



FIREQUIP

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Low-volume, medium-expansion foam nozzle ...from your workshop

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Introduction

Class A wildland foam is a very useful tool for both fire suppression and prescribed fire operations. A particularly useful version is medium expansion foam. It can be used in direct attack, blanketing fuels in mop-up, protecting selected resources and anchoring and building wetlines for backfiring, burnout and prescribed fire operations.

Commercially available medium expansion, aspirating nozzles are expensive. Typically, prices range from \$300 to \$500 per unit. Additionally, these nozzles are all designed to work with flow rates in excess of 50 GPM.

The U.S. Fish and Wildlife Services (FWS) actively manages over 91 million acres of wildlife habitat as the national Wildlife Refuge System. Prescribed fire is a primary tool. Most refuges are equipped with small slip-on packages varying in capacity from 75 to 200 gallons. The small water tank capacities of most FWS engines combined with limited funding suggested that an alternative to current nozzles be developed. Most other resource agencies, including the Bureau of Land Management (BLM), also experience this problem. All are looking to minimize costs of equipment, yet still accomplish the tasks of the job.

The BLM program at the Boise Interagency Fire Center includes a Foam Technology Development group. As part of the many foam workshops this group presents, one demonstration shows the basics behind generating aspirating medium-expansion foam. The demonstration is done with a 4-

(See FROM YOUR SHOP..., p. 2)

1 each 14" length of 6" diameter PVC pipe

3 each 1/8" x 1/2" flat stock brackets (2" x 1" x 1/2")

1 each 1" KK variable pattern nozzle NFES #1081

3 each nuts, pan bolts, and washers

1 each 8" diameter hose clamp

1 each 2 1/2" diameter hose clamp

1 each 20" x 20" nylon window screen

1 each 10" x 10" nylon window screen

1 each strap handle

Equipment and parts needed

Because of the simplicity of the design of the medium nozzle, all parts and supplies should be readily available in even the most remote stations. The equipment list is as follows:

- PVC pipe, 6-inch diameter, 12 to 14 inch length
- One piece 1/8" thick by 1/2" flat stock, 15-3/4 inches long
- Nylon window screen — 20" X 20"
- Nylon window screen — 10" X 10"
- 1-inch KK variable pattern type nozzle (NFES #1081; GSA 4210-01-165-6603)
- Hose clamp, 7 to 8 inches in diameter
- Hose clamp, 2-1/2 inches in diameter
- Three each — 1/4" diameter 1-inch long bolts, washers, and nuts
- Cabinet or strap handle

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inch stove pipe with screening taped over the end and a KK variable pattern type nozzle found in NFES caches. The results are crude, but low- to medium-expansion foam is generated.

A medium expansion nozzle was built using simple materials, available at local hardware and plumbing suppliers, and through the NFES caches. The design of the nozzle then could be used by any agency

wishing to produce a low-cost efficient nozzle.

By using the 1-inch KK variable-pattern type nozzle, the resulting foam nozzle has the flexibility to produce both low-expansion foam (discharge distance 30 ft.) and medium-expansion foam (discharge distance 15 feet). Another benefit is it also allows the nozzle to deliver foam solution at either the 10 gpm or 24 gpm flow rate. One can see

these flow ranges are well below the 50 gpm flows most commercially-produced nozzles operate at.

Note: For higher flows and more expansion, a 12- to 14-inch length of 8-inch diameter PVC pipe can be used along with a 1-1/2" KK variable-pattern type nozzle (NFES 1082; GSA 4210-01-167-1123). This nozzle allows the operator to deliver foam solution at either the 40 gpm or 60 gpm flow rate.

Most aspects of assembly are not critical. However, for best foam production and discharge distance, the nozzle must be centered within the opening of the PVC pipe. This is critical because if the nozzle is not com-

Assembling the nozzle

At these three points, measure down 1/2", and drill a 1/4" hole. These will become the anchor points for the brackets. This will also become

the rear end of the medium nozzle. Now mount the strap handle parallel with the pipe length on the outside of the PVC pipe. The exact location does not matter.

flat stock material into three straps 5-1/4 inches long. On each strap, drill one 1/4" hole, with the edge a half-inch from the end of the stock (the center of the hole will be 5/8ths of an inch). The measurements to bend the straps into brackets will be taken from these drilled hole ends. All three brackets will be bent in the same way.

Measure two inches along the strap. This is the location of the first 90-degree bend. Now measure another 1-3/4 inches. This is the next point to make a 90-degree bend. The two bends made to the finished bracket will look somewhat like a "Z" (with 90-degree corners). The ending run, or "tang," which is about 1-1/2 inches long, is where the KK nozzle will be attached. It should be the (see ASSEMBLY, p. 5)

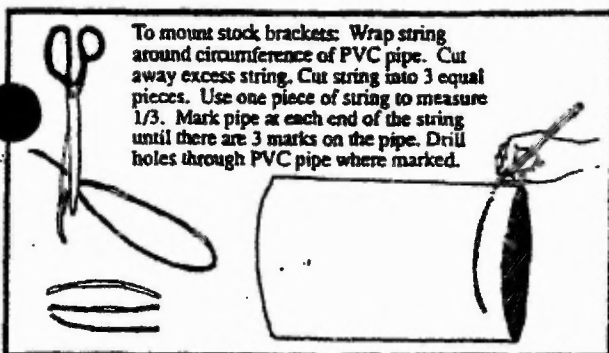


Figure 1: Locating the drilling points

pletely centered and balanced, foam production is dramatically decreased.

To determine the three places to mount the brackets, place a piece of string around the PVC pipe's circumference. Mark the spot where the string meets itself and cut off the excess string. Next, divide and cut the string into three equal parts. One piece of string will be the "measuring tool." Place the measuring tool in an arc on the PVC pipe edge, and mark the beginning and ending point. At the ending point, place the measuring tool in another arc and mark. (See Figure 1).

material, build the brackets to hold the KK nozzle to the PVC pipe. Cut the

Using the 1/2" flat stock material,

Mount stock brackets with nuts, bolts and washers as shown. Insert nozzle within brackets. Nozzle should be centered. Attach handle.

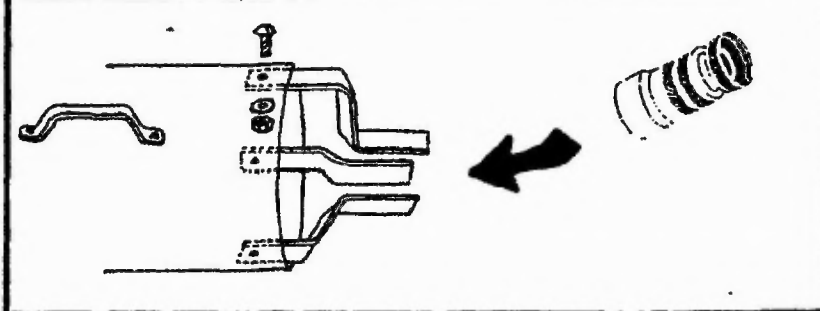


Figure 2: Mounting the stock brackets

ASSEMBLY..., from p. 2

Place the KK nozzle between the tangs with the KK nozzle tip pointing towards the front of the medium nozzle. Place the small hose clamp over the tangs and nozzle, then screw tight. This action will compress the

and the flat screen, with the point centered in the circle of the pipe projecting outward. Secure both screens to the PVC pipe with the large hose clamp. The 10" screen should be flush with the PVC pipe

small) from the front end of the PVC pipe. Cut off excess screening around the hose clamp. (Figure 5).

The inexpensive, low volume, medium-expansion nozzle is now complete. The materials used to build this nozzle cost roughly \$35.

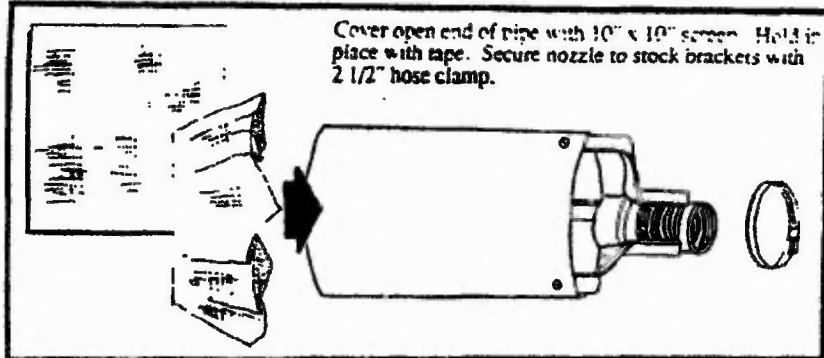


Figure 3: Positioning the nozzle in the stock brackets

tangs against the KK nozzle and secure it in a centered position. Make sure the tangs do not interfere with the twist open/close action of the nozzle. (See Figure 3)

Next comes the nylon window screening, used to fracture the foam solution stream that is flowing through the PVC pipe.

Building the two fracturing screens is simple. Take the 20" screen, and fold two opposite corners together to form a triangle. Sew up (with an ordinary sewing machine) one side of the triangle-shaped screen, forming a conical screen. (Figure 4).

Place the 10" screen over the non-drilled end of the PVC pipe, and then the conical-shaped screen over the 10" screen. The 10" screen should be flat across the end of the pipe. The conical screen should be pulled down tightly over the pipe

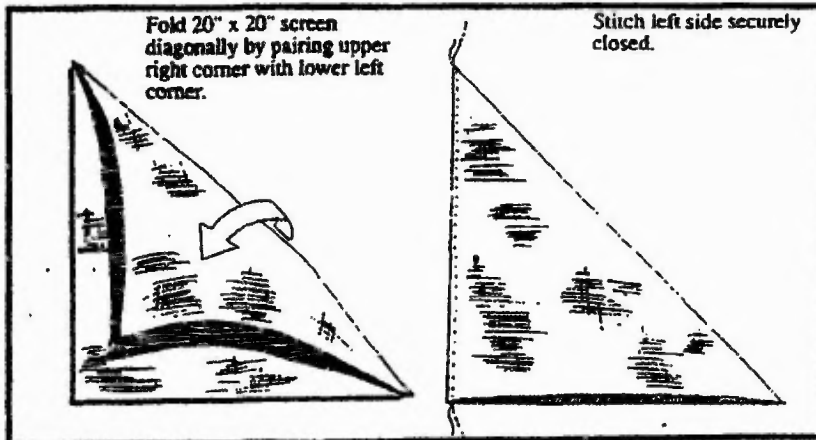


Figure 4: Preparing the nylon screen

These nozzles are also capable of producing variable-flow patterns, from straight stream to a fog pattern in both ranges. By using the flow pattern and the different gpm settings, we can create low-expansion foam as well as medium-expansion foams.

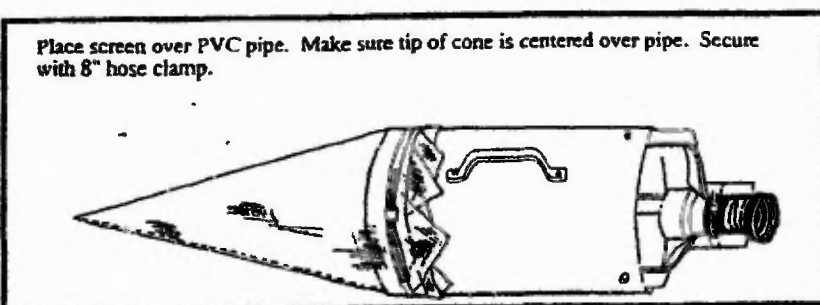


Figure 5: Attaching the screen to the foam nozzle

opening and the conical-shaped screen should form a cone (big to

On Page 6 —
Conclusions and a Chart

Now you've made your own low-volume, medium-expansion foam nozzle, here are

....Test results

The resulting nozzles were tested to measure their flow rates and foam-expansion ratios. By using an automatic regulated proportioner, we were able to monitor and set both flow rates and concentrate mix ratios. The concentrate mix ratio was set at five-tenths (0.5) per cent and remained constant during all flow volumes. Expansion ratios were determined by collecting the foam generated from a timed volume of solution flow at a set nozzle pressure of 70 psi, and then measuring the volume of foam.

The two nozzles were compared to the Angus MEX225 medium-expansion nozzle, the closest performing commercially available nozzle. The results are by no means to be considered scientific. They are rough field evaluations, but they do give a feel for the nozzle's performance.

(See Chart this page)

Conclusion

By following these instructions you should be able to make an inexpensive, low-volume, medium-expansion foam nozzle. By doing some experimentation, i.e., adding or subtracting screens, regulating pressures, changing flow patterns, you could get different expansion ratios and varying discharge distances to meet different objectives.

Nozzle Discharge and Expansion Rates

Nozzle	Flow Rate (gpm)	Discharge Distance (feet)	Expansion Ratio ⁽¹⁾
Angus MEX225.....	55	13	70/1
6" med., SS low	7	12	25/1
6" med., FG low	11	5	50/1
6" med., SS high	25	25	70/1
6" med., FG high	26	12	80/1
8" med., SS low	20	10	80/1
8" med., FG low	20	7	80/1
8" med., FG high	40	21	80/1
8" med., FG high	42	7	80/1

SS = Straight Steam FG = Fog Pattern
 Low = Low flow end of variable pattern nozzle
 High = High flow end of variable pattern nozzle

(1) "Expansion Ratio" compares the Gallons of Foam produced to each Gallon of Water. "Medium-expansion" foam falls in the range of 20/1 to 80/1. There is no one "best" or "preferred" ratio, since the various tasks — direct attack, mop-up, wetlines, etc. — have their own requirements.