# Water Mist Fire Protection For The Food Industry

By

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# Water Mist Fire Protection For The Food Industry

## *Industrial Oil Cookers*

## Agenda

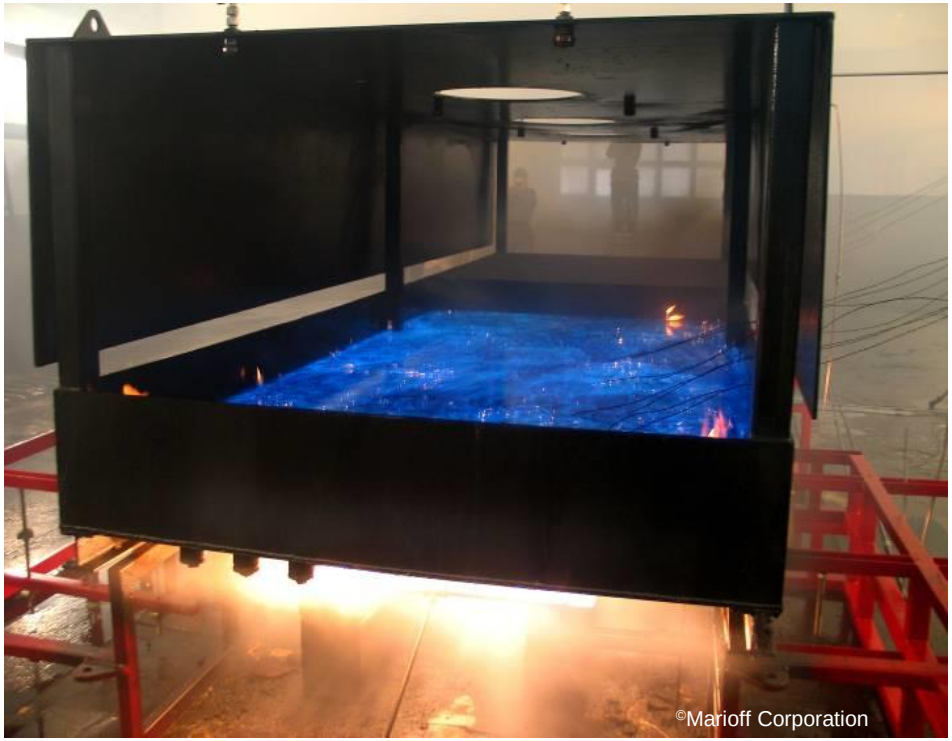
Introduction of the application

Approval testing

Water mist system solution

Sharing Marioff experience

Summary

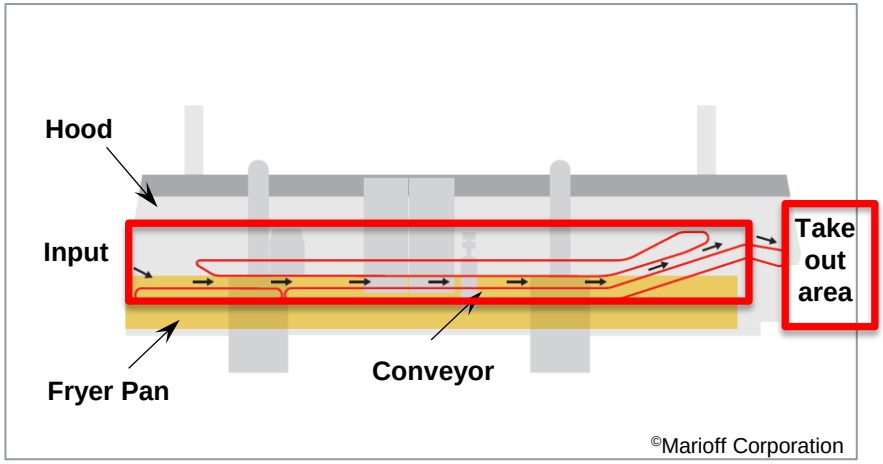


# Introduction To Industrial Oil Cookers

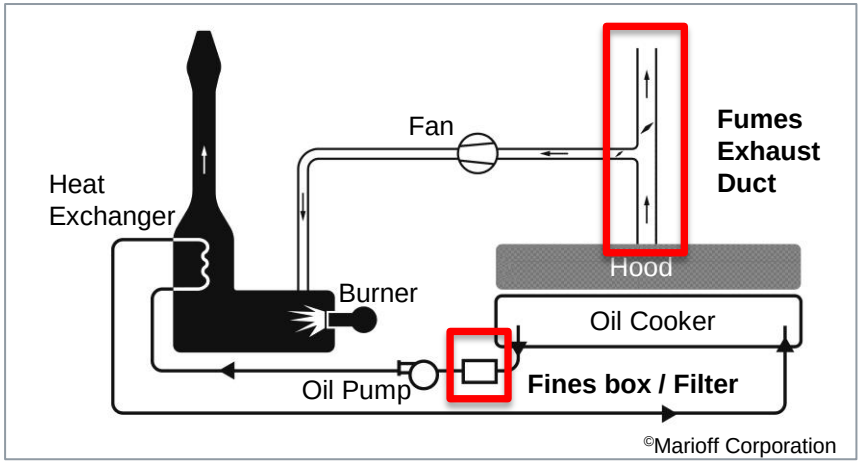
- Industrial oil cookers are typically conveyorized fryers or occasionally batch kettles used in food processing plants for chicken, fish, potato and many other food products.

- Industrial oil cookers use a direct or indirect heating source. With direct heat, the heat source or burner is in direct contact with the cooking oil. Indirect heating means the heat source or burner heats an intermediate media, which is then used to heat the cooking oil. Indirect heating is typically safer, and is preferred from a risk management point of view.

Pic. 1. Conveyorized fryer




Pic. 2. Indirect heating



# Introduction To Industrial Oil Cookers

By definition, the industrial oil cookers are large containers filled with heated combustible oil, with related heating, ventilation and electrical equipment.

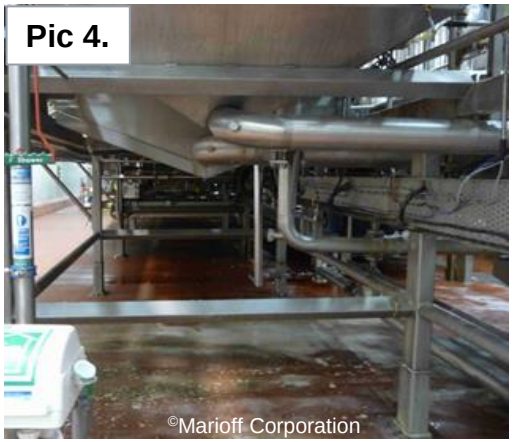
They can contain a few hundred to several thousand liters of cooking oil and have extensive open surfaces.

**Pic 1.**

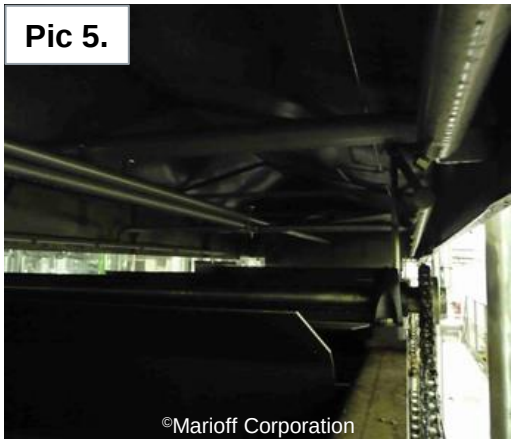

**Pic 2.**


**Pic 3.**


**Pic 4.**




**Pic 5.**



# Why Fire Protection?

**Ballreich's temporarily shuts down production again after second fire in four days**

Nov 2nd, 2015

http://www.13abc.com/home/headlines/Ballreichs-temporarily-shuts-down-production-again-after-second-fire-in-four-days-[illegible]9653412.html

**Factory Clarebout Potatoes totally destroyed by fire**

Sep 8th, 2015

http://www.potatopro.com/news/2015/factory-clarebout-potatoes-totally-destroyed-fire

**Wangara factory fire damage bill tipped to hit $12m**

Aug 24th, 2015

http://www.abc.net.au/news/2015-08-24/wangara-factory-fire-damage-bill-estimated-at-12-million/6720106

**Employees evacuate after potato chip factory catches fire**

Mar 12th, 2015

http://www.wbtv.com/story/28407424/employees-evacuate-after-potato-chip-factory-catch[illegible]

**Fryer fire at Wisbech factory**

Sep 17th, 2014

http://www.peterboroughtoday.co.uk/news/latest-news/fryer-fire-at-wisbech-factory-1-6378479

**Massive Fire at Old Potato Chip Factory Under Control**

Mar 25th, 2014

http://fox8.com/2014/03/25/crews-battle-massive-fire-at-cleveland-building/

***Production shut down!***

***Factory totally destroyed!***

***$12M fire damage!***

***Employees evacuate!***

***Fryer fire!***

***Massive fire at potato chip factory!***

# Fire Protection of Industrial Oil Cookers

- The fires in industrial oil cookers are very challenging to extinguish. Effective fire extinguishment requires not only that all the flames over the large oil surface to be extinguished, but also that a significant amount of hot oil to be cooled down below its ignition point to prevent re-ignition.

- Fire suppressants that contain chemical components are not allowed to be used in the food processing industry due to considerations of food safety.

- Previous research shows that sprinkler water sprays were able to extinguish industrial oil cooker fires, but extensive oil was spilled over the oil cooker and formed large fires on the ground, as large water droplets sank and boiled up in the hot oil.

- Carbon dioxide is commonly used for industrial oil cooker protection. It is capable of extinguishing flames over the oil surface, but it cannot effectively prevent re-ignition, because carbon dioxide does not have a sufficient cooling capacity to cool the oil below its auto-ignition temperature, especially for those vegetable oils that have high burning temperatures.

| Type of Cooking oil | Flash Point ºC (ºF) | Ignition Temp. ºC (ºF) |
|---|---|---|
| Canola oil | 338 (641) | 363 (686) |
| Corn oil | 342 (647) | 362 (684) |
| Cotton seed oil | 334 (633) | 366 (690) |
| Palm oil | 328 (623) | 377 (710) |
| Peanut oil | 348 (659) | 370 (698) |
| Soyabean oil | 333 (631) | 377 (710) |

# Water Mist - FM Approval Protocol

Based on FM Standard 5560 (Approval Standard for Water Mist Systems), some of the acceptable performance criteria's for using a water mist system for industrial oil cooker protection are:

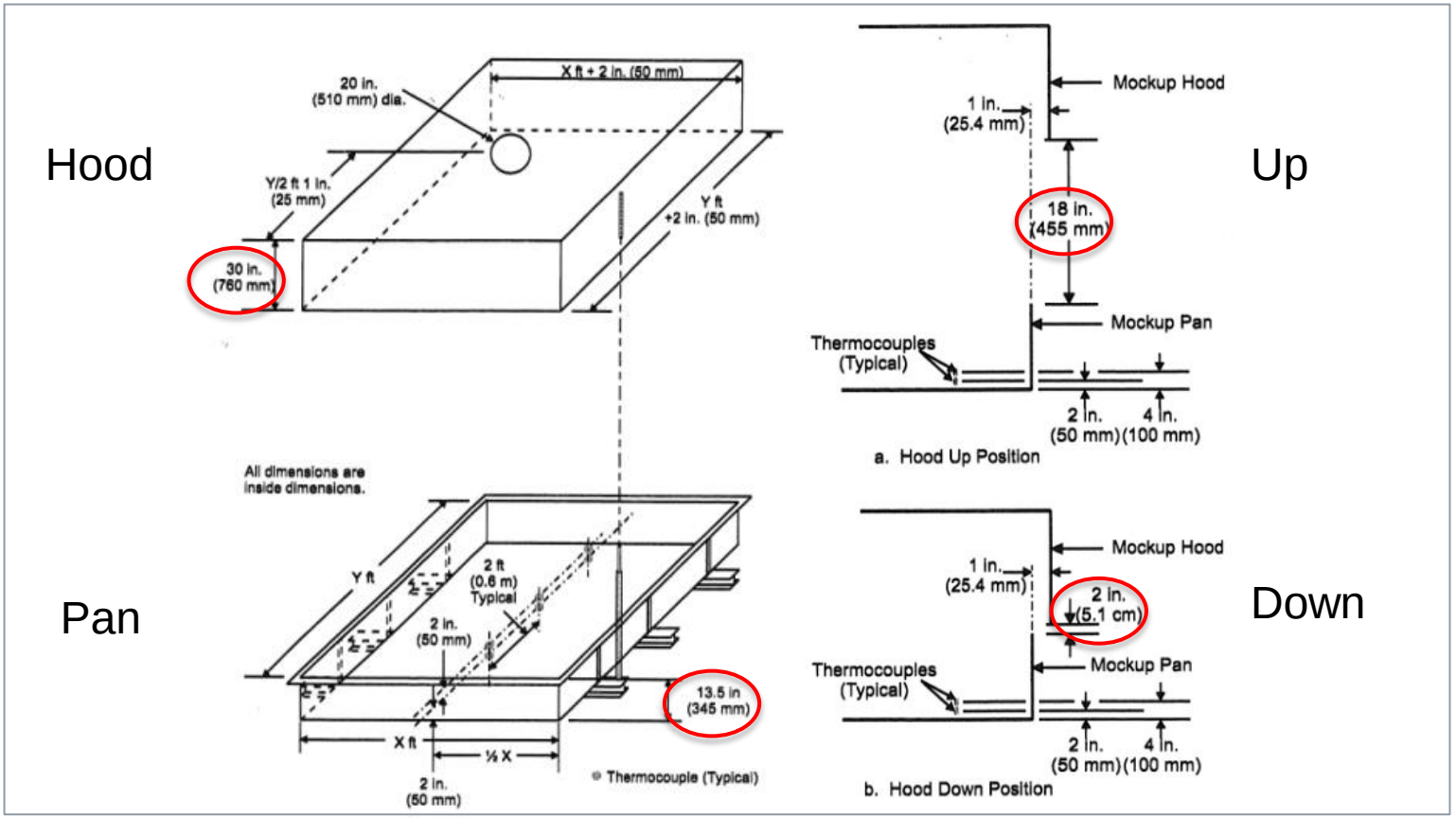
1. The water mist system shall be capable of extinguishing any auto-ignition fire inside the industrial oil cooker mock-up, regardless of its hood position

2. All flames shall be extinguished within one minute

3. The average oil temperature shall be cooled down below flash point within 2 min

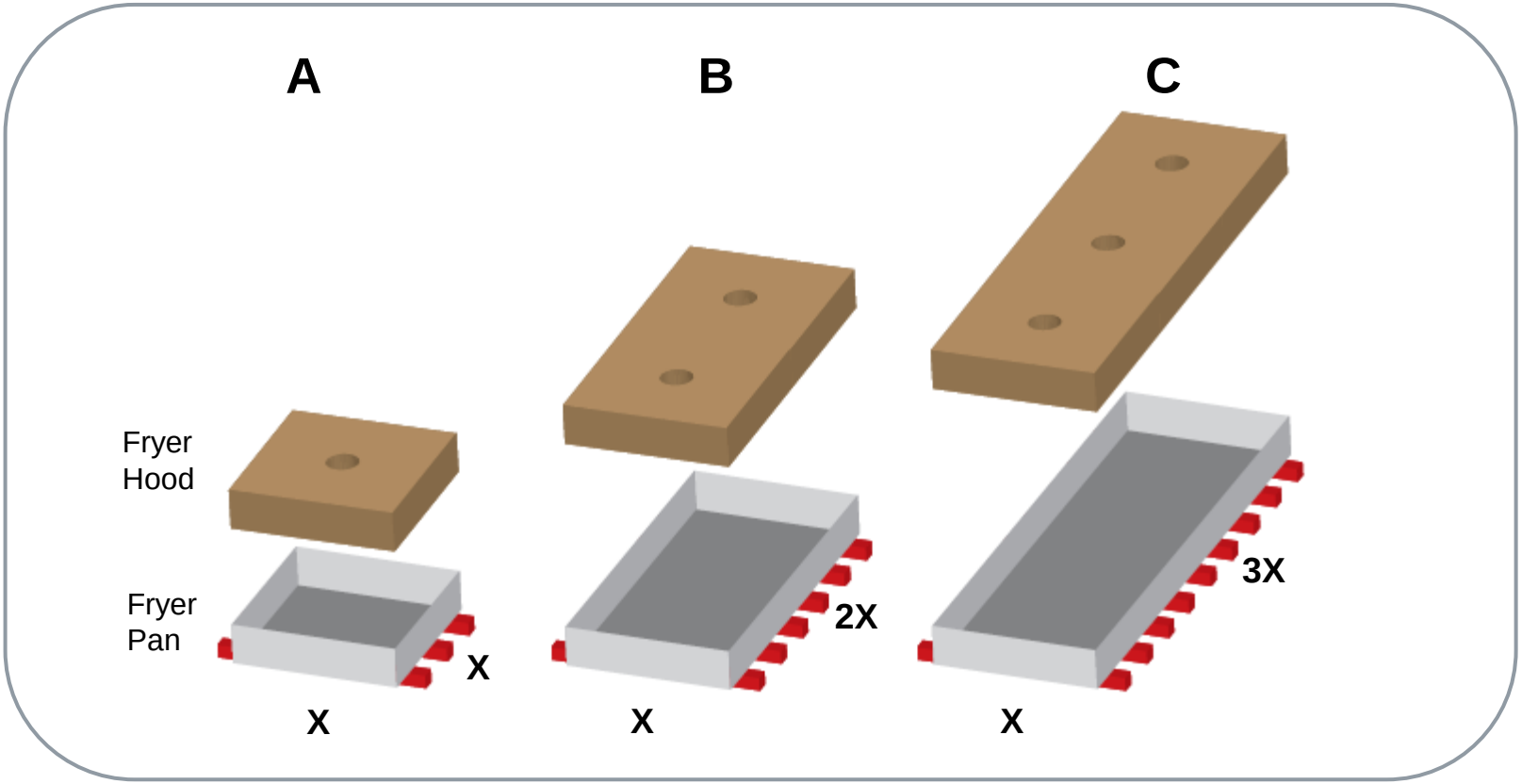
4. During the discharge of the water mist system, there should be no excessive fire flare-ups, micro explosions of oil reacting with water, or splashing of burning oil.

# FM 5560 – Oil Cooker Mock Up




- Spray heads attached to the hood
- Max distance to oil surface 1.5 m (hood up)
- Min distance to oil surface 1 m (hood down)

# Mock Up's for FM Approval Testing




Three mock-up sizes: same width, lengths X, 2X and 3X
Hood up position and hood down position, resulting in 6 fire tests

# Approval Testing

**Important characteristics of high pressure water mist to be considered when extinguishing a cooking oil fire**

- Water flux (water per unit of time per area)
- Spray coverage (nozzle spacing, spray pattern)
- Spray momentum (pressure at the nozzle)

To develop an appropriate water mist system, water mist haracteristics of the nozzle including the drop size, spray angle, water density distribution and water flow rate, were studied.

Prior to the approval testing, Marioff conducted internally +50 full scale fire tests with different mock up and nozzle configurations.

Final approval testing was done in July 2008 @ VTT in Finland, witnessed by FM Global


# Fire Test Results

| Fire Test | Mock Up | Hood |
|---|---|---|
| 1 | A | Up |
| 2 | A | Down |
| 3 | B | Up |
| 4 | B | Down |
| 5 | C | Up |
| 6 | C | Down |

Fire testing per FM 5560

All fire tests approved

Infinite length scalability

FM APPROVED

## Certificate of Compliance

This certificate is issued for the following:

| | |
|---|---|
| System Designation: | HI-FOG® SPU Water Mist System for the Protection of Industrial Oil Cookers with widths up to, and including 6.9 ft (2.1 m) |
| Design, Installation, Operation and Maintenance Manual: | HI-FOG® Systems for Protection of Industrial Oil Cookers With Widths Up To, and Including 2.1 m (6.9 ft), Design, Installation, Operation and Maintenance Manual, Document Ref: MO/ES/28/DIOM/FM/08, Revision 1.1, Date of Issue: May '14 |

**Prepared for:**

MARIOFF CORPORATION OY
PLAZA BUSINESS PARK HALO
AYRITIE 24
FIN-01510
VANTAA, FINLAND

**Manufactured at:**

MARIOFF CORPORATION OY
MOREENITIE 4
FIN-04250
KERAVA, FINLAND

FM Approvals Class: 5560

Approval Identification: 3024528 Approval Granted: December 19, 2014

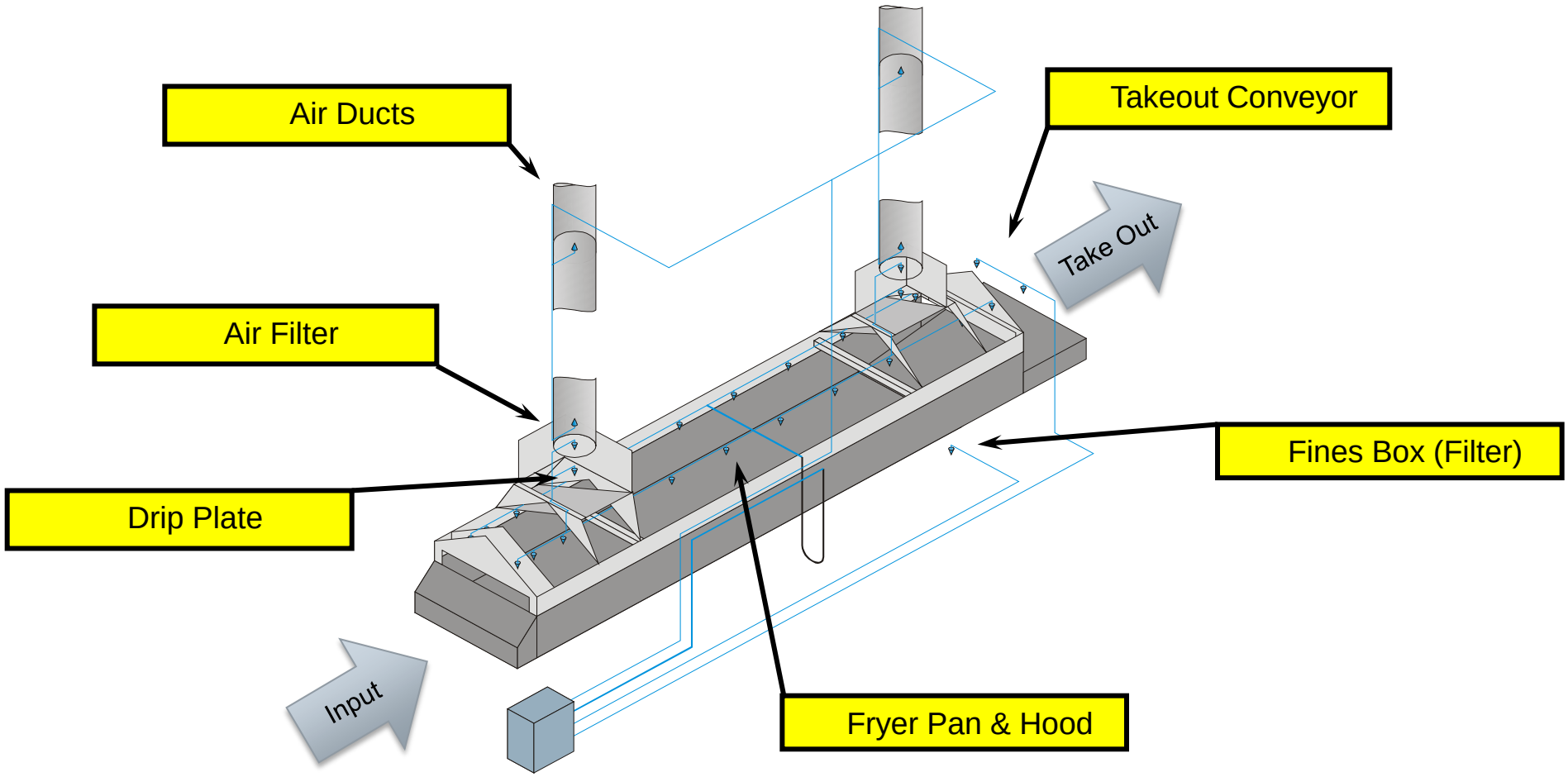
To verify the availability of the Approved product, please refer to www.approvalguide.com or www.roofnav.com

Said Approval is subject to satisfactory field performance, continuing Surveillance Audits, and strict conformity to the constructions as shown in the Approval Guide, an online resource of FM Approvals.

Richard B. Dunne
Manager – Fire Protection Group
FM Approvals
1151 Boston-Providence Turnpike
Norwood, MA 02062

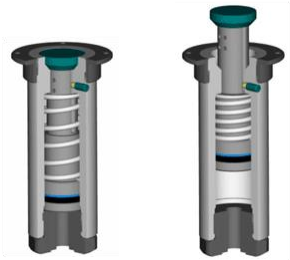
FM Approvals
*Member of the FM Global Group*

# The Application & Fire Risk

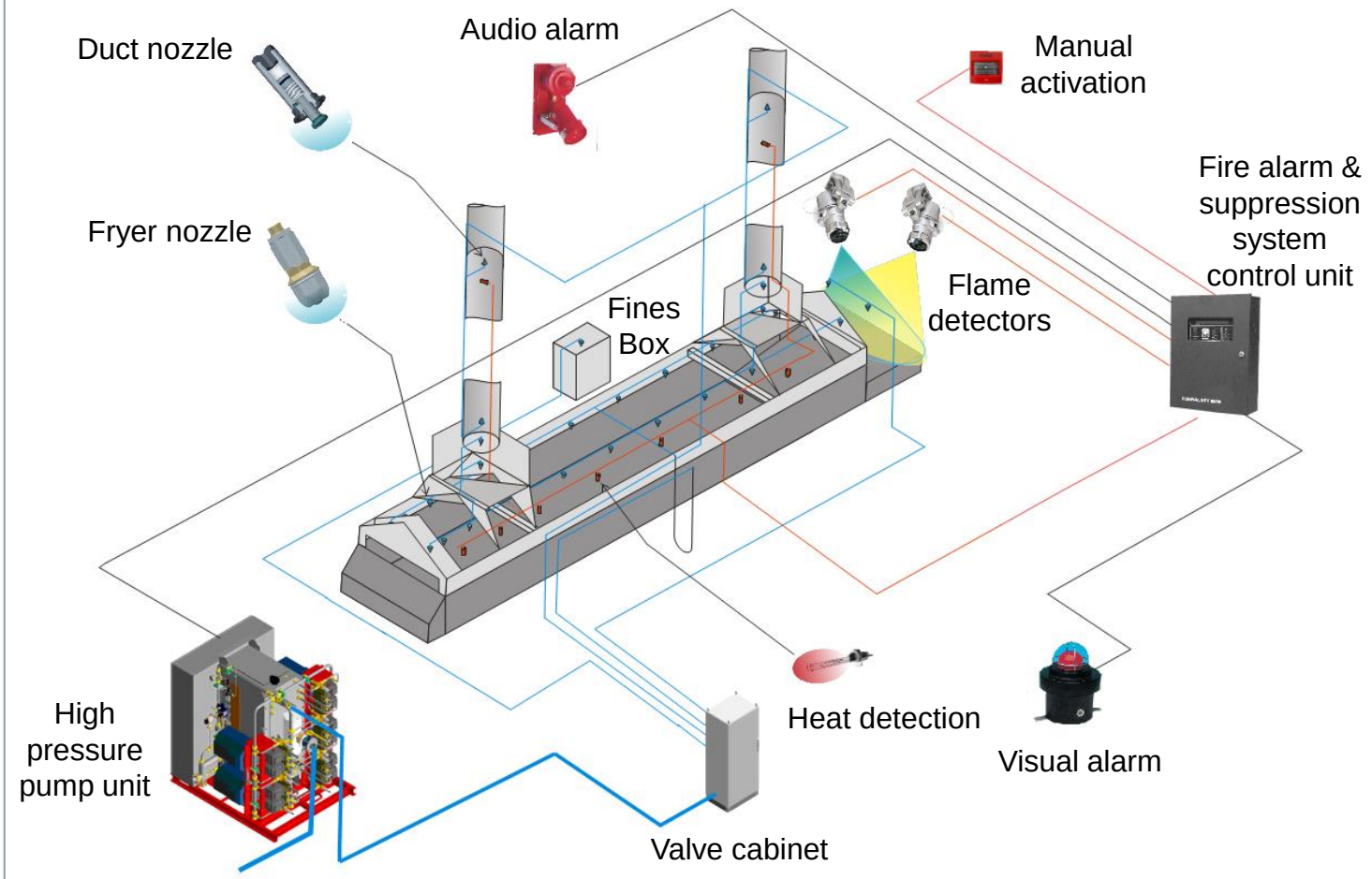


# Water Mist System Solution Including D&A

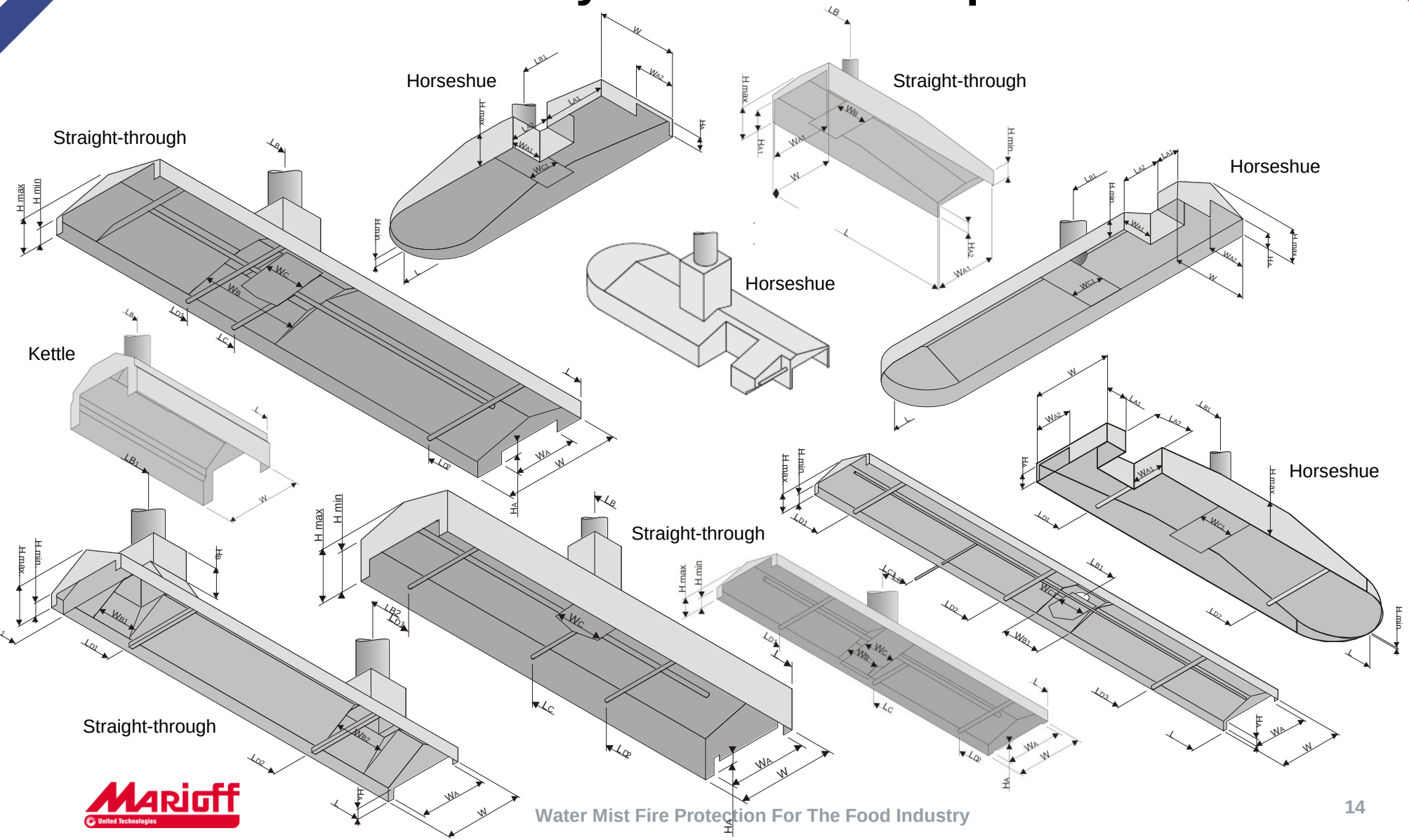
Pop-out
Duct nozzle



Fryer nozzle
& blow off cup



# Industrial Fryers – Marioff Experience



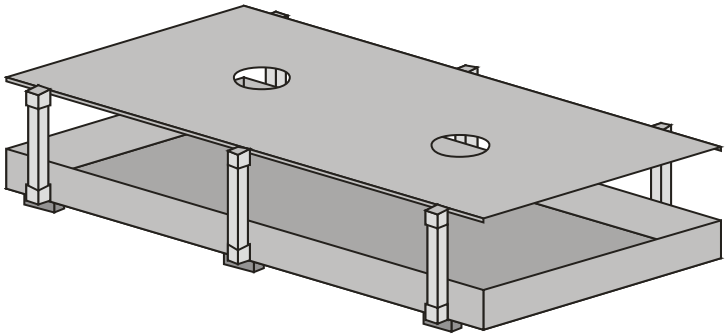
# The Challenge

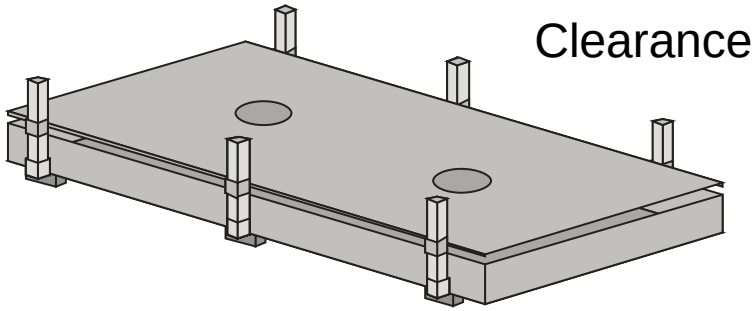
**Many different configurations**

- sloped hoods
- different pan shapes
- many hoods only 50-60 cm from oil surface
- some hoods as low as 38 cm from oil surface
- different obstructions under the hood

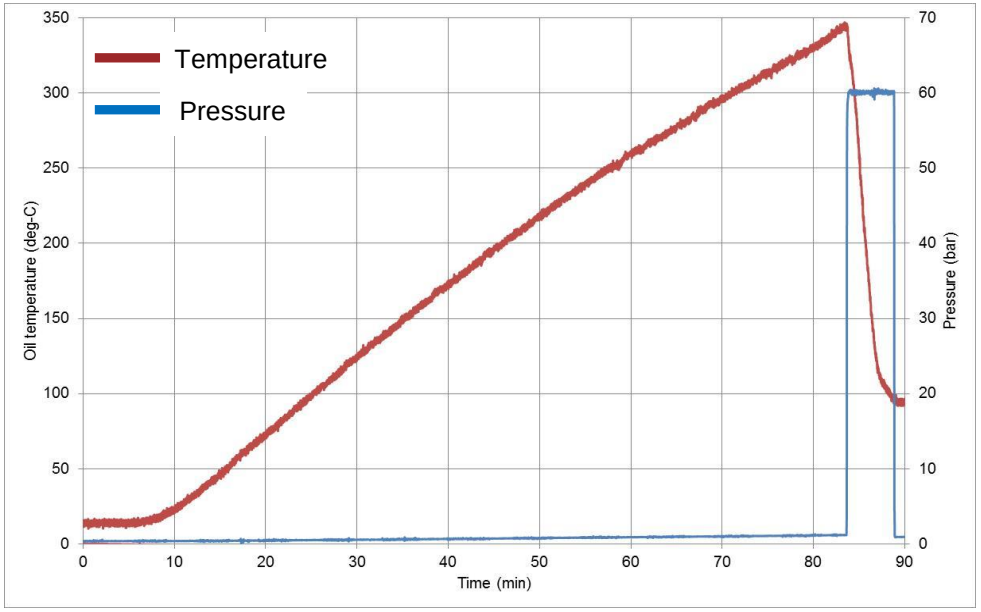
From water mist fire suppression performance point of view, the hood height or nozzle distance to oil surface is a critical parameter affecting the system performance.

# Customized Fire Testing – Mock Up Configuration





Clearance 30 cm

# Customized Fire Testing

## Observations

- The fire is very different at a short clearance
- The duct holes in the hood play a major role
- Major burning externally on top of the hood
- The oil is cooled down very quickly
- The fire gets extinguished quickly
- No splashing of burning oil in the surroundings
- The extinguishment time is very sensitive to the pre-burn time

## Final Outcome

- Customer very satisfied
- Insurance company very satisfied

# Summary

**High pressure water mist is an excellent alternative for the food industry, in particulary, protecting industrial oil cookers**

### The HI-FOG® Water Mist Solution For Industrial Oil Cookers

- ✓ Proven performance and tested for the food industry
- ✓ Approved by third party through fire and component tests
- ✓ Scalable and adaptable for wide range of fryers
- ✓ Safe for personnel and production
- ✓ Minimized business disruption
- ✓ Single system for the entire plant
- ✓ Choice of food industry leaders

# Thank You For Your Attention

HI-FOG®
water mist fire protection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Web: www.marioff.com

Youtube: https://www.youtube.com/user/MarioffHIFOG/