump output directly

(3) Determining foam percentage by use of a refractometer

(4) Determining foam percentage by use of a conductivity meter

Validate Less than 1% - Class A

Foam Proportioning System Accuracy. (Paraphrased)

Foam proportioning shall be accurate throughout the manufacturer's stated range of flows and pressure(s). Systems designed to produce foam at less than one percent (class A for example) shall proportion foam concentrate to an accuracy of -0 to +40%.

Example: Setting 1/2% (0.5), 0.7 is allowable - Setting 0.2%, (0.28) is allowable.

Validate Greater Than 1%

Systems designed to produce foam greater than 1 percent (class B for example) shall proportion foam concentrate to an accuracy of -0 to +30%, or 1 percentage point, whichever is less.

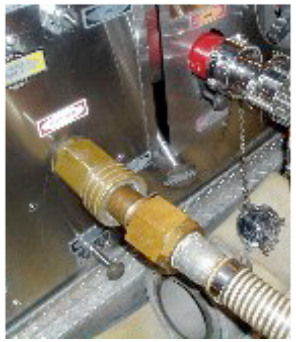
Therefore, if your system is set at 3% (0.3) it's OK if it proportions at 0.39 (4%). If at 6%, it is OK at 7%.

Solution can be rich - but no lean…

Water Substitution Method

Colored water in a graduated pail or trash can

This method relies on substituting water for foam concentrate. Where measuring how much water (by weight or volume) is drawn into the proportioning system over time.



I would add foam concentrate equivalency factors here. As foam viscosity can be cause for lean proportioning.

Water Substitution Method

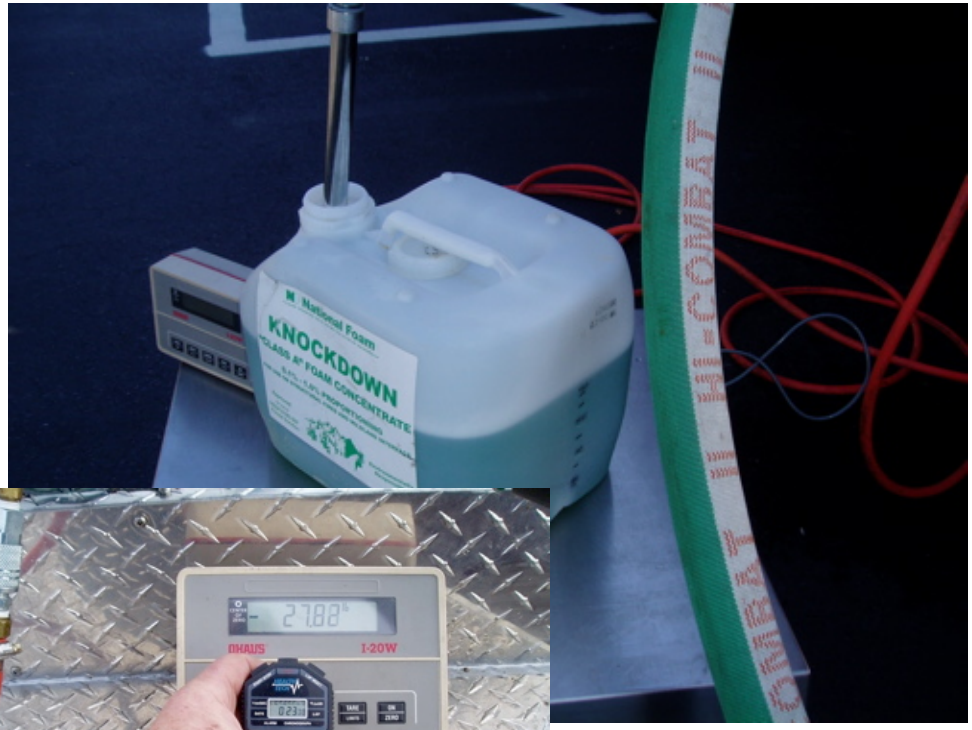
(National Foam) Foam Concentrate Equivalencies

A 500 GPM system, set at 3% will drink fifteen-gallons of water or more in sixty-seconds. If it drinks fifteen-gallons of water in a minute, it will drink about 99% of that using AFFF or Class A foam.

If using fluoroprotien foam or Alcohol Resistant, AFFF (AR-AFFF) the same system will consume about 15% less, or 85% of water's value.

Foam Pump Outlet Flow Measurement

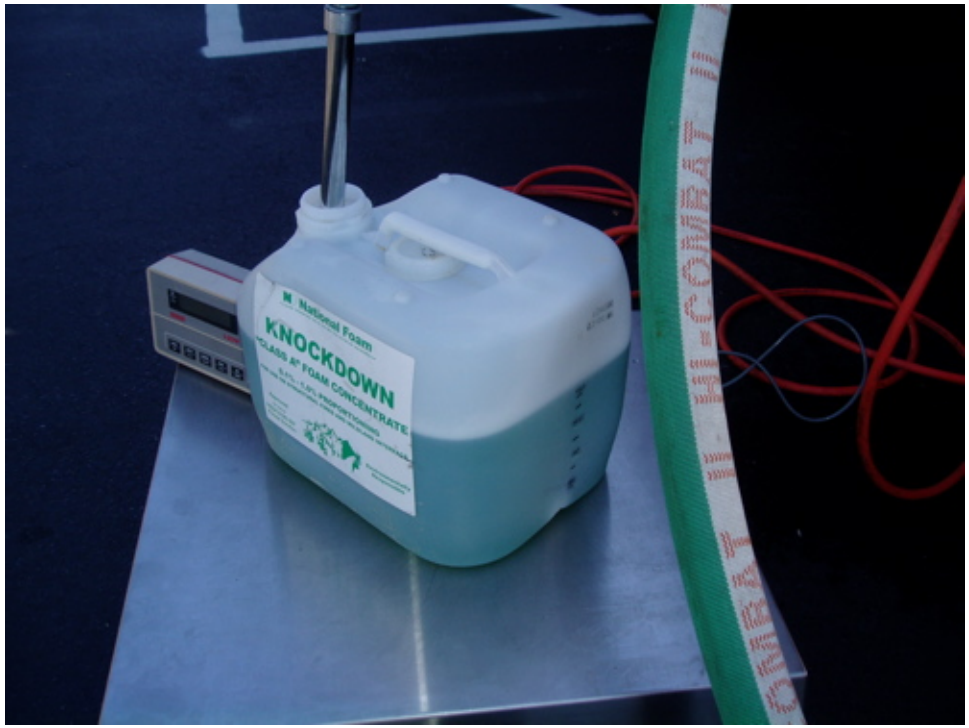
Suitable For Direct Injection Systems



A 3%, 100 GPM solution setting should discharge three gallons of concentrate in sixty-seconds. If water were in the foam tank, it might discharge slightly more than 3 GPM. I recommend viscosity equivalents be considered for fluoroprotien and AR-AFFF foam concentrate.

If using a scale to determine exact foam concentrate output, consult foam manufacturer's data sheet for your foam's weight (specific gravity) compared to water.

Foam Pump Outlet Flow Measurement



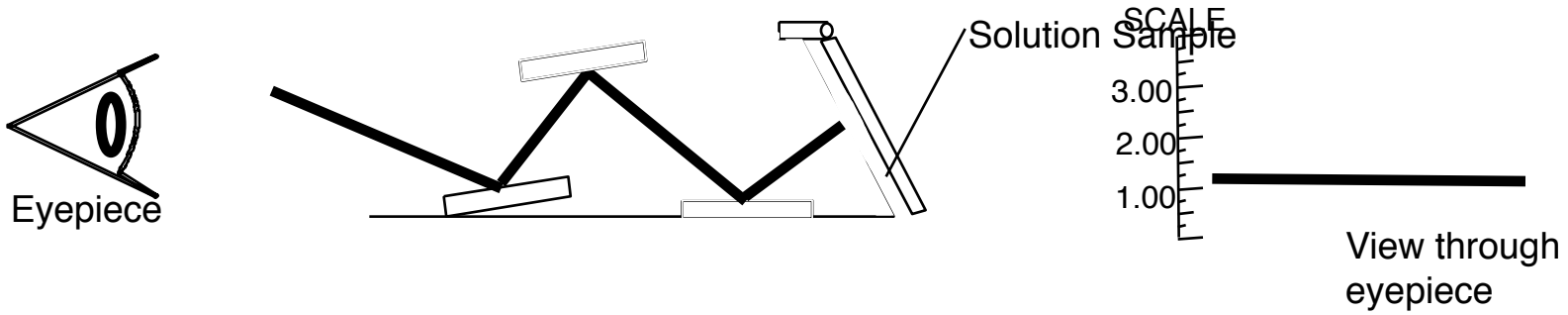
Cause for inaccuracy using this method may be due to lack of back pressure against the foam pump's discharge hose.

A foam concentrate pump in good or new condition may well perform to specification. If the pump is worn or slipping, back pressure may be a cause for lean proportioning.

A restrictor valve and pressure gauge fit on the pump's discharge hose can be helpful where tests against the water pump's discharge pressure is desired.

Refractive Index Method

A system sample compared to a bench-mark sample



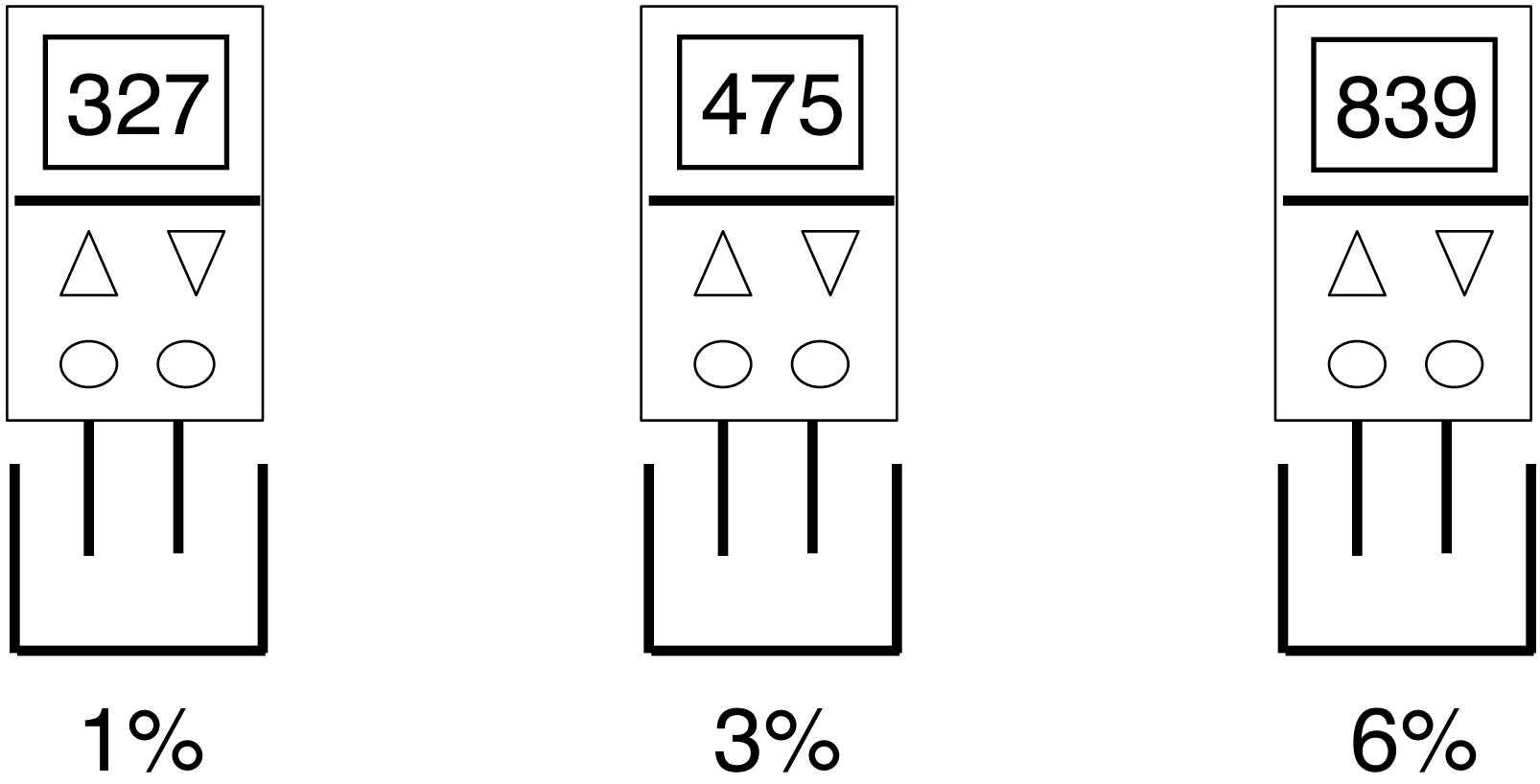
The refractometer works fine for protein based foam solutions and Mil Spec. (F24385) AFFF, as butylcarbitol is the refractive chemical in these foams.

Readings should be done with solution at 50 degrees (10 C) or higher.

Not recommended for class A, civilian AFFF and AR-AFFF's, as refractive chemicals may not be present in enough quantity to produce accurate readings.

Accurate readings are difficult achieve in solutions of 1% or less.

ELECTRICAL CONDUCTIVITY



As concentrate is added to water, solution becomes increasingly conductive.

A properly proportioned sample is compared to system discharge.

Not appropriate for solutions produced with sea water.

Down and dirty - In the field

Need:

Stop watch

Two empty, 1000 ml plastic bottles

Cylinder graduate

Marking pen

Using water measured in a graduate, mark the two bottles (as shown) at 100 - 500 - 750 and 25 mil. The 25 ml line should be at the capped end of the bottle.

Down and dirty 3% test…

Step 1

Sample from foam pail or foam tank

Add 3 ml of the foam concentrate your system will be using for the test to 97 ml. test water.

Booster tank or hydrant water.

Down and dirty 3% test… Step 2

Vigorously shake the bottle for fifteen seconds or longer. Make sure all the concentrate and water has fully expanded.

Turn it on its cap and start the watch… Note expansion ratio.

Down and dirty test… Step 3

25 ml drainage line

When 25 ml have drained to the line, stop the watch. This is the quarter drain time of the bench-mark sample. You're going to compare this to a system discharge sample in the next step.

Down and dirty test…. Step 4

Run the foam system (make foam) for at least thirty seconds at a setting that compares with the bench-sample.

Down and dirty test… Step 5

Shut down.

Bleed pressure.

Capture a solution sample from a discharge hose coupling.

Down and dirty test… Step 6

Put 100 ml of the system discharge sample into the other test bottle.

Shake till its fully expanded. Compare the system sample's quarter drain time to your bench-mark sample.

Down and dirty test… Step 7

If the quarter life is near the same (+/- 5%) as the bench sample, you're good to go.

Five-minutes is 300 seconds. Five % would be +/- fifteen seconds.

If it's less, you're lean

If it's more you're rich.

A little rich is OK

Lean is not good

Note: Although this test method is not as scientific as the tests described in the NFPA standard, it's close enough to determine if something is very wrong.

Down and dirty test… Alcohol Resistant?

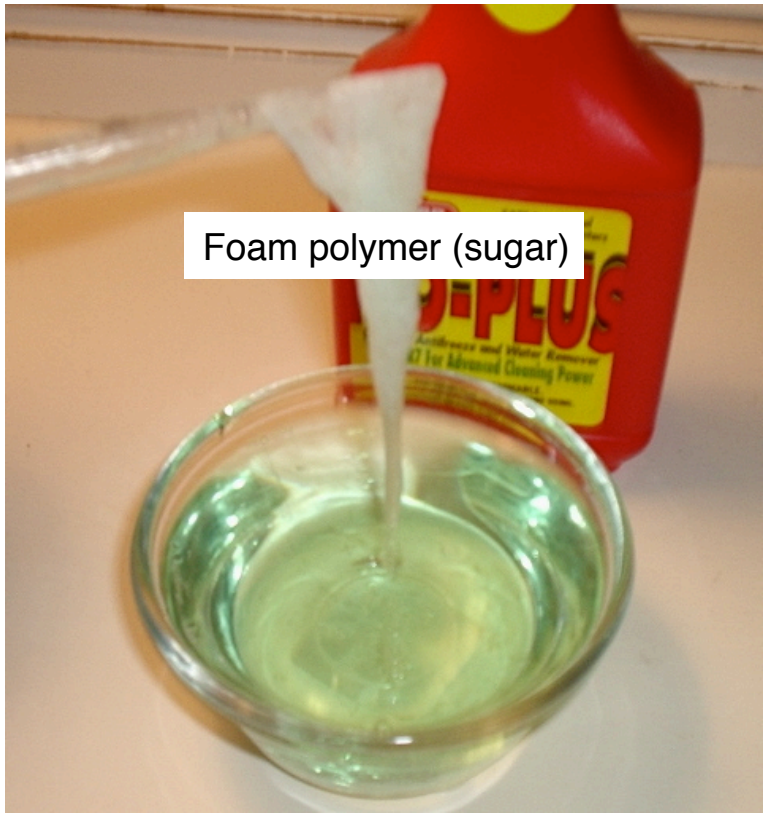
Determine your foam's ability to resist polar solvents (alcohols).

Shake the sample again, apply it to dish of isopropyl alcohol (UL's test alcohol). Isopropyl alcohol can be found as dry gas. Be sure it is isopropyl. Methyl alcohol is not as aggressive.

If the foam is disappears as you apply it, it's not alcohol resistant.

A polymeric membrane will form under alcohol resistant foam.

If the foam concentrate you measured does not have a gooey consistency, it's probably not alcohol resistant.



This (sugar) membrane (polymer) will form on alcohol if the foam is alcohol resistant.

Causes for test failure:

Contaminated concentrate. AR-AFFF loaded in regular AFFF or class A tank. A cupful can be system fatal.

Debris (dried concentrate) in the foam concentrate plumbing.

Foam tank vent clogged, or too small

Concentrate plumbing too small (viscosity issues)

Too much system back pressure (eductors)

System not installed to manufacturer's specification.

Low budget, non-listed foam concentrate

Foam Storage

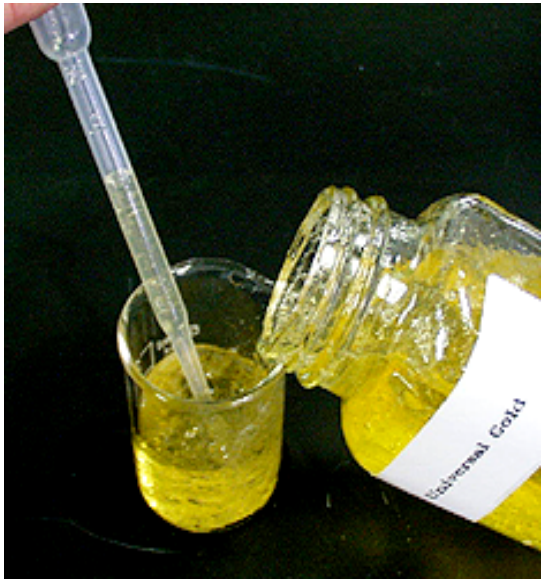
“Our foam concentrate is gelled-up”

No... That’s the way you bought it.

AR-AFFF’s are thick and viscous. The thicker they are the longer they last.

An eyedropper will lift it because it thins as it moves.

Faster it moves, the thinner it becomes.



Storing Fire Fighting Foams

Store between 35 and 120 degrees

Keep containers closed. Do not store foam concentrate in boiler rooms, out-door sheds or attics. Storage temp. range should be between 120 f and 35 f. Freezing and thawing should not harm foam.

Shelf life is indefinite as long as foam is stored in original packaging or in approved tanks.

NFPA 11 says:
Do not mixing unlike foam brands. Never mix class A foam with Class B foam. Not even trace amounts.

Accidental A or B mixing can be system fatal...

Half cup alcohol based class A foam or regular AFFF and a shot glass of AR-AFFF will do this in minutes.

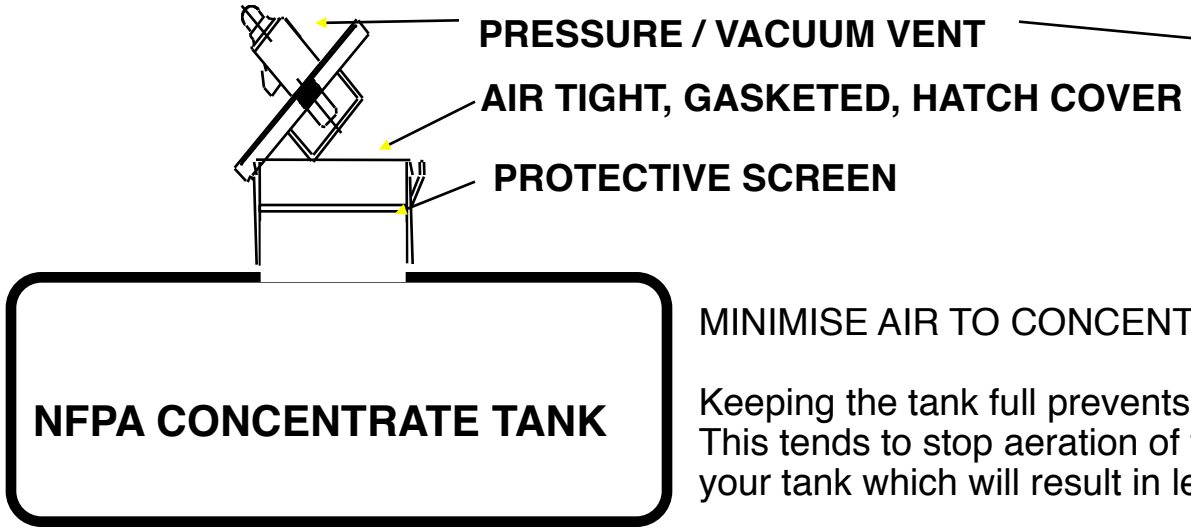
The AR-AFFF's AR gum is doing what it should - in your tank, rather than on a spill...

Accidental A or B mixing can be system fatal...

FoamPro Strainer

Apparatus Foam Tanks

Store foam as if it were latex paint.

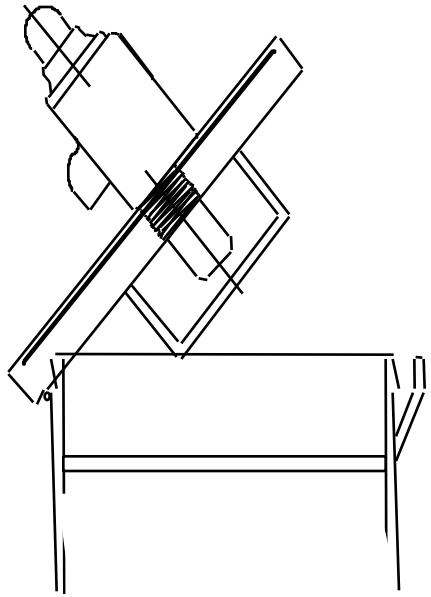


MINIMISE AIR TO CONCENTRATE INTERFACE

Keeping the tank full prevents sloshing.
This tends to stop aeration of the foam in
your tank which will result in lean proportioning.

Keep Apparatus Foam Tanks Full!

- Foam concentrate sloshing around in a foam tank will turn concentrate into a froth. The greater the air space the the worse it gets. AR-AFFF concentrate may take weeks to unfroth, if at all. This condition will cause lean proportioning.



NFPA CONCENTRATE TANK

Keep Apparatus Foam Tanks Full!

Thirty-six grams Universal Gold, 1-3%, AR-AFFF.

Left sample (shaken) proportioned 24.7% leaner than right.

Concentrate supply plumbing

Supply plumbing from foam concentrate tank to foam pump or foam eductor must be at least 3/4”

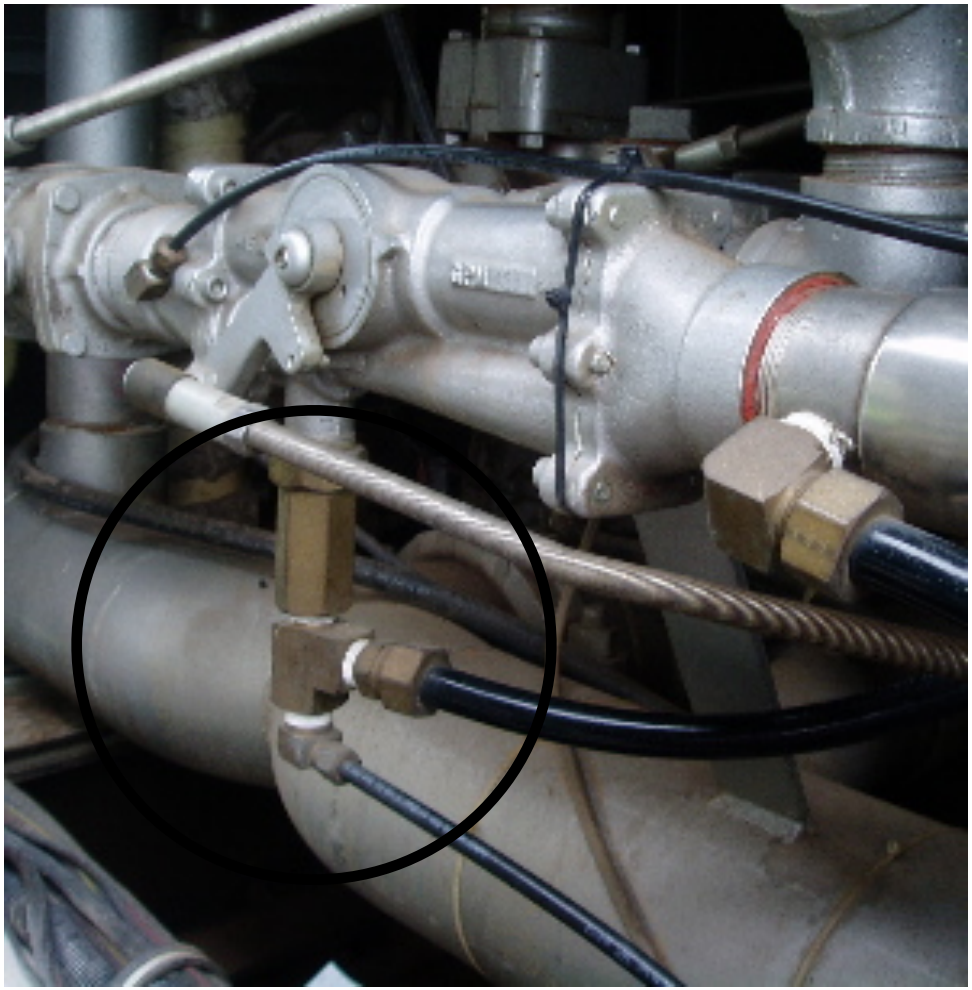
Three to 8 gpm concentrate flow, requires 1” i.d. hose.

10 to 15 gpm - 1.25”

20 to 30 gpm - 1.5”

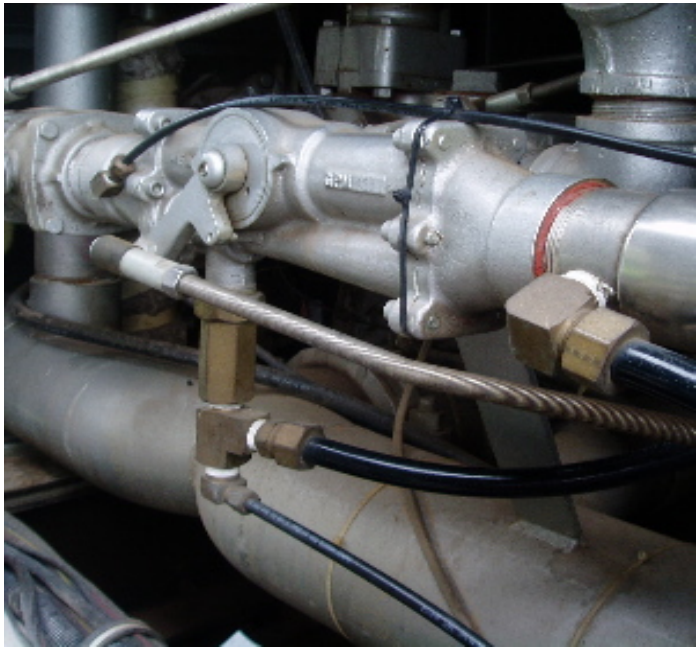
30 gpm + 2”

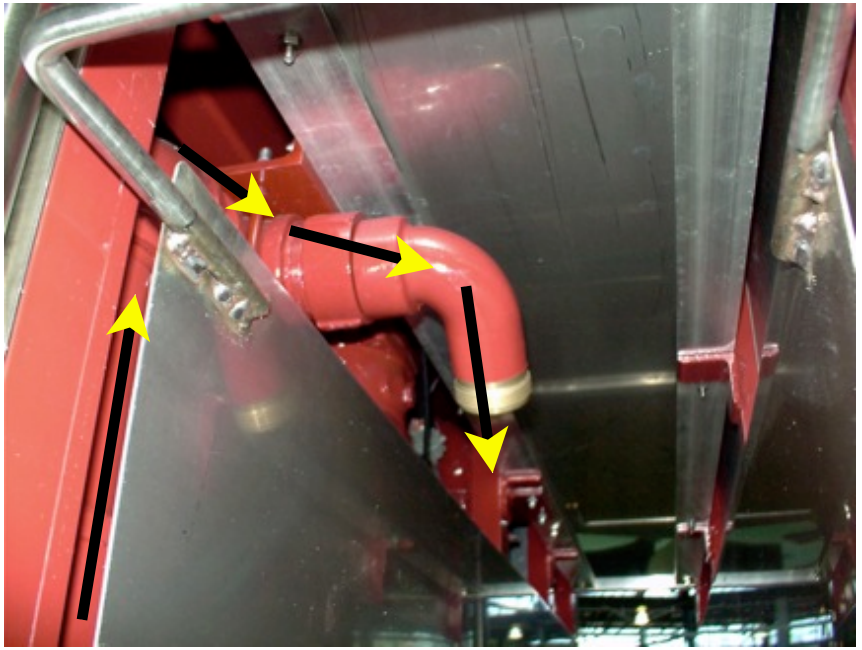
NO AIR HOSE! Compression fitting “O” rings may disintegrate over time.



My Pet Peeves:

Most onboard eductor system failures are caused by back pressure and plumbing mistakes.





Foam eductors can only stand 130 psi back pressure, or 65% of inlet pressure. A pressure gauge on the eductor outlet will show system back pressure. Green... Go. Red... No

“Our foam concentrate is gelled-up”

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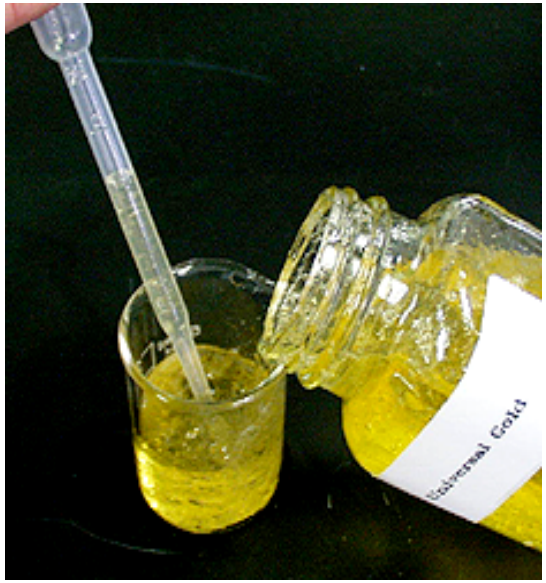

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Thank You