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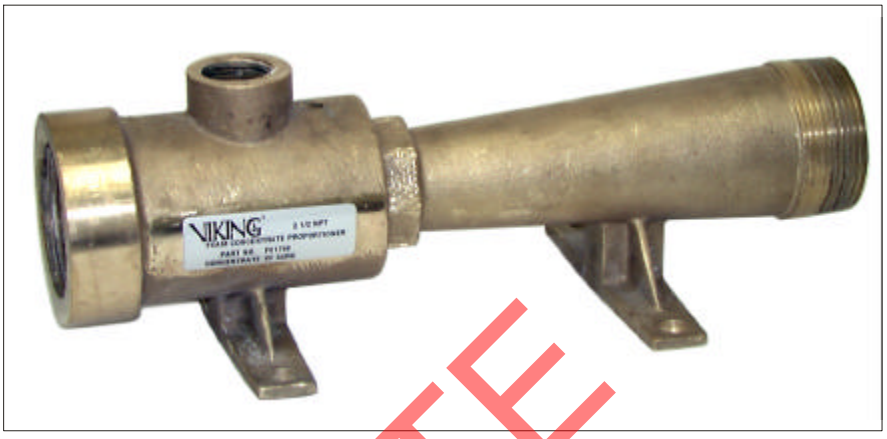
DESIGN DATA

FOAM EDUCTORS FIXED APPLICATIONS



1. PRODUCT NAME

FOAM EDUCTOR FOR FIXED APPLICATIONS

Model FE-200, 2-1/2" (65 mm)
K-factor Water = 17.5 U.S. (25,23 metric)
K-factor 1% Foam = 17.68 U.S. (25,49 metric)
K-factor 3% Foam = 18.04 U.S. (26,01 metric)

Model FE-250 , 2-1/2" (65 mm)
K-factor Water = 21.0 U.S. (30,35 metric)
K-factor 1% Foam = 21.26 U.S. (30,65 metric)
K-factor 3% Foam = 21.70 U.S. (31,29 metric)

Model FE-300 , 2-1/2" (65 mm)
K-factor Water = 25.25 U.S. (36,41 metric)
K-factor 1% Foam = 25.51 U.S. (36,78 metric)
K-factor 3% Foam = 26.04 U.S. (37,54 metric)

Model FE-350 , 2-1/2" (65 mm)
K-factor Water = 30.47 U.S. (43,93 metric)
K-factor 1% Foam = 30.78 U.S. (44,38 metric)
K-factor 3% Foam = 31.42 U.S. (45,30 metric)

K-factors include solution flow at discharge of eductor
Flow in GPM = $\sqrt{P}$ Inlet x K-factor

2. MANUFACTURER

The Viking Corporation
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3. PRODUCT DESCRIPTION

The Viking foam eductor for fixed system applications is an inexpensive, simple foam proportioning device, which proportions the proper amount of Foam Concentrate into the water supply, creating a mixture of foam/water solution that is piped to the flammable liquid hazard area. Other equipment required to complete the fixed foam system includes an atmospheric storage tank or container, which is compatible for Viking or 3M Foam Concentrate and vented properly to atmosphere, pressurized water supply, and open discharge device. The discharge device shall be properly sized for the application hazard area and is approved for the application. A Viking foam eductor system may be designed for manual or automatic operation in the event of a fire. The eductor consists of a brass body with 2-1/2" (65 mm) NPT female inlet and male outlet connections. The foam concentrate inlet is 1" (25 mm) NPT and includes a metering orifice sized for the selected application. Note: the piping size from the outlet of the eductor and to the concentrate inlet of the eductor may require an increase in size in order to adjust for pressure losses due to flow-friction loss of downstream piping. For proper operation, refer to sizing information described below. A fixed foam eductor system requires sizing for narrow flow range at a predetermined flow rate and pressure. Also, discharge devices must be of the open deluge type properly sized for the application and the proper eductor size. Viking foam eductors operate as low as 50 psi (345 kPa) up to a maximum of 150 psi (1 034 kPa), depending on flow requirements to hazard area and available water supply. See application and sizing information below for proper sizing of system and backpressure requirements.

4. TECHNICAL DATA

Rated Inlet Pressure to 150 psig (1 034 kPa) maximum working pressure

Eductor Materials
Body: Brass Casting UNS-84400
Internal Parts: Naval Brass UNS-46400
Retaining Rings: Stainless Steel

5. OPERATION

The Viking foam eductor for fixed applications is a venturi-type foam concentrate proportioning device, which has the ability to draw Viking or 3M foam concentrate into the eductor, and mix at the proper percentage of water to foam without the need for a foam pump or balanced pressure bladder tank system. The primary Inlet E of the eductor (see Figure 1) includes a reduced orifice nozzle, which causes an increase in flow velocity, thereby creating a negative pressure at the foam concentrate inlet. This allows atmospheric

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pressure to force Viking or 3M foam concentrate from the storage container through the concentrate piping and into the foam eductor. The metering orifice located at the inlet of eductor is sized for each foam concentrate and allows the proper amount of concentrate to flow into the water stream and become entrained in the water supply to the hazard at the desired percentage (usually 1% or 3% foam/water solution).

Foam eductor selection is determined by the required density over the hazard, the foam concentrate required to protect the fuel being used, and the available water supply and pressure capacity. The K-factor of the discharge system coming from the eductor must be properly sized to match the foam eductor (see sizing information below) for proper operation of the system.

Viking fixed foam eductors are intended for use with Viking open sprinklers as listed on page 900 a-l of the "Discharge Devices" section of the *Viking Foam Systems Engineering and Design Data* book. Type II foam chambers, which match up to the flow of the selected foam eductor and are listed with the selected fuel and foam concentrate or monitor with properly sized nozzle (see pages 911a and 912a).

I**MPORTANT** factors for proper application:

1. Select the proper foam concentrate for the specific fuel being protected.
2. Select the proper discharge device to meet the application density and the desired starting pressures.
3. The total K-value of discharge devices for each fixed foam eductor shall total 1.6 x K-value of the eductor selected.
4. Starting with the most remote discharge device, calculate the pressure loss at flowing condition using Hazen-Williams method per NFPA requirements back to the discharge of the foam eductor. Include the pressure loss due to height of discharge device above the outlet of the foam eductor. After summing up the total pressure loss of the system and adding to the starting pressure of the discharge device, the pressure at the discharge of foam eductor must be 65% of the required inlet pressure to foam eductor or less. See foam eductor maximum allowable pressure %. Pressure directly adjacent to outlet of the eductor must be equal to or less than the % listed. If % is less than that shown, the system will proportion at a higher %. Depending on the quantity of fittings, length of discharge piping, and height of discharge device above the foam eductor, the discharge pipe size may require a larger size than the outlet size of foam eductor.
5. Foam concentrate piping from concentrate container to foam eductor must be of the proper size and length in equivalent ft. of pipe as indicated in the application chart for eductor and foam type, adjustment in size may be required.
6. The foam container shall be large enough to supply the required duration of foam solution to the hazard area at the designed density.
7. The foam container shall be located such that the bottom of container is at the maximum height, or less than value show in the application chart.
8. The foam container shall be properly vented to atmosphere for proper operation.
9. A check valve shall be installed directly adjacent to the foam concentrate inlet of foam eductor to protect from water flow from eductor to foam concentrate reservoir.
10. System discharge shall be open flow deluge only, sized for the selected foam eductor.

A Viking fixed foam eductor system can be manually operated or automatically operated with a Viking deluge or flow control valve system installed as recommended. See the *Viking Engineering and Design Data* book for suggested applications.

6. SELECTION

The eductor should be selected upon the maximum flow rate and the available pressure. The 1-1/2" Viking fixed eductors are designed to offer an option for small foam water systems with adequate water flow and pressure. The 2-1/2" Viking fixed eductors are designed for larger foam water solution flow rates where a reduced installation cost can be realized by the simplicity of the proportioning method. Vacuum induction requires an adequate water supply and water pressure, an eductor, a foam concentrate container (normally a plastic container), a means to supply the foam concentrate to the eductor (normally known as a pick-up tube). Normal proportioning methods require expensive storage tanks, a pressurized foam concentrate (either produced by a pump or through water pressure around a bladder tank), and a proportioning device.

The first step in selecting a large fixed eductor for an application, is

determining the minimum solution flow rate.
Example of determining minimum solution flow rate:

Density x Area = Solution flow rate
.16 gpms x 1000 sq. Ft. =160 gpms

The second step in selecting a large fixed eductor is matching the solution flow rate to a rating of the eductor. The Viking large eductors come in 4 maximum flow rates, with two pressure ranges. The two pressure ranges are 50 through 90 psi and 90 psi through 150 psi. The two different pressure ratings are ranges that the given orifice plate in the eductor will proportion the rated foam concentrate, normally 1% or 3%.
In our example above, the minimum flow rate is 160 gpms. Viking large fixed eductors come in maximum flow rates of 200 gpms, 250 gpms, 300 gpms, and 350 gpms. Each of these eductors are capable of producing 160 gpms. The pressure required to produce the 160 gpms will indicate what choice of eductors is available. Suppose that the foam concentrate required is Supreme3ARC, there are 4 choices of eductors to use. The K factors and the flow is known.

FE-200 K factor for 3% foam concentrate is 18.04 = 78.66 psi required (P=Q/K)2

FE-250 K factor for 3% foam concentrate is 21.70 = 54.36 psi required

FE-300 K factor for 3% foam concentrate is 26.04 = 37.74 psi required (not an option)

FE-350 K factor for 3% foam concentrate if 31.42 = 25.93 psi required (not an option)

The minimum pressure that can be utilized for these eductors is 50 psi. From the above list of eductor pressures, the FE-200 and FE-250 are the only options for this application. The combined K factors of the discharge devices must exceed the K factor of the eductor by 1.6. From the above exercise, if the eductor chosen were a FE-250, the K factor would be 21.7 multiplied by 1.6 for a factor of 44.32. The K factor of the discharge device must exceed this. If (7) sprinklers are utilized, 44.32 divided by 7 requires an orifice larger than 6.33. A Viking large orifice sprinkler or larger have to be used because its K factor of 8.0 exceeds 6.33. If more sprinklers were to be supplied by the eductor, such as 10 sprinklers, the K factor of the sprinkler must exceed 4.43 (44.32 divided by 10), if this were the case, a standard orifice sprinkler could be utilized.

7. SYSTEM START-UP

1. Clean and flush the foam concentrate tank in accordance with the recommended procedure.
2. Flush all water and foam solution lines. This should be performed prior to the installation of eductors, sprinklers, and nozzles. Foreign materials shall be removed from the water supply mains, both underground and overhead, by way of flushing the system at its maximum flow rate, but in no case at a rate less than that indicated in NFPA standards. Flushing of system piping shall be deemed complete when flow rates have flowed for the duration as specified in NFPA standards and when water discharge is visually clean. Disposal of flushing water must be suitably arranged. All foam system piping shall be flushed after installation. Foam concentrate control valves shall be shut off during flushing operation. If area cannot be subject to water discharge, system pipe interiors shall be visually inspected for cleanliness. (Refer to NFPA 11 for interior piping inspection procedure for systems not able to be flushed.)
3. All strainer screens shall be removed and cleaned after system flushing. Strainer screens shall be re-installed after cleaning.
4. Place system valves in their normal operating condition.
5. Fill foam concentrate storage tank with foam concentrate with appropriate foam concentrate for hazard protection.
6. Proceed with system test using the following "Operating Procedures" on this data page.

8. OPERATING PROCEDURES

Note: Prior to operating system, all water supply and foam/water solution discharge piping should be flushed to prevent clogging of eductor. System riser valves shall be set-up in accordance with the manufacturer's installation and operating guidelines.

1. Open water control valve to eductor. Establish design supply pressure to eductor. Verify design discharge pressure at outlet of eductor.
2. Open foam concentrate supply control valve.
3. Collect foam/water solution sample and verify design concentration proportion for hazard.
4. After completion of system discharge test, replenish foam concentrate used for test with the same type of foam concentrate and reset system.

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9. SHUTDOWN AND FLUSHING

Note: System shutdown should only be considered after fire has been extinguished and any possibility of re-ignition has been eliminated.

1. Close the foam concentrate supply control valve(s).
2. Close the water supply control valve(s).
3. Flush system by opening water supply valve(s) and discharging water from discharge outlets until water discharge is visually clean and shows no residue.
4. Close all water control valves and drain water in system.
5. Remove all strainers and clean strainers. Install cleaned strainers. Inspect sprinkler heads for blockage, remove any and all blockage in sprinkler head waterway.
6. Replace foam concentrate in storage tank. If no foam concentrate is remaining in storage tank, determine if storage tank requires cleaning. If cleaning of tank is required, clean foam storage tank in accordance with manufacturer's instruction.

Warning: Mixing of foam concentrates is prohibited by NFPA 11, The Standard for Low Expansion Foam. Only the foam concentrate type and manufacturer listed on the storage tank placard should be used when refilling the storage tank. System failure could result in the mixing of dissimilar foam concentrates.

7. Return system to service following system setup instructions.

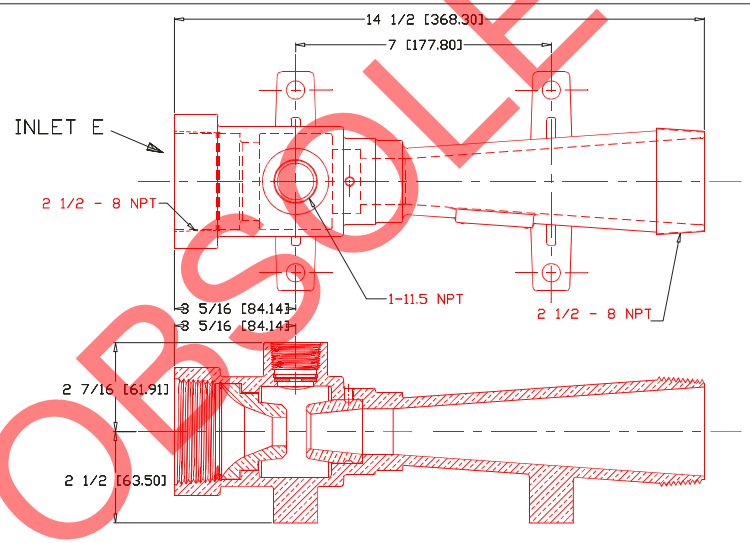

FIGURE 1

SYSTEM INSTALLATION

1. The use of Viking fixed foam eductor requires careful hydraulic analysis of discharge piping concerning friction loss, head and other discharge system loses concerning backpressure on the discharge side of foam eductor. The backpressure must not exceed that indicated above for each foam concentrate indicated.
2. Careful consideration shall be given to foam concentrate pipe size and length, or else improper proportioning will occur.
3. In order to obtain optimum performance and to reduce turbulence, a minimum of 12" (0,3 m) on upstream and 24" (0,6 m) on downstream of straight unobstructed pipe should be used for each eductor.
4. All foam eductors are furnished with mounting brackets, however, all piping to and from the eductor shall be self-supporting to eliminate piping strain on the eductor.
5. Because water inlet and outlet pressures are critical, it is recommended that a pressure gauge be placed at the inlet and outlet of each foam eductor.
6. A shut-off valve and a check valve shall be installed in each foam concentrate supply line of eductor to enable isolation from water backflow to concentrate storage tank and to flush with water after system operation.
7. For compatibility of materials, see Foam Technical Data Pages 755a-d.
8. Stainer required.
9. No strain on body.

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APPLICATION REQUIREMENTS FIXED FOAM EDUCTORS

MODEL FE-200

VIKING FOAM CONCENTRATE	EDUCTOR PART NO.	MAX INLET PRESSURE PSIG (kPa)	MIN. INLET PRESSURE PSIG (kPa)	MAX. PRESSURE AT OUTLET % OF INLET	SOL. % AND CONC. PIPING NOTES
VF1AFFF	F01772	150	90	65%	1% (1)
VF1AFFF	F01773	90	50	65%	1% (1)
VF3AFFF-MS	F01774	150	90	65%	3% (1)
VF3AFFF-MS	F01775	90	50	65%	3% (1)
VF3AFFF	F01776	150	90	65%	3% (1)
VF3AFFF	F01777	90	50	65%	3% (1)
VF3ARC	F01768	150	90	65%	3% (1)
VF3ARC	F01769	90	50	65%	3% (1)
SUPREME3ARC	F01770	150	90	65%	3% (1)
SUPREME3ARC	F01771	90	50	65%	3% (1)

MODEL FE-250

VF1AFFF	F01782	150	90	65%	1%
VF1AFFF	F01783	90	50	65%	1%
VF3AFFF-MS	F01784	150	90	65%	3%
VF3AFFF-MS	F01785	90	50	65%	3%
VF3AFFF	F01786	150	90	65%	3%
VF3AFFF	F01787	90	50	65%	3%
VF3ARC	F01778	150	90	65%	3%
VF3ARC	F01779	90	50	65%	3%
SUPREME3ARC	F01780	150	90	65%	3%
SUPREME3ARC	F01781	90	50	65%	3%

MODEL FE-300

VF1AFFF	F01772	150	90	65%	1%
VF1AFFF	F01773	90	50	65%	1%
VF3AFFF-MS	F01774	150	90	65%	3%
VF3AFFF-MS	F01775	90	50	65%	3%
VF3AFFF	F01776	150	90	65%	3%
VF3AFFF	F01777	90	50	65%	3%
VF3ARC	F01768	150	90	65%	3%
VF3ARC	F01769	90	50	65%	3%
SUPREME3ARC	F01770	150	90	65%	3%
SUPREME3ARC	F01771	90	50	65%	3%

MODEL FE-350

VF1AFFF	F01782	150	90	65%	1%
VF1AFFF	F01783	90	50	65%	1%
VF3AFFF-MS	F01784	150	90	65%	3%
VF3AFFF-MS	F01785	90	50	65%	3%
VF3AFFF	F01786	150	90	65%	3%
VF3AFFF	F01787	90	50	65%	3%
VF3ARC	F01778	150	90	65%	3%
VF3ARC	F01779	90	50	65%	3%
SUPREME3ARC	F01780	150	90	65%	3%
SUPREME3ARC	F01781	90	50	65%	3%

[1] 15 equivalent ft. (4,6 m) of 1” (25 mm) Sch 40 steel pipe, maximum 5 ft. (1,5 m) lift bottom container to center of foam Inlet 1” check valve and ball valve.