COMPARATIVE ANALYSIS OF ROTARY ATOMIZATION VS CANNON STYLE PRESSURIZED SPRAY NOZZLES

EVAPORATION KING

EVAPORATION EFFICIENCY

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ROTARY ATOMIZATION VS CANNON STYLE PRESSURIZED SPRAY NOZZLE

CONTENT

"The key to effective atomization is the consistent production of droplets under 100 microns to increase surface area"

EXECUTIVE SUMMARY

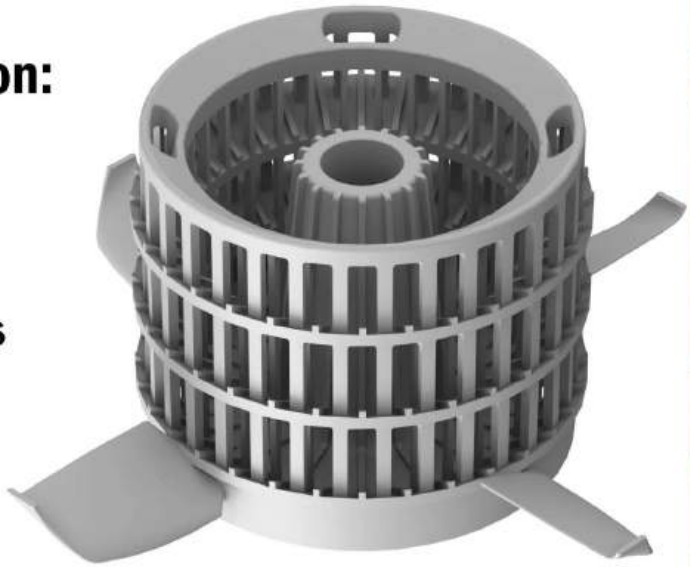
This white paper presents a comparative analysis of two prominent technologies in the field of atomization for industrial applications: Evaporation Kings' Rotary Atomization and pressurized nozzle blower cannons. Both technologies are designed to enhance the efficiency of liquid atomization processes, but they operate on different principles and are suited for different applications. This document aims to evaluate the performance, efficiency, cost-effectiveness, and application suitability of each technology to determine which is more effective in various industrial contexts.

INTRODUCTION

Atomization is a critical process in various industries, including chemical manufacturing, food processing, and environmental applications. The choice of atomization technology can significantly impact product quality, operational efficiency, and overall costs. This white paper focuses on two leading technologies:

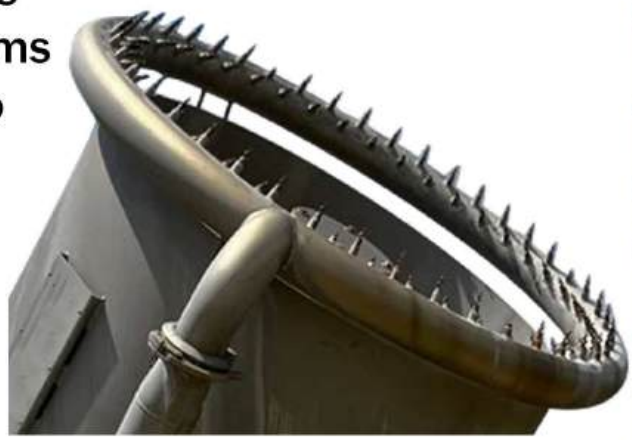
Rotary Atomization:

A technology that utilizes high-speed rotating head to create fine droplets from liquids.



Cannon Style Pressurized Spray Nozzles:

A system that employs high-velocity air streams to atomize liquids into droplets



Technology Overview

Rotary Atomization:

Principle of Operation

This technology uses a rotating head to fling liquid outward, where it is fractured and broken into fine droplets due to centrifugal force. The size of the droplets can be controlled by adjusting the rotational speed and the liquid feed rate.

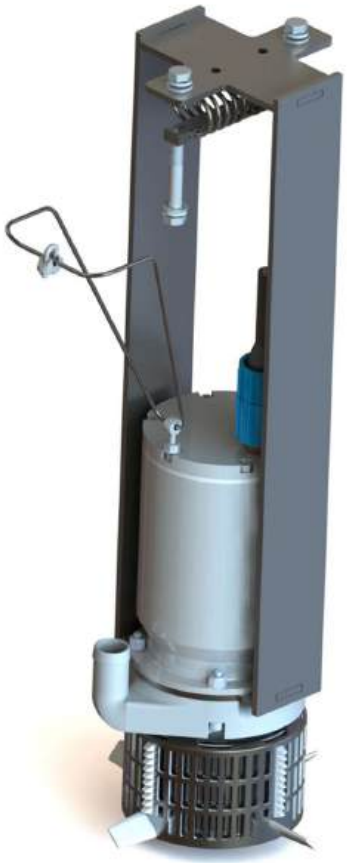
Applications

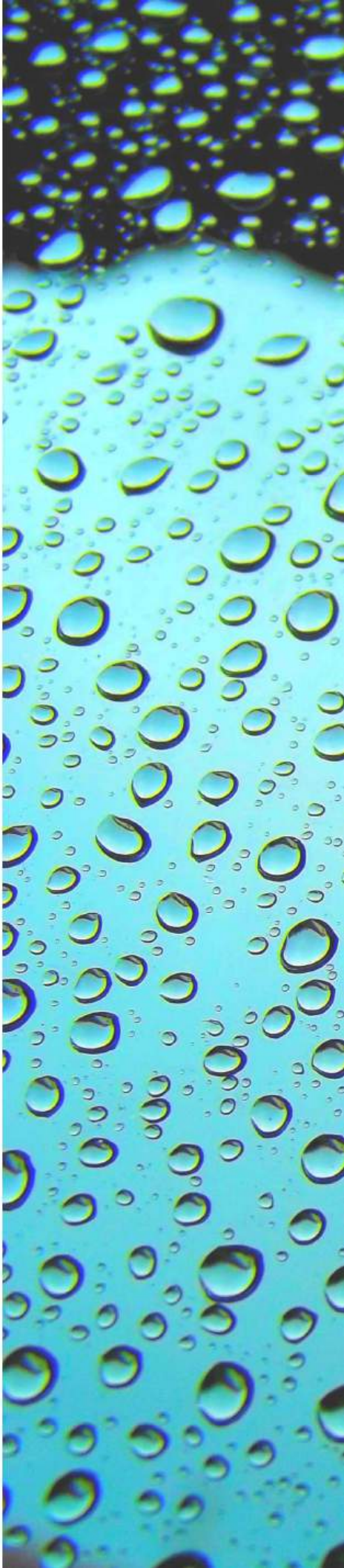
Commonly used in applications requiring fine mist generation. Best suited when precise droplet control is required.

Advantages

- High efficiency in producing uniform droplet sizes.
- Ability to handle a wide range of viscosities.
- Minimal energy consumption compared to other

EK's rotary atomizer consists of a small compact 7.6-hp permanent magnet electric motor that can Atomize up to 30 gallons per minute and operate at speeds between 2000 and 18000 rpm's using a variable frequency driver (VFD). The rotary atomizer basket is 3D printed from polypropylene giving it maximum durability in the harshest water conditions. The water inlet initially fractures and distributes the water evenly before dropping inside the spinning atomizer hub. This process keeps all water away from the motor shaft and seal.





Technology Overview

Cannon Style Pressurized Nozzles:

Principle of Operation

This system utilizes a high-velocity air stream to atomize liquid. The liquid is injected into the air stream, where it is broken into droplets by the shear forces of the air

Applications

Suitable for applications such as dust suppression, cooling, and humidification in large areas

Advantages

-Effective for large-scale applications where coverage area is critical.
- Simple design with fewer moving parts, leading to lower maintenance requirements.
- Flexibility in adjusting droplet size by varying air pressure and liquid flow rate.

Fan Motor: 120hp
Water Pump: 100hp
Nozzle Pressure: 145psi

High power motors require a much higher cost in electrical infrastructure

DROPLET SIZE PERFORMANCE COMPARISON

Why is it essential to know droplet spectrums for enhanced evaporation equipment? There are two main reasons, one is related to performance, and the other is related to overspray conditions. **An Ohio State drift study concluded that water droplets <50 microns evaporate entirely within 18 inches from the discharge point in relative humidity levels between 20-80%.**

60 MICRON DROPLET

600 MICRON DROPLET

20-80 MICRON DROPLET PRODUCTION

Drop Sizes

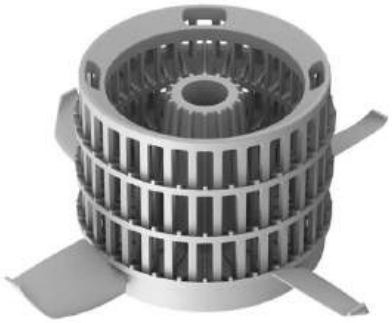
Size comparisons related to precipitation and common objects

DEGREE OF ATOMIZATION	DROPLET SIZE	RELATIVE SIZE	OBJECT COMPARISON
Fog	Up to 20 microns		Point of needle (25 microns)
Fine mist	20–100 microns		Human hair (100 microns)
Fine drizzle	100–250 microns		Sewing thread (150 microns)
Light rain	250–1000 microns		Staple (420 microns)
T-storm rain	1000–4000 microns		Pencil lead (2000 microns)

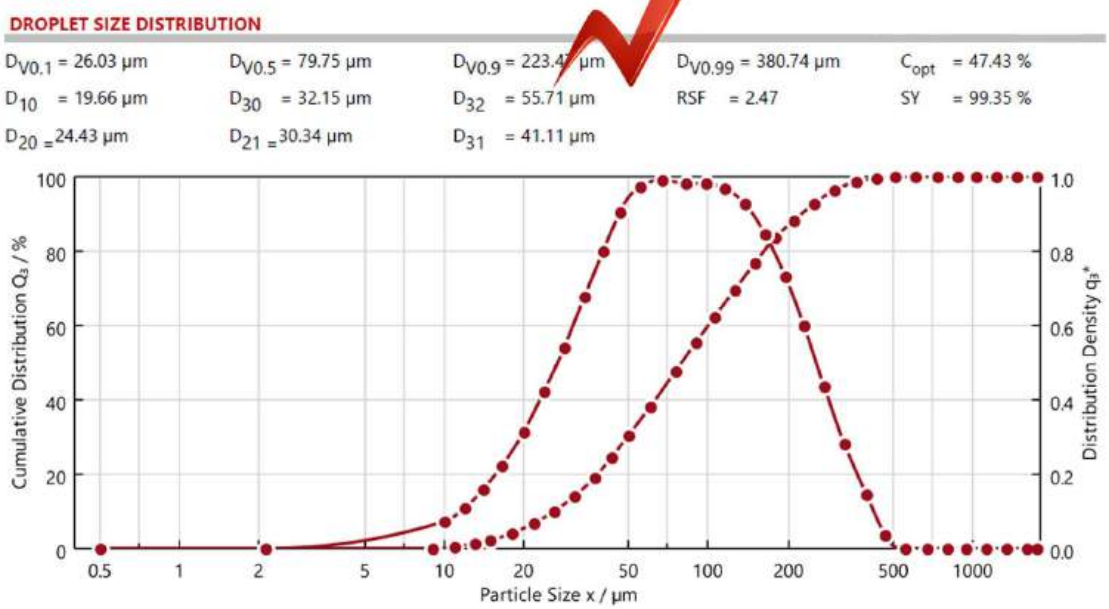
500-600 MICRON DROPLET PRODUCTION

DROPLET SIZE PERFORMANCE COMPARISON

EK's droplet spectra have the highest industry average between 20-80 microns.Creating this much surface area allows for a faster evaporation rate and lowers the typical pond size requirements by a 10 to 1 ratio. Rotary atomization enables the manipulation of droplet sizes by changing the speed of the atomizer that allows control during any overspray conditions



Average droplet size produced with Evaporation King's atomizer heads are 55 microns



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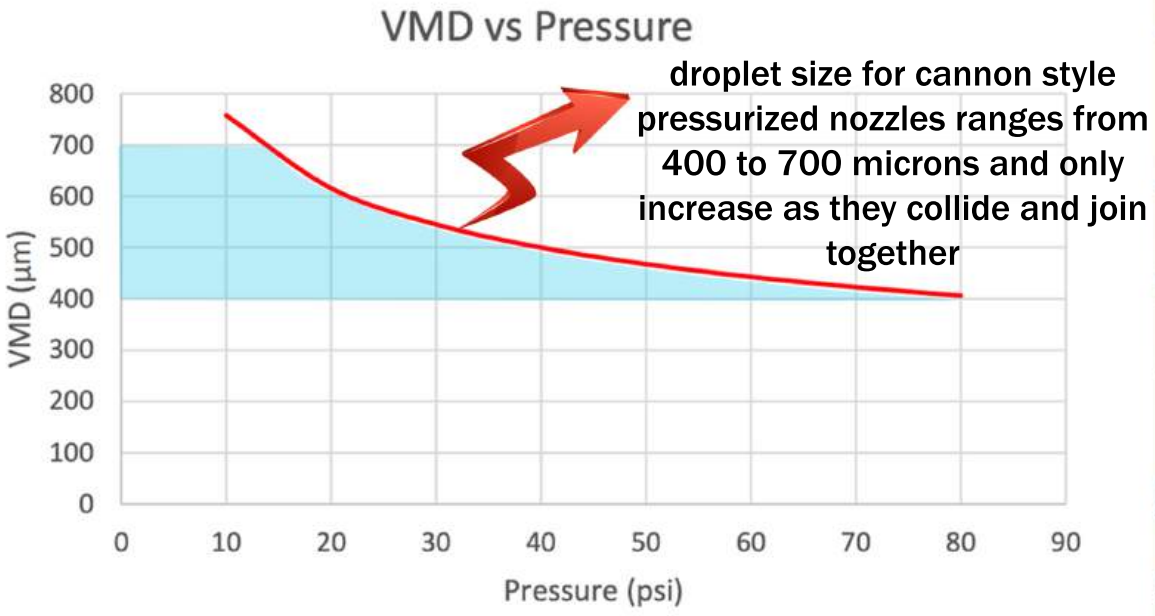
EK'S ROTARY ATOMIZATION 45-60% EFFICIENCY

DROPLET SIZE PERFORMANCE COMPARISON

The Spraying Systems Co. 8-15W nozzle used on snowmaking type cannon evaporators operate at 40 psi. The 8-15W nozzle has a mean water droplet average of 500 to 600 microns. These cannon systems use over 270 8-15W pressure nozzles to obtain a 25 L/S flow rate. These nozzles are spaced very tightly around the end of the cannon creating multiple collisions of 500-micron droplets due to each nozzle having a 100° cone spray angle. Several studies regarding the collision coalescence of water droplets prove droplets increase in size as they move away from the nozzle.“During this process, smaller droplets collide, form larger droplets, and lose their momentum due to drag. Thus, the droplet diameter starts increasing away from the nozzle. As the droplets become larger and slower, the probability of subsequent droplet-droplet collision increases, resulting in further coalescence.”



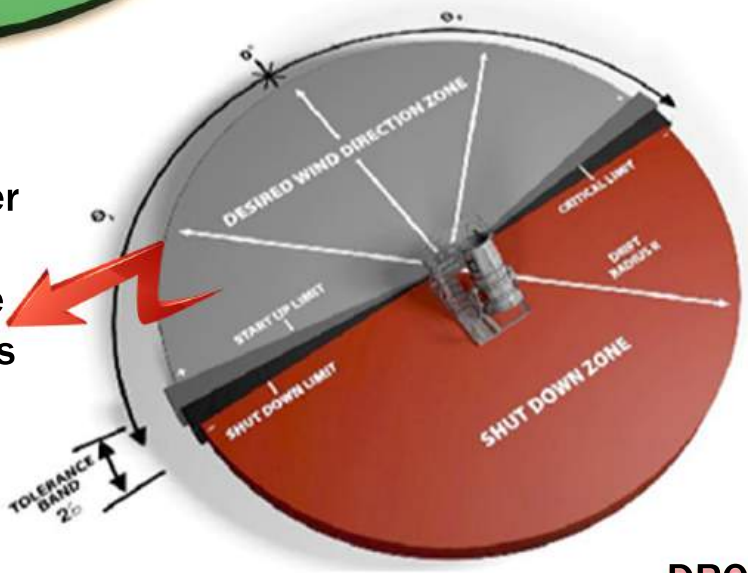
A single unit can pump 600 GPM and blow this tight stream 150’ high into the air. These system manufacturer’s claim a 50% evaporation rate based solely on the droplet size reduction and not droplet evaporation. The only in-depth evaporation study found using fan-style cannons was performed near Savannah, GA. Due to the significant fallback with these styles of evaporation systems, much lower volumes of water were used so data could be collected. The Study concluded if significant fallback were tolerable, the actual evaporation efficiency would be 10-12 GPM from the 70 GPM spray rate. This 17% evaporation rate during daylight operation only, was never confirmed directly from the Study.

CANNON STYLE PRESSURIZED NOZZLE 12-17% EFFICIENCY

APPLICATION FACTORS

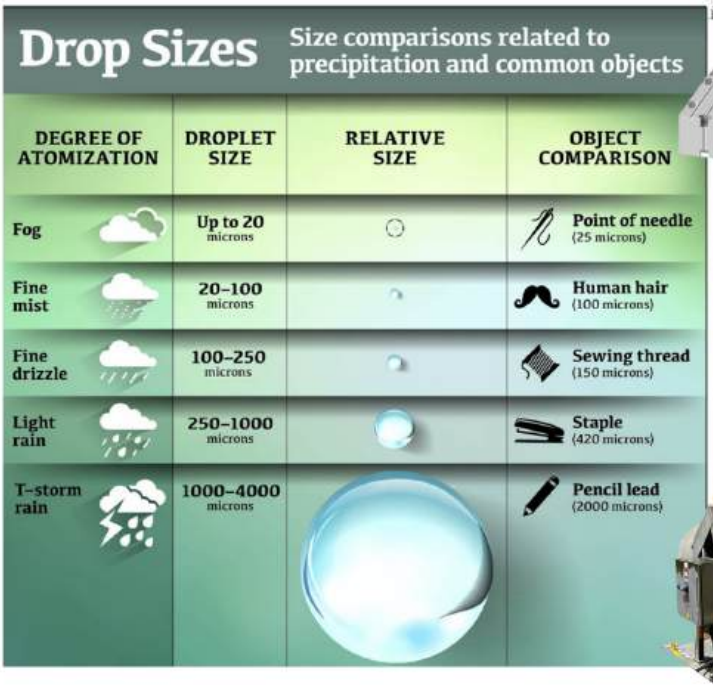
OPERATIONAL CAPACITY

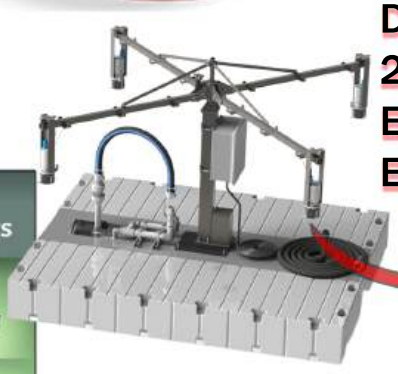
Evaporation Kings Rotary atomizers are floating offering 360 degrees of operational capacity. The units can operate and ponds as small as 50' x 50'



Land based cannon style pressurized nozzle only offer 180 degrees of operational capacity due to undesirable blowback. The mist streams are forced 150' into the air requiring a large area for operation

EFFICIENCY





DROPLET SIZE: 20-80 MICRON EVAPORATION EFFICIENCY: 45-60%

60 micron droplet

10X Larger

600 micron droplet

DROPLET SIZE: 500-600 MICRON EVAPORATION EFFICIENCY: 12-15%

APPLICATION FACTORS

SOUND PRESSURE LEVEL (dB)

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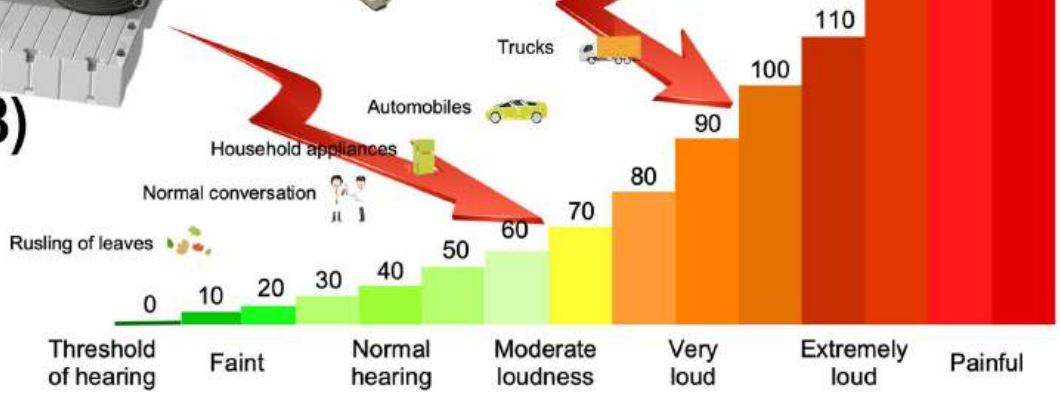
65-70(dB)

95-100(dB)



NOISE LEVEL

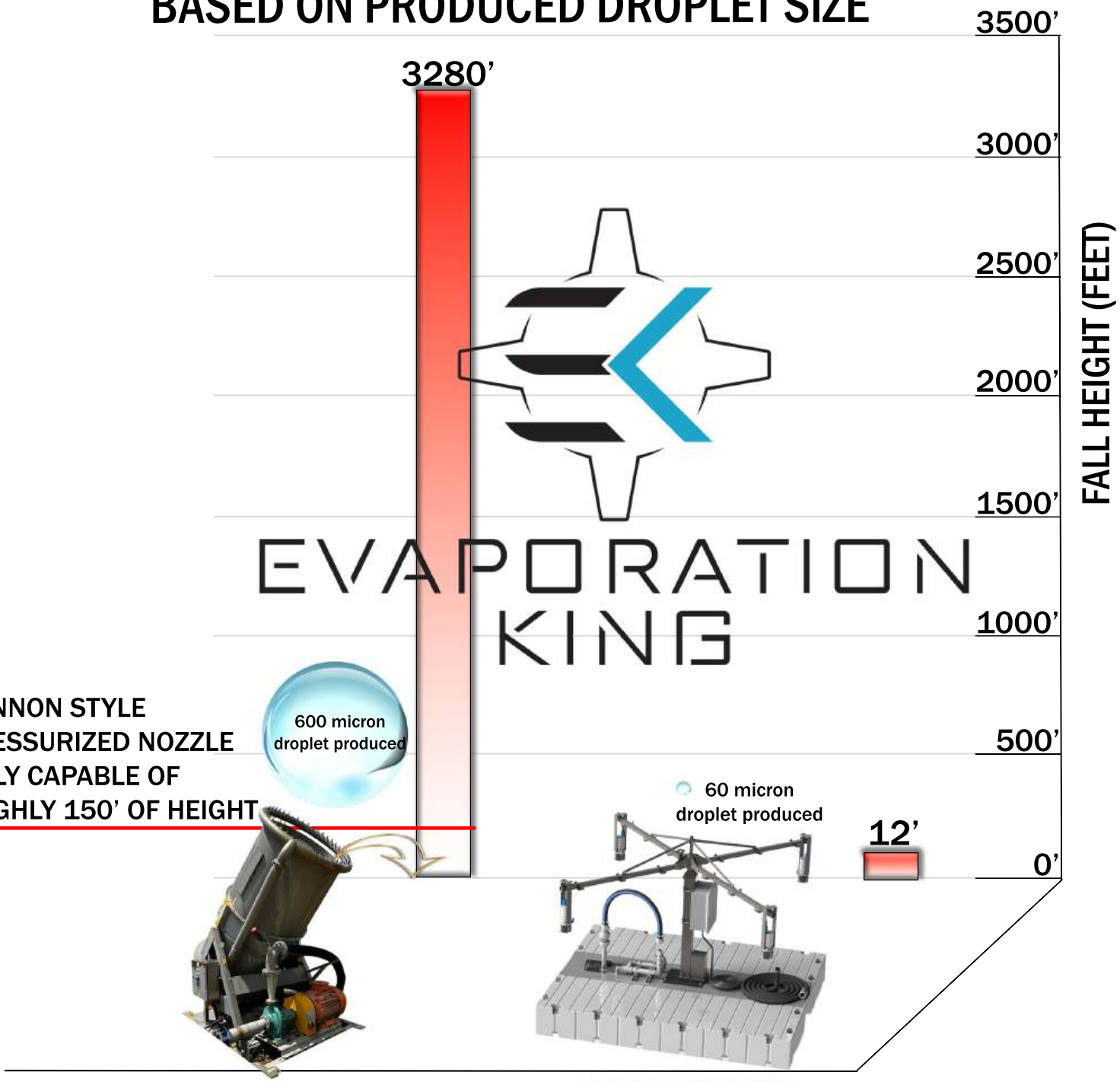
OPERATION COST

1$ PER 1000 GALLONS EVAPORATED

ON AVERAGE **6X** MORE GALLON FOR GALLON COST

APPLICATION FACTORS

HEIGHT REQUIRED FOR 100% EVAPORATION BASED ON PRODUCED DROPLET SIZE



CANNON STYLE PRESSURIZED NOZZLE ONLY CAPABLE OF ROGHLY 150’ OF HEIGHT

DROPLET SIZE: 500-600 MICRON
EVAPORATION EFFICIENCY: 12-15%

DROPLET SIZE: 20-80 MICRON
EVAPORATION EFFICIENCY: 45-60%

CONCLUSION

Ultimately, the choice between these technologies should be guided by specific application requirements, operational constraints, and cost considerations. For applications requiring precision, low operational cost, and high efficiency, Rotary Atomization is the superior choice due to its ability to produce uniform droplet sizes and lower energy consumption. For large-scale applications where coverage is critical, Cannon style pressurized nozzles provide great solutions for suppression of dust generation and humidification.

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