The three C's of suppression

Ray McCormack, Director, Business Development at HEN Nozzles, explains how coverage, cooling and contraction enhance suppression and how modern nozzles improve efficiency and firefighter safety

Rapid fire suppression is governed by three fundamental principles—coverage, cooling and contraction. Each "C" represents a critical component of the suppression process that must be delivered in rapid succession to effectively suppress a fire. However, few stream patterns possess the intrinsic ability to achieve all three simultaneously.

Instead, successful suppression with traditional streams often relies on coordinated manual nozzle manipulation to achieve the necessary performance. In other words, the stream can't do much by itself because it cannot interact with the fire environment at a rate that provides rapid suppression. The reason is one or more of the C's are difficult to obtain using traditional streams.

Fire streams background

Traditionally, two types of nozzles have been used for delivering fire streams: the smoothbore nozzle and the combination fog nozzle. The smoothbore nozzle generates a solid stream consisting of large water droplets in a tight, cylindrical pattern. In contrast, the combination fog nozzle can produce either a wide fog pattern or a straight stream, both of which consist of small droplets.

Recent advances in nozzle technology have introduced the combination smoothbore nozzle, also known as the combination blade nozzle. This innovative design can deliver either a wide blade stream or a solid stream. Notably, the blade stream features large droplets arranged in a concentrated linear edge, providing enhanced performance in fire suppression.

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Coverage

Coverage refers to the ability of a stream to blanket the fire area effectively. Straight and solid streams must be intentionally broken up to provide coverage beyond their flow shape. Whereas a pre-broken stream like the HEN BLADE provides a linear pattern of large droplets that inherently offers wider coverage. A fog stream is a hollow conical stream shape that is broken into small droplets and provides a circular band of coverage.

"The expanded stream pattern of the blade stream allows it to interact with a larger volume of heated space than narrow streams."

For standard streams, nozzle movement plays a crucial role in optimising coverage. With straight, solid or fog* streams movement is typically provided using a given letter pattern like O or Z or a wall ceiling wall approach to maximise their area of effect. In contrast, the blade stream offers enhanced coverage with simpler nozzle movements, such as up-and-down or side-to-side sweeps. This not only centers the stream more effectively but also minimises nozzle fatigue, allowing firefighters to maintain effective coverage with less effort. The streamlined application methods associated with the blade stream can raise the operational proficiency of the department's firefighters, offering an intuitive approach that ensures extensive coverage of the fire space.

Achieving broad coverage is imperative for rapid knockdown of the fire. A straight or solid stream relies on contact with a surface to break apart and cover a larger area. In contrast, the blade stream is designed to deliver a pre-broken, large-droplet, linear stream that naturally covers a wide area without depending on external factors. Its application is straightforward and replicable, making it an attractive option for both seasoned firefighters and those in training.

Cooling

Modern fires are characterised by high heat release rates that can quickly overwhelm suppression efforts. Effective cooling is therefore paramount and the blade stream addresses this need by delivering cooling benefits in two distinct locations simultaneously. As the blade stream expands from the nozzle, it forms a triangular pattern that intensifies cooling near the nozzle team. This expansion not only interacts with and pushes heat away from the firefighters but also contracts the heated gases toward the nozzle, a phenomenon that can be initiated early in an operation for a distinct safety advantage. ▸

The expanded stream pattern of the blade stream allows it to interact with a larger volume of heated space than narrow streams. To visualise the difference, consider a broom: a narrow stream is akin to the broom's handle, providing minimal cooling effect, whereas the brush represents the blade stream with its wide coverage. This broad interaction zone results in more effective cooling, as the large droplets absorb heat more efficiently and deliver it across a greater area.

The efficiency of the blade stream reduces the need for repetitive nozzle movements, particularly in expansive or corridor-type environments. With floor-to-ceiling coverage easily achieved, the blade stream not only cools the fire environment but also creates a safer zone for firefighter operations. Its design minimises the application rate required to cool the space, thus expediting fire knockdown and reducing water consumption.

Contraction

Contraction refers to the process by which heated gases are condensed or "contracted" faster than new steam is generated. Effective contraction is essential to reducing the fire's intensity and preventing the rapid generation of steam, which can impede firefighter operations. The blade stream's broad, linear pattern allows it to interact with a more substantial volume of gases, promoting rapid contraction through efficient heat absorption.

As the blade stream projects from the nozzle, its large droplet composition allows it to penetrate the gas layers effectively. By absorbing heat from these layers, the droplets survive the high-temperature environment and descend onto burning materials, thereby aiding in the cooling and contraction of the gases. In scenarios where heated gases accumulate above the firefighting team, a well-placed, long-range blade stream can effectively contract these layers, improving both safety and suppression efficiency.

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A critical aspect of achieving gas contraction is the initial targeting of the extreme gas layer, often by aiming the stream high to capture the hottest gases first. The blade stream, through its progressive capture from the lower to the upper reaches of the fire space, maximises gas contraction bilaterally across different layers.

This not only enhances suppression efficacy but also serves as a force multiplier, reducing the overall water usage by rapidly stabilising the fire environment.

Conclusion

When coverage, cooling and contraction are delivered in rapid, coordinated fashion, fire suppression becomes significantly more effective. The blade stream stands out as a superior tool in achieving these goals. Its design—characterised by an inherently broken, wide linear pattern—ensures extensive coverage, effective cooling and efficient contraction, all while minimising the physical demands on firefighters.

By simplifying nozzle movements and enhancing overall application efficiency, the blade stream not only improves suppression outcomes but also elevates firefighter safety. Its intuitive application makes it accessible for both experienced personnel and new recruits, ultimately contributing to a more responsive and effective fire suppression strategy. In modern firefighting, where every second counts, the blade stream provides a critical advantage in rapidly controlling fires and protecting lives and property.

*Note: UL-FSRI does not endorse using 30-degree or larger fog cones for interior structural fire operations. ■

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