National Foam

Foam Lines

COMBAT SUPPORT FIRE FIGHTING PRODUCTS

CombatSupportProducts.com

Portable Foam Eductors - The inexpensive, bullet-proof alternative.

A simple, inexpensive foam eductor or self inducting master stream nozzle is an accurate, bullet-proof alternative to complex and often maintenance intensive multi-discharge foam firefighting systems. Eductors have no moving parts, no flow meter interfaces, pumps, motors or electrical requirements. Foam eductors can work within UL accuracy with all known fire fighting foams, wetting agents and specialty chemicals - as long as a the first commandment of foam eductor operations is not broken.

"Thou shalt not have too much back pressure, lest ye don't make foam"

Basically, a foam eductor is a jet pump which relies on a high-speed water jet to provide suction energy

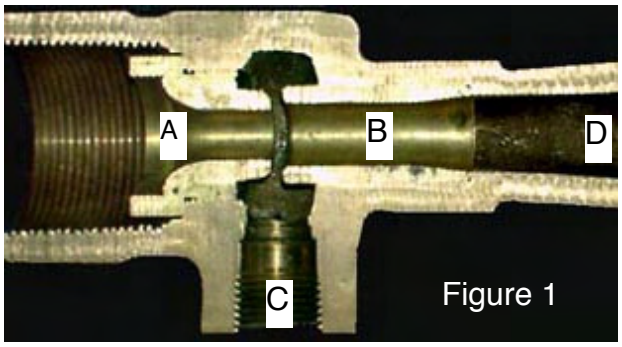

Figure 1

This foam eductor cross section shows two nozzles aligned front to back in a common space. As water passes from nozzle A to nozzle B it jumps across a narrow gap causing a strong suction effect. The gap is vented by way of casting or machined space to the pick-up tube inlet, C. As long as water speed across the inner nozzle gap does not slow below 65% of inlet pressure it will continue to draft foam concentrate into the stream, creating a foam/water solution.

Self-Flushing eductor designed for very viscous alcohol type foams.

If discharge is interrupted at the outlet of the eductor (D), a check valve will prevent water back-flow through the gap, into the pickup hose and on to the foam concentrate supply.

At the pickup tube connection (C) there is often an adjustable choke (meter) and check valve. When the choke is wide open, proportioning rate is 6%, which is 94 parts water and 6 parts foam concentrate, a 94:6 ratio. When half open it proportions 3%, a 97:3 ratio. Modern fire service eductors have metering capability from 1/4% through 6%, accommodating both class A and B foams.

65% Velocity Rule

When operating a fire service foam eductor at 200 psi, water velocity at the inlet smoothbore (A) is 116 mph. If eductor discharge (D) is slowed by a partly closed nozzle, too long or a kinked hose can causes water flow across the gap to slow. Too slow is 130 psi (70 mph) - the eductor begins to stops drafting.

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The first commandment of foam eductor operations was the inspiration for Combat Support Product's, GoGauge®. This gauge, when screwed on an eductor's outlet will indicate downstream back pressure. When it reaches the red zone one can expect foam induction to stop. If the hose is too long, the wrong size or nozzle flow setting too low, the GoGauge® says so. This addition makes eductor operations pretty much a no brainer.

Eductor Flow Rate

What determines eductor flow is the eductor's inlet nozzle diameter. In the case of a fire service-type foam eductor as seen in figure 1 on the previous page, the inlet nozzle of the 95 gpm eductor pictured is slightly less than 1/2 inch. A 125 gpm eductor has a slightly larger smoothbore, and 350 gpm eductor has an inlet nozzle slightly less than one inch (0.90").

Examples of the 65% rule using the figure 1 eductor, set for 3% at various inlet pressures.

100 psi inlet - 65 psi is allowable outlet back pressure (nozzle plus hose and elevation losses). At 100 psi, this eductor inlet nozzle (A) will flow will flow 67 gpm and proportion at near 4%.

150 psi inlet - 97 psi is allowable outlet back pressure (nozzle plus hose and elevation losses). At 150 psi, this eductor inlet nozzle (A) will flow will flow 87 gpm and proportion a little rich.

200 psi inlet - 130 psi is allowable outlet back pressure (nozzle plus hose and elevation losses) At 200 psi, this eductor inlet nozzle (A) will flow will flow 95 gpm and proportion accurately.

250 psi inlet - 163 psi is allowable outlet back pressure (nozzle plus hose and elevation losses). At 250 psi, this eductor inlet nozzle (A) will flow will flow 106 gpm and proportion a little lean.

Using the 65% rule, distance from a 95 gpm eductor to a foam nozzle is a function of the back pressure. Fire ground hydraulics dictates that a 95 gpm foam stream will flow through 200 ft. of 1.75" hose with a 100 psi nozzle when 130 psi is at the supply end of the hose. If using a 75 psi nozzle, the pressure requirement is 105 psi. Remember, these pressures would register as back pressure on the GoGauge®. If using 2" hose, the distance could double, because 2" hose has half the friction loss of 1.75".

In the case of a 350 gpm eductor, the rule is the same. Therefore, a dismounted deck gun with a 75 psi nozzle, using 2.5" hose can be fed 100 ft.; with 3", 400 ft; with 4", 2200 ft, and 5" ... 7300 ft.

Without a nozzle the discharge hose can be used to fill a folding tank or an engine's water tank. The distance from eductor outlet to the fill site using 1.75" hose would be near 850 ft. Using 2" hose it would be 1700 ft.; using 2.5" hose it is 5200 ft. This is because nozzle pressure isn't needed at the fill site.

Foam Eductor Operation Pointers

Solution Transit Time

Transit time is the time it takes foam solution to get from eductor outlet to nozzle inlet. With 200 ft of 1.75" hose, at 95 gpm, it will take about 18 seconds. A 60-gpm eductor can take as much as thirty seconds for the solution to get to a nozzle. The larger the hose, the longer it will take. This is true for on-board foam system too. So, whatever setting changes you make, it will take half a minute or more before you notice change at the nozzle. Never charge the hose with water before putting tube in the pail.

Eductor Start-Up Steps.

1. Connect eductor to a convenient discharge.There is no technical reason to have eductor in a hose line other than extending distance when long stretches are needed. Never throttle eductor supply discharge, use pump speed throttle.
2. Put pick-up hose in foam pail or connect it to an onboard foam tank eductor connection.
3. At idle, fully open discharge and fill hose with solution. It works at idle pressure because the eductor feels no back pressure, because you are discharging into an empty hose.
4. Once hose line is full, throttle to 200 psi.

No transit time issues if done in this order, and nozzle will have solution ready to go when operator opens the nozzle bale.

Proportioning Accuracy - A Major Safety Issue At Crash Scenes

Just because you're making bubbles does not mean they will have enough body to hold down gasoline vapors on a hot road spill. Industry standards allow proportioning as much as one full percent rich, no lean. Lean proportioning means fires may not go out as fast as you want, if at all. Lean means finished foam disappears (drains) way too fast while trying to maintain vapor security at crash scenes. **Caution: Never use class A foam for this task.**

During the summer, unignited road spills can get very hot, resulting in dangerously high vapor pressure. **Here is where I proportion 3% foam at 6%.** Doubling up on concentrate should double your foam staying power (quarter life).

Since foam concentrate viscosities vary from type to type it would be wise to test all your eductors for accuracy. AR-AFFF's (ATC's) are the most viscous. My experience with older foam eductors and AR-AFFF has not been good, they tend too be lean. Proportioning accuracy can be tested using water. **Remove pick-up tube strainers before testing.** Equivalency numbers for Universal Gold is 15%. Your eductor will drink +/- 15% less foam concentrate than water. How to test is at www.CombatSupportProducts.com.

Flushing

After making foam, put the pick-up tube in fresh and flush for a minute. If using a TFT push-button flush foam eductor - shut the nozzle, or cap the eductor; set pump pressure less than < 50 psi; press the red button for a few seconds. If necessary, throttle the discharge gate to get pressure low enough to press the button.

Eductor on pump discharge, not 50' down the street... Try it!

Long term vapor suppression require properly proportioned solution.

Eductor Firefighting Capability - The Rule of Ten

Liquid firefighting is done by the square foot. A 100 gpm foam eductor will handle a 1000 sq. ft. oil spill fire when using AFFF, and 60% less when using protein base foams. Multiply your eductor flow rate by 10 and you have the size fire you can manage. If up against alcohol multiply by 5 when using alcohol resistant foam (AR-AFFF). You should have a 15 minute supply of foam and water on hand for each device you bring to the party. The table below will come in handy for calculating distance and how much fire you can handle and how much foam it will drink..

Foam Eductor Distance & Fire Fighting Table

Foam Eductor GPM @ 200 PSI	Fire Control size AFFF & AR-AFFF	Concentrate flow GPM	Nozzle or Hose outlet psi	Distance Hose I.D. 1.5"	Distance Hose I.D. 1.75	Distance Hose I.D. 2	Distance Hose I.D. 2.5	Distance Hose I.D. 3	Distance Hose I.D. 4	Distance Hose I.D. 5
				LEVEL GROUND		LEVEL GROUND		LEVEL GROUND		
60 gpm	Hydrocarbon 600 sq ft	1%= 0.6	100	300 ft	700 ft	850 ft	3300			
	AFFF & AR-AFFF	3%= 1.8	75	600 ft	1250 ft	1550 ft	6100			
	Polar Solvent 300 sq ft	6%= 3.6	50	850 ft	1850 ft	2200 ft	8800			
			10	1300 ft	2800 ft	3400 ft	13300			
95 gpm	Hydrocarbon 950 sq ft	1%= 1.0	100	100 ft	200 ft	350 ft	1200 ft	3300 ft		
	AFFF & AR-AFFF	3%= 3.0	75	250 ft	350 ft	650 ft	2200 ft	6100 ft		
	Polar Solvent 425 sq ft	6%= 6.0	50	350 ft	500 ft	1000 ft	3200 ft	8850 ft		
			10	550 ft	800 ft	1500 ft	4800 ft	13300 ft		
125 gpm	Hydrocarbon 1250 sq ft	1%= 1.25	100	50	100	250	750	1900		
	AFFF & AR-AFFF	3%= 3.75	75	175	200	450	1400	3500		
	Polar Solvent 625 sq ft	6%= 7.2	50	250	300	650	2200	5100		
			10	400	500	1000	3000	8000		
250 gpm	Hydrocarbon 2500 sq ft	1%= 2.5	100				200 ft	480 ft	3000 ft	
	AFFF & AR-AFFF	3%= 7.5	75				350 ft	880 ft	5500 ft	
	Polar Solvent 1250 sq ft	6%= 15	50				500 ft	1280 ft	8000 ft	
			10				800 ft	1920 ft	12000 ft	
350 gpm	Hydrocarbon 3500 sq ft	1%= 3.5	100				150 ft	250 ft	1250 ft	4800
	AFFF & AR-AFFF	3%= 10.5	75				250 ft	450 ft	2300 ft	8800
	Polar Solvent 1750 sq ft	6%= 21	50				400 ft	650 ft	3300 ft	12800
			10				600 ft	1000 ft	5000 ft	20800
500 gpm	Hydrocarbon 5000 sq ft	1%= 5	100				50 ft	100 ft	600 ft	2000 ft
	AFFF & AR-AFFF	3%= 15	75				100 ft	200 ft	1100 ft	3600 ft
	Polar Solvent 2500 sq ft	6%= 30	50				100 ft	300 ft	1600 ft	5300 ft
			10				200 ft	450 ft	2400 ft	8000 ft

NFPA 11 requires a 15 minute foam concentrate supply for spill fires (one-inch or less)
NFPA 11 requires a 65 minute foam concentrate supply for fires in depth (tank type fires)
Eductor back pressure cannot exceed 65% of inlet pressure. BP is sum of hose friction loss, elevation and nozzle pressure.
Put a pressure gauge on eductor inlet and outlet. At 200 psi nilet pressure, do not exceed 130 psi on the outlet gauge (65% of inlet psi).
Distance to hose outlet is based on NFPA friction loss tables and or actual field experience. BE SURE TO ADD OR SUBTRACT ELEVATION HEAD.