TASK FORCE TIPS
Technical Bulletin

USING AUTOMATIC NOZZLES WITH FOAM EDUCTORS

Fire departments using automatic nozzles with 1-3/4” hose often ask, “Can we use our foam eductors with this equipment?” The answer is YES. Foam-making is simply the addition of the proper amount of foam concentrate to water. This solution is then mixed with air (aeration) either at the nozzle with air-aspirating devices, or as the foam solution shoots through the air and makes foam for non-aspirating nozzles. The finished foam is applied to a flammable liquid for extinguishment or to suppress vapors and prevent ignition.

By-pass or in-line eductors are pre-engineered systems that require specific inlet pressures for operation, usually 200 PSI. A large amount of that inlet pressure is lost in creating the vacuum pressure. If the back pressure is more than 65-70% of the inlet pressure, then the eductor stops producing a vacuum, and foam cannot be made. The actual back pressure at the eductor is the combination of nozzle pressure plus friction loss in the hose and elevation loss.

Let’s look at a typical eductor set-up with old nozzles and 1-1/2” hose:

Flow Rating of Eductor	95 GPM
Inlet Pressure to Eductor	200 PSI
Maximum Back Pressure on Eductor	140 PSI
Nozzle Pressure, fixed 95 GPM nozzle	100 PSI
Friction Loss from 150 ft. of 1-1/2” hose	30 PSI
Elevation Loss / Gain (zero for level ground)	0 PSI
Actual Back Pressure Total	**130 PSI**

THE LAYOUT WORKS since the actual back pressure of 130 PSI is less than the maximum allowable back pressure of 140 PSI. Foam will be made.

Now, let’s look at an AUTOMATIC NOZZLE on 1-3/4” hose:

Flow Rating of Eductor	95 GPM
Inlet Pressure to Eductor	200 PSI
Maximum Back Pressure on Eductor	140 PSI
Nozzle Pressure, fixed 95 GPM nozzle	100 PSI
Friction Loss from 150 ft. of 1-1/2” hose	18 PSI
Elevation Loss / Gain (zero for level ground)	0 PSI
Actual Back Pressure Total	**118 PSI**

THE LAYOUT WORKS since the actual back pressure of 118 PSI is less than the maximum allowable back pressure of 140 PSI. Foam will be made. The automatic nozzle maintains the correct 100 PSI nozzle pressure, so foam can be made.

It is well known that 1-3/4” hose has considerably less friction loss than 1-1/2” hose for a given flow. This can be useful in two situations. The lower friction loss of 1-3/4” hose can help when pumping uphill. In this case, the larger hose would allow pumping up almost 30 ft. of rise and still be within the capability of the eductor. The lower friction loss can also be used to gain extra distance between the incident and the pumper. The hose length can be increased and still be below the maximum allowable back pressure of the eductor. Lengths of up to 300 ft. of 1-3/4” hose can be operated with some eductors with great results.

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Fog-type nozzles have the greatest reach in the straight stream position. The finished foam is produced as the stream projects forward, and the greatest expansion is at the end of the stream. While straight stream gives maximum reach, it can also splash flammable liquids if not carefully applied. The stream impact can be softened by deflecting the stream off nearby objects. The stream can also be trimmed to a 10-15 degree pattern which gives good reach and creates a softer “snow-flaking” effect at the end of the

60 GPM EDUCTOR		
	Time to Empty	Foam
Mixture	5 Gallons	flow rate
1% setting	8 min. 20 sec.	.60 GPM
3% setting	2 min. 47 sec.	1.80 GPM
6% setting	1 min. 23 sec.	3.60 GPM

125 GPM EDUCTOR		
	Time to Empty	Foam
Mixture	5 Gallons	flow rate
1% setting	4 min. 0 sec.	1.25 GPM
3% setting	1 min. 20 sec.	3.75 GPM
6% setting	40 sec.	7.50 GPM

95 GPM EDUCTOR		
	Time to Empty	Foam
Mixture	5 Gallons	flow rate
1% setting	5 min. 16 sec.	.95 GPM
3% setting	1 min. 45 sec.	2.85 GPM
6% setting	53 sec	5.70 GPM

250 GPM EDUCTOR		
	Time to Empty	Foam
Mixture	5 Gallons	flow rate
1% setting	2 min. 0 sec.	2.50 GPM
3% setting	40 sec.	7.50 GPM
6% setting	20 sec.	15.00 GPM

As long as the inlet pressure to the eductor is within the manufacturer’s recommended guidelines, and the hose lay and proper nozzle combination, at the matching flow, does not exceed 65-70 % of inlet pressure, foam pickup in the correct proportion will occur. The table below indicates the foam concentrate flow rate and the time it will take to empty a 5 gallon container of various concentrates with eductors of different ratings.

Air-aspirating devices, such as the **TFT FOAMJET,** allow a wider selection of foam concentrates to be used, and can produce a better quality of finished foam. When used with **AFFF**, for example, air-aspirating attachments will, (1) improve the 1/4 drain time, (2) produce a more uni form bubble structure, (3) improve the burn back resistance of the finished foam, and (4) the foam blanket is visibly thicker. This thicker foam blanket has better vapor suppression and is longer lasting than foam from non-aspirated nozzles. The final expansion ratio and, therefore, the amount of finished foam, depends on the type of foam concentrate being used.

It must be remembered that when using **any nozzle** with an eductor, the nozzle **must be fully open** to prevent excessive back pressure which will prevent foam pickup.

Although originally designed for use with 1-1/2” hose and a nozzle of matching GPM, most eductors will function correctly with an automatic nozzle and 1-3/4” hose. By experimenting with various engine pressures on the training ground, correct operation can be assured for actual fire conditions. Automatic nozzles have an excellent performance record when used as structural fire fighting nozzles. If these guidelines are followed, they will perform as well as foam-making nozzles.

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