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White Paper

Water mist systems: superior fire suppression for industrial fryers

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Johnson Controls

Testing data suggests that water mist should not only be considered but heavily favored as a fire suppression solution for industrial fryer protection.

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Industrial fryers are essential for producing fried chicken, fish, potato chips and more. These fried food factories are deemed high-risk properties by insurers due to potential business interruption costs, so it's critical that companies equip industrial fryers with effective fire suppression systems. This is especially important with modern, energy-efficient fryers, which are designed to stay very hot for a long time.

In modern fryers, controls help maintain the needed cooking temperatures and prevent fryers from overheating. However, oil can start to burn as a result of the long production process and a fire event can still occur. Therefore, most fryers are equipped with a fixed fire suppression system.

Traditionally, these fire suppression systems have been CO_2 gas systems. But given the required safety measurements for CO_2 systems, many manufacturers have been moving toward water mist fire suppression systems for industrial fryer protection (IFP).

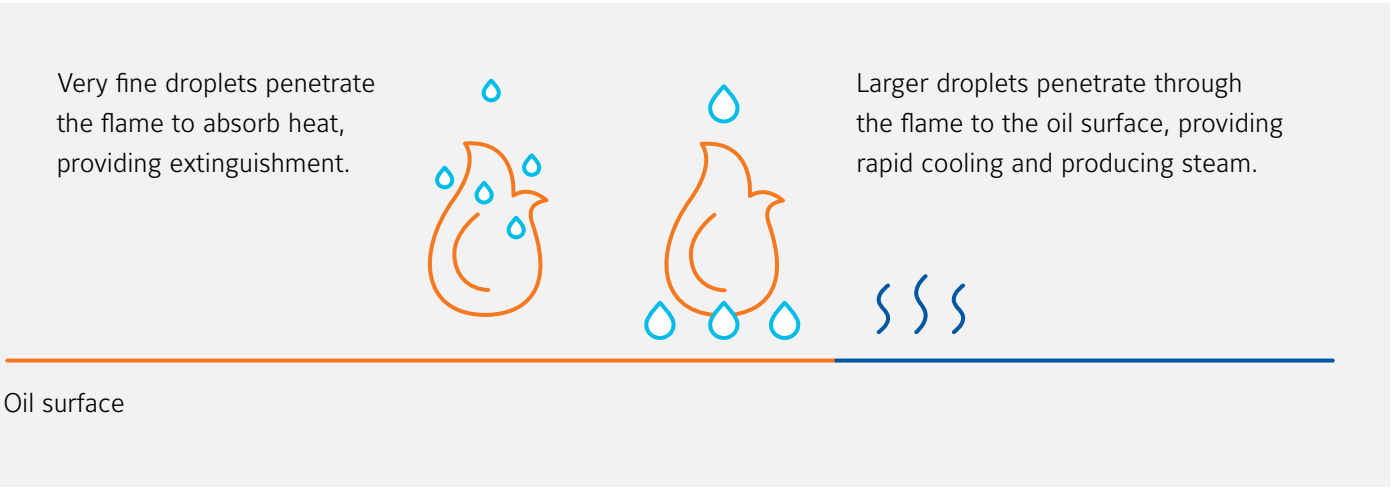
Moving from CO_2 to water mist systems

Environmental, health and safety (EHS) surveyors and insurers are moving away from CO_2 systems for fryers for reasons related to life safety, design and installation complexity, and reflash. While CO_2 is a fire suppressant, it can also be a potential asphyxiation risk for people working in production areas depending on the volume of the space where the fryer is located. To protect personnel, there are additional precautions manufacturers must take and guidelines they must establish when they install a CO_2 system. Then, there is also the issue of reflash. CO_2 can put out a fire, but it may not cool down the oil. If oil remains hot enough, reflash is possible, and there's no protection once fire reaches the auto-ignition point.

Although fire sprinklers are an option for fryer protection, they are not ideal. This is due to the amount of water dispersed, the large size of the droplets and the risk of fire spread due to its reaction with the oil. However, there is another alternative to CO_2 systems and fire sprinklers: water mist systems.

When looking for effective suppression solutions, fried food producers are often unaware of the benefits of water mist systems for industrial fryer protection. Water mist systems provide efficient fire suppression for industrial fryers, including suppressing the hazard and preventing reflash by cooling the hazard below ignition temperature – all without the life safety risk involved with CO_2 systems, and without the violent interaction that would happen when mixing hot oil with large amounts of water from a sprinkler system.

Protecting oil with water mist



Understanding how water mist works

There is a common belief that water is ineffective in fighting oil fires. This is only true with large water droplets that enter the oil and contribute to the spreading of oil and flames via explosions caused by the retardation of boiling. However, unlike the droplets that water sprinklers produce, water mist systems discharge droplets that are so small they do not impinge directly into the heated oil, which prevents micro explosions.

Water mist droplets are small enough to hover above oil surface, evaporate, create steam, cool the area and push away oxygen. In this way, they efficiently suppress fire and effectively cool the oil. When a system discharges, very fine mist droplets (~100 microns) are suspended in the flame to absorb heat and extinguish the flame. At the same time, larger mist droplets (~200 microns) penetrate the flame and reach the oil surface. There, they absorb heat from the oil and evaporate, producing large amounts of steam that creates an inert gas in the area directly surrounding the flame, effectively cooling the oil below its ignition temperature.

The dangerous reaction we typically think of between water and hot oil only happens with higher volumes of water, like large droplets from a sprinkler system.

Proving the effectiveness of water mist for IFP

Water mist has been proven to work for IFP. Certain water mist systems, including AquaMist from Johnson Controls, were part of a small group of systems that have undergone testing and received Factory Mutual (FM) approval specifically for the protection of industrial fryers.

The FM "Fryer Test" protocol includes three stages. Each stage consists of two tests, one with the hood up and one with the hood down, for a total of six fire tests for three cooker sizes. To earn FM approval for the full system during testing, the water mist system being tested must accomplish the following:

- Extinguish any auto-ignition fire, regardless of whether the hood is open or closed
- Extinguish all open flames within one minute of discharge

During extinguishment, there are additional parameters that water mist systems must meet. They must bring the average oil temperature below 392 F (200 C) to prevent thermal damage. They must also be able to discharge for twice the amount of time required to extinguish the worst-case fire scenario (minimum 10 minutes). The depth of the industrial fryer's oil bath determines the specific length of water mist discharge.

If designed to operate at constant pressures, the system pressures shall be automatically controlled by the water mist system to within ±5 percent. During the discharge of the water mist system, there shall be no fire flare-ups, micro explosions of oil reacting with water, or splashing of the burning oil.

The water mist systems that received full FM approval, such as AquaMist, are proven to provide this level of suppression and cooling. This data suggests that water mist should not only be considered but heavily favored as a fire suppression solution for IFP.

It's important to note that third-party certifications of individual fire suppression system components are not the same as complete fire suppression systems that have undergone full-scale testing to demonstrate effectiveness. Only FM system approval demonstrates that a water mist system has successfully passed fire tests, the required system components have been FM laboratory tested, and the Design, Installation, Operation and Maintenance Manual (DIOM) has been FM checked, resulting in a complete approved system.

Gaining the additional benefits of water mist systems

Beyond effective fire suppression for industrial fryer protection, water mist systems offer fried food manufacturers other significant benefits. These include installation cost and space savings, as well as a minimized impact on business compared to other systems if discharged.

FM-approved water mist systems can use a facility's existing fire sprinkler water supply and connect directly to the tank, no additional tank needed. Since water mist systems only use this water supply, there's also no additional tank required for a separate fire suppression medium. In some cases, a water mist system can be connected to the building water supply due to the low consumption of water. In comparison, CO_2 systems require separate fire suppression medium cylinders and space. Low-pressure water mist systems also have reduced pipe weights, lower required power supplies (mains connection) and lower pump cost compared to high-pressure water mist alternatives.

Water mist systems also tend to be less consequential in terms of water damage to clean up after system discharge, meaning there is less disruption to production and impact to manufacturers' bottom line compared to other solutions. Water mist systems provide the most effective fire suppression performance in mitigating business impact. There is less fire and water damage to clean up, resulting in less downtime. This means businesses can return to production more quickly.

Selecting effective fire suppression that minimizes business interruption

When looking for effective and reliable suppression solutions, fried food producers need to consider fully approved water mist systems, not only for safety but for business continuity. Water mist systems can reduce the severity of a fire event, as well as reduce costs and space needs compared to other solutions. By effectively suppressing fire and cooling the oil, water mist systems offer superior protection for industrial fryers without the risks associated with CO_2 and sprinkler systems.

AquaMist®

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For more information, please visit **tycoaquamist.com/industries/industrial-fryer-protection.**

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