Water Mist Fire Protection Systems for the Protection of Industrial Oil Cookers

8th March 2016

Dr Tim Nichols CPhys MIFireE

AquaMist

tyco Fire Protection Products

Industrial Oil Cookers

What are Industrial Oil Cookers

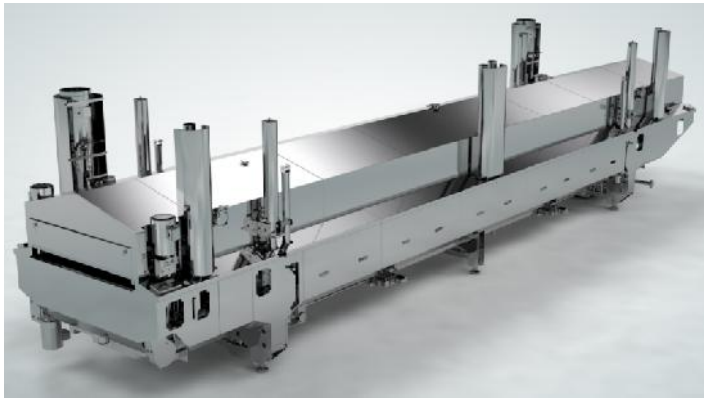
Large cooker of food products

- Oils used as cooking medium
- Up to 5,000 gal (18,927 l) of oil

Arrangements:

- Conveyor Fryers
- Kettle Fryers

Placed in large industrial manufacturing environments



Conveyor Fryer

Kettle Fryer

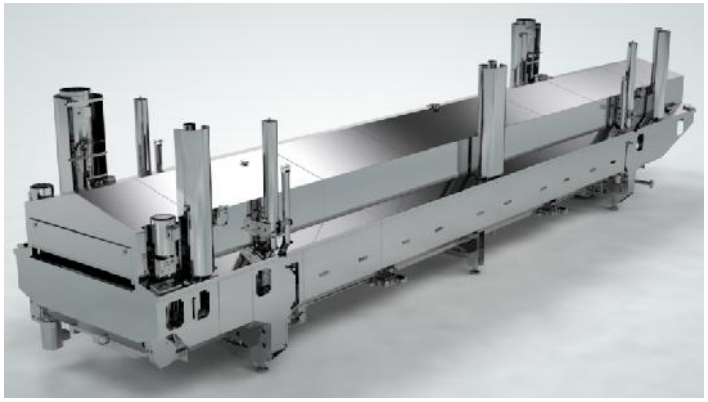
What are Industrial Oil Cookers

Configuration

- Movable covers, or hoods, that may be hydraulically operated
- Hood is closed during system operation, but occasionally opened for routine maintenance
- Exhaust Stacks connected on top of hood

Cooking Methods

- Heated indirectly by exchanging heat with a heat transfer fluid or steam
- Heated directly by gas/oil fired radiant tubes beneath pan or flame impingement on the bottom of the pan



Conveyor Fryer

Kettle Fryer

Fire Hazard

Fire Classification

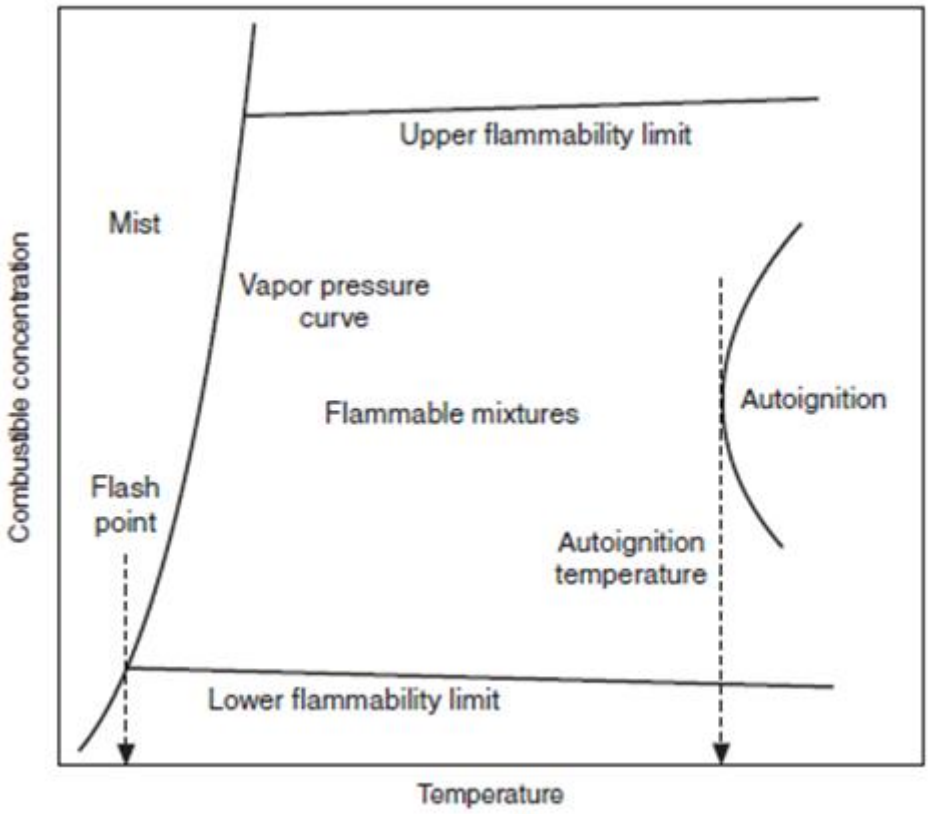
- Class K – Cooking Oil
- Combustible Liquid – Class IIIB
  - Tested with canola oil
  - Comparable oils:
    - Olive Oil
    - Corn Oil

Flash Point

- Temperature at which the vapour and air mixture lying just above the liquid fuel's vaporizing surface is capable of supporting a momentarily flashing propagation of a flame when prompted by a quick sweep of a small gas flame pilot near the surface

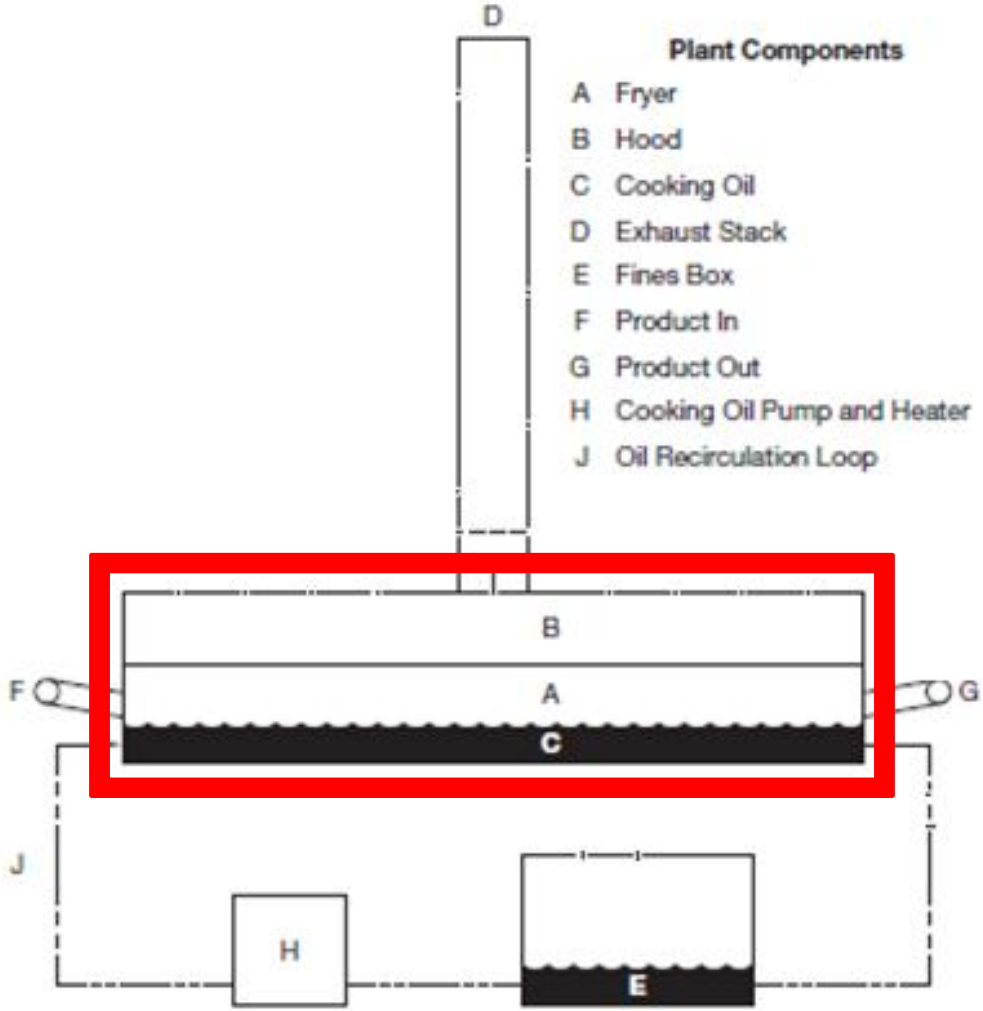
Auto-ignition Temperature

- Minimum temperature at which the mixture of a vapour (or gas) and air is self-igniting



Fire Risk – Primary Cooking Area

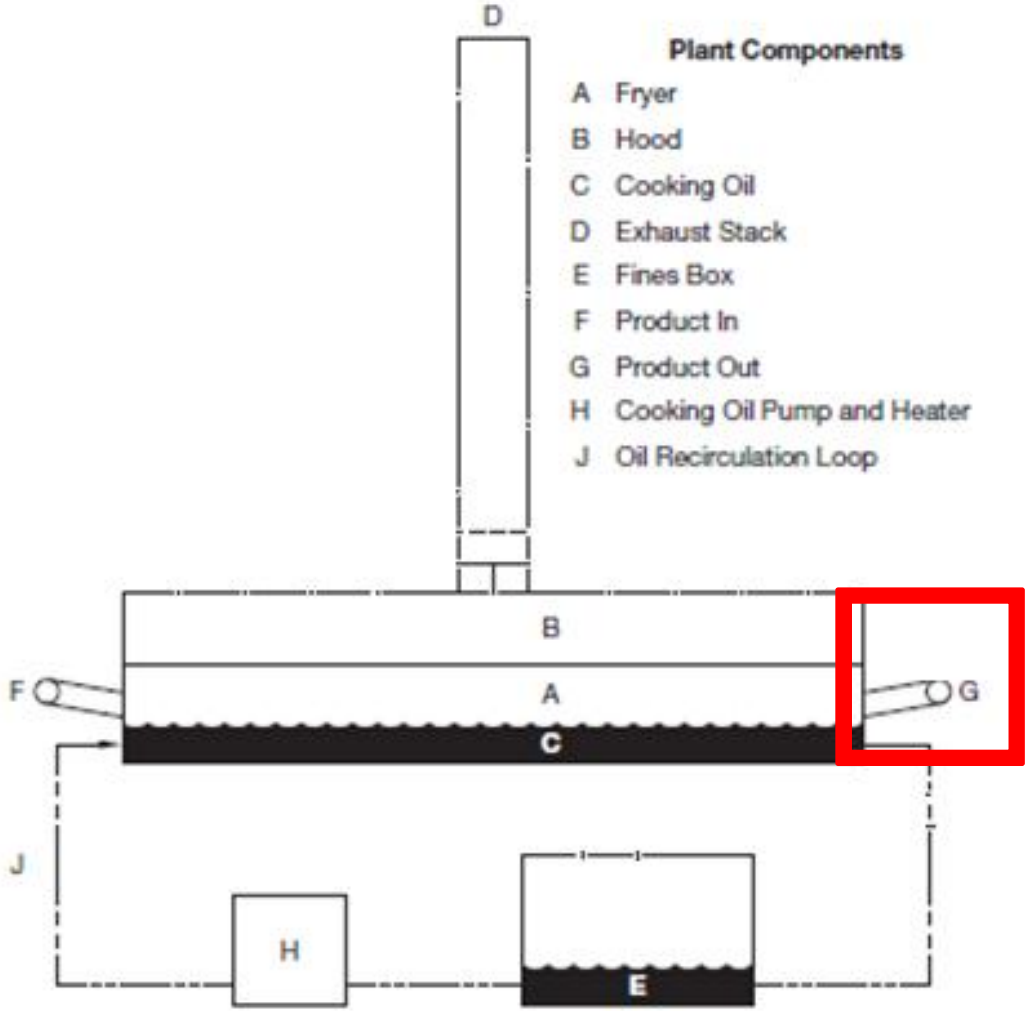
- The Primary Cooking Area consists of the pan area under the hood containing heated oil where general cooking takes place.
- Highest Probability for fire events due to product
- Paddles, Drums, & Conveyors
- Movable Hoods



Fire Risk – Primary Cooking Area

Fire Risk – Take Out Area

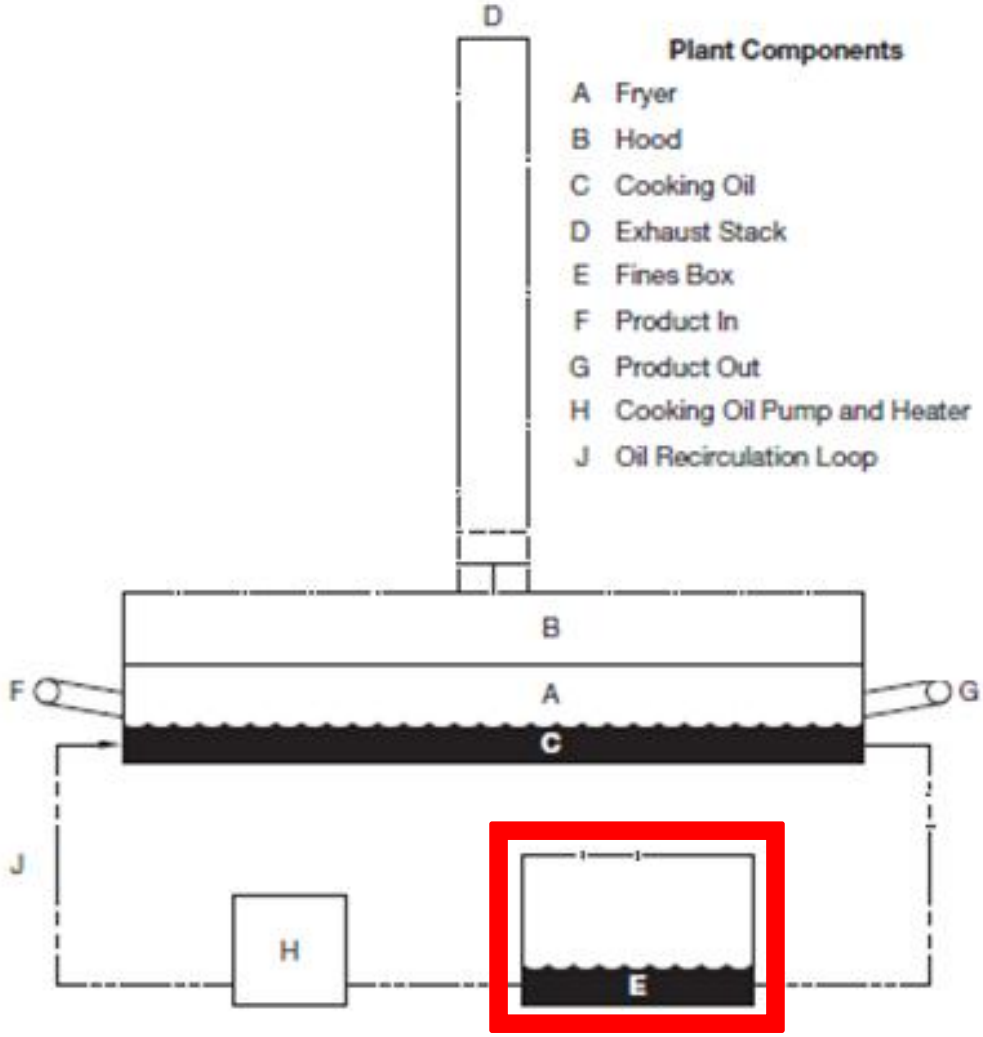
- The Takeout Area consists of the area in which processed or “cooked” food is removed from the fryer, typically via a conveyor.
- High Probability for fire events due to cooked product and oil soaked crumbs



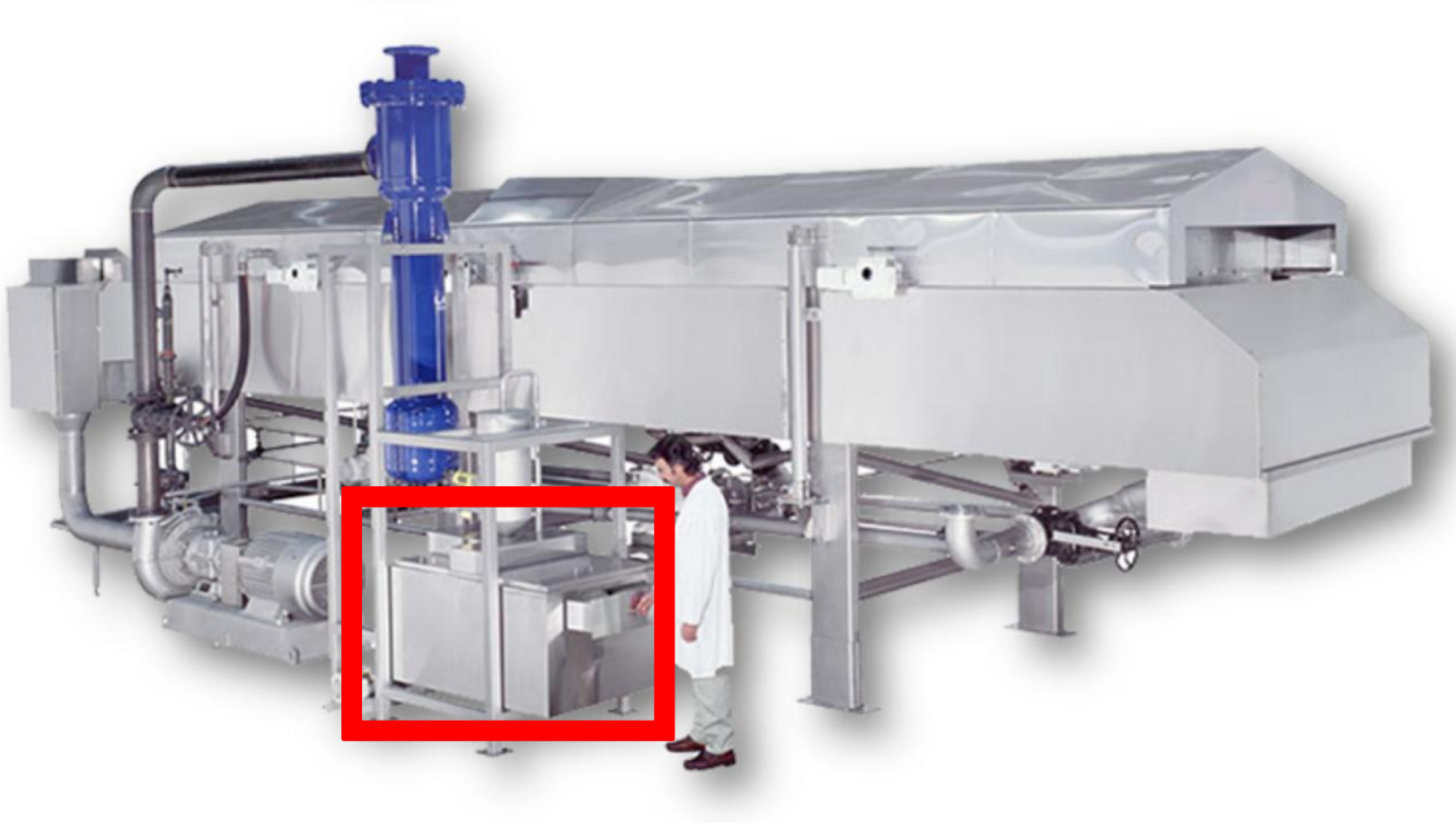
Fire Risk – Take Out Area

Fire Risk – Fines Box

// The Fines Box consists of the equipment utilized to filter the oil during continuous operation.

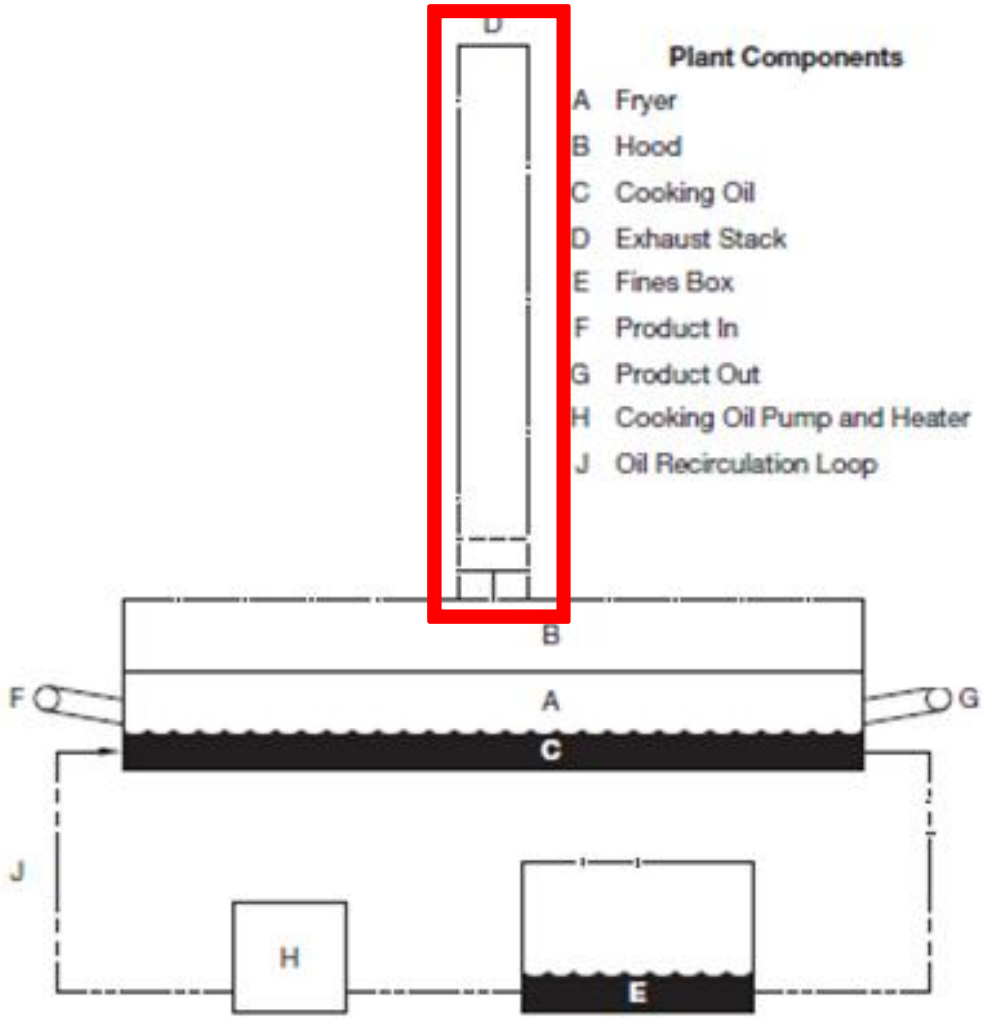


Fire Risk – Fines Box



Fire Risk – Exhaust Stack

// The Exhaust Stack(s) consists of the ductwork utilized to remove the gases and vapours generated during the cooking process from the primary cooking area and possibly the fines box.



Fire Risk – Exhaust Stack

Challenges

Challenges

Insurers view

- Significant risk potential
  - Material damage
  - Consequential loss
- Large recent claim history

Operators view

- Rapid suppression
- Minimal infrastructure impact
- Quick recovery

Challenges

Agent	Reference	Advantages	Disadvantages
CO_2	NFPA 12	• Established	• Health & Safety Issues • Finite Supply/Downtime • Reduced Cooling Effect • Not supported by FM
Water Spray	FM 7-20	• Prescriptive • Economic	• Thermal Shock • Flood Risk • High Water Consumption
Water Mist	FM 5560 /NFPA 750	• High Cooling Effect • H^2O Consumption • Expandable • Small Footprint	• Infrastructure

FM Global Property Loss Prevention Data Sheet 4-11N, ***Carbon Dioxide Extinguishing Systems***

- *"Appendix B, B-1 Commercial/Industrial Food Processing Deep-Fat (Hot Oil) Cookers – Protection of industrial oil cookers is covered by FM Global Loss Prevention Data Sheet 7-20, Oil Cookers. Carbon dioxide protection of industrial oil cookers is not recommended by FM Global given the limited cooling capacity of carbon dioxide and its questionable based on reported loss experience"*

Industrial Oil Cooker Approval Fire Test Protocol

Approval Protocol

Fire Testing per FM 5560

- Appendix J: Fire Tests for Water Mist Systems for the Protection of Industrial Oil Cookers

Primary Cooking Area Dimensions

- Mock-Up A: 8.0 ft (2.4 m) wide by 8.0 ft (2.4 m) long (1 x L)
- Mock-Up B: 8.0 ft (2.4 m) wide by 16.0 ft (4.8 m) long (2 x L)
- Mock-Up C: 8.0 ft (2.4 m) wide by 24.0 ft (7.2 m) long (3 x L)

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

We have proved infinite length scalability through fire testing; the results suggest there is no trend between fryer length and rapid extinguishment reliability.

Approval Protocol

Fire Test Approval Criteria

- Extinguish AIT fire inside oil cooker mockup, regardless of hood position
- Extinguish all open flames within 1-minute of system discharge
- Cool oil so its average temperature is below the oil's flash point 600^{o}F (316^{o}C) within two minutes of system discharge
- Design Duration shall be twice the cooling time to get below Flash point, or 10 minutes, whichever is greater (be aware of potential spill over)
- No excessive fire flare-ups, micro explosions of oil reacting with water, or splashing of burning oil

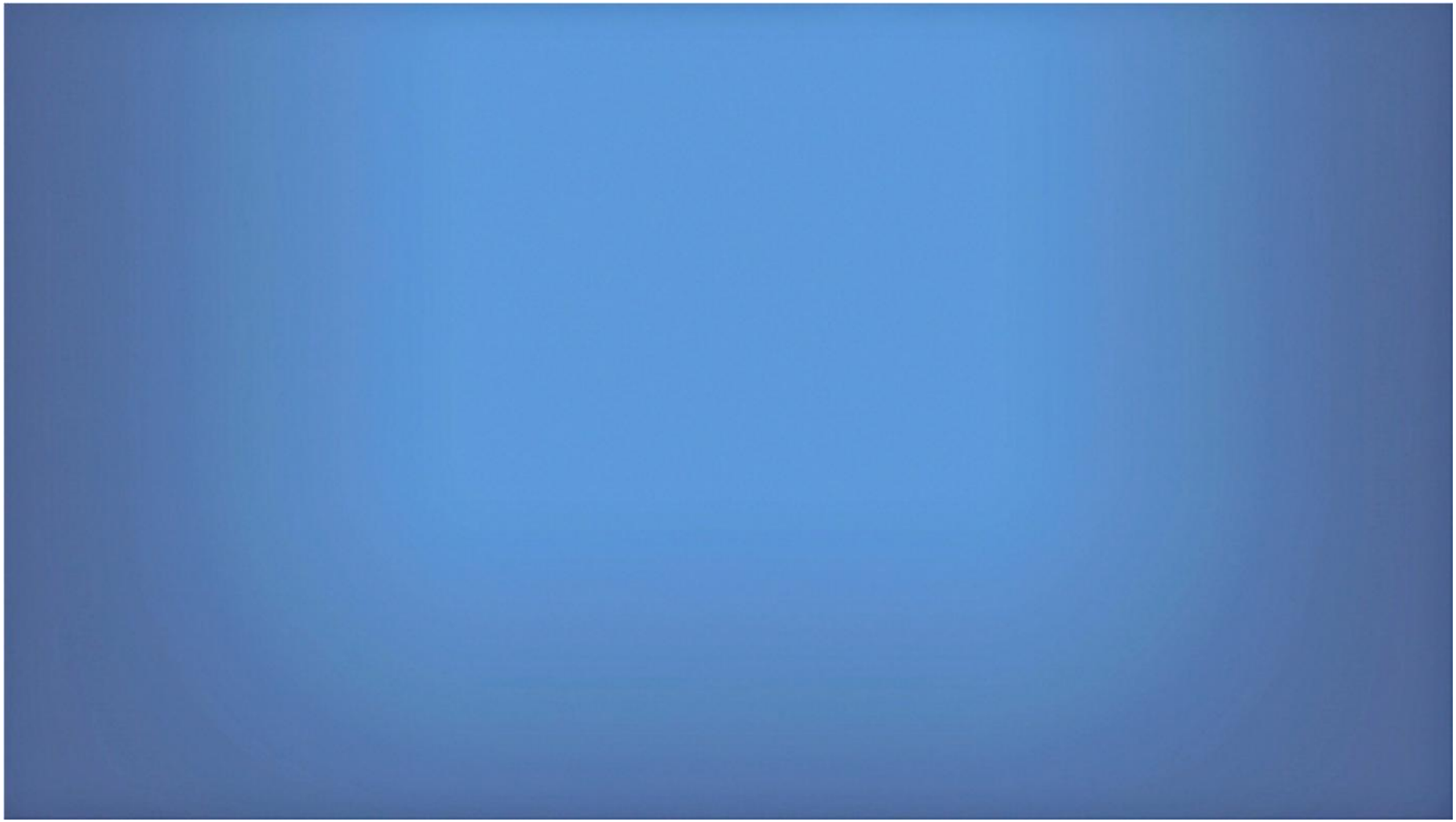
Approval Protocol

TFPP Fire Tests

- More than 50 full-scale fire tests were performed
- 14 tests were witnessed by FM Global in Marinette, WI

Approval Protocol

Approval Protocol



Approval Protocol

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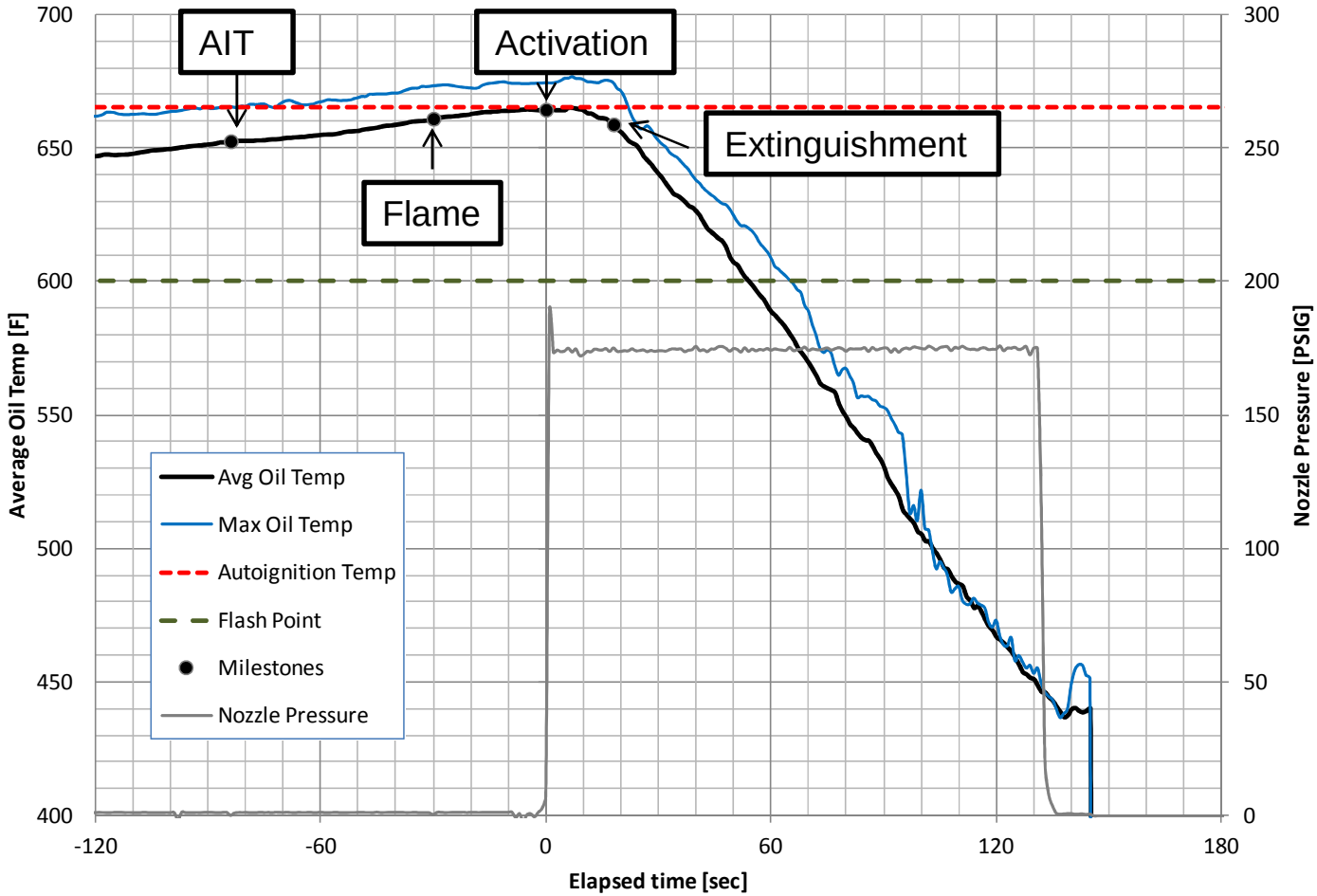


Approval Protocol

Component Approval:

- Strength
- Discharge Co-efficient
- Corrosion Resistance
- Vibration
- Rough handling
- Extreme temperature exposure

Vitally important for challenging environments such as industrial oil cookers

Approval Protocol

FM APPROVED

Certificate of Compliance

This certificate is issued for the following:

System Designation:	AQUAMIST Type Industrial Fire Protection (IFP) Fire Suppression System for the Protection of Industrial Oil Cookers
Design, Installation, Operation and Maintenance Manual:	AQUAMIST Type Industrial Fryer Protection (IFP) Fire Suppression System Design, Installation, Operation and Maintenance Manual, Document No. TFP2240, Revision October 2013

Prepared for:

TYCO FIRE PRODUCTS, LP
1467 ELMWOOD AVENUE
CRANSTON, RI 02910
UNITED STATES

Manufactured at:

TYCO FIRE PRODUCTS, LP
1467 ELMWOOD AVENUE
CRANSTON, RI 02910
UNITED STATES

FM Approvals Class: 5560

Approval Identification: 3047379 Approval Granted: October 16, 2013

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

FM Approvals

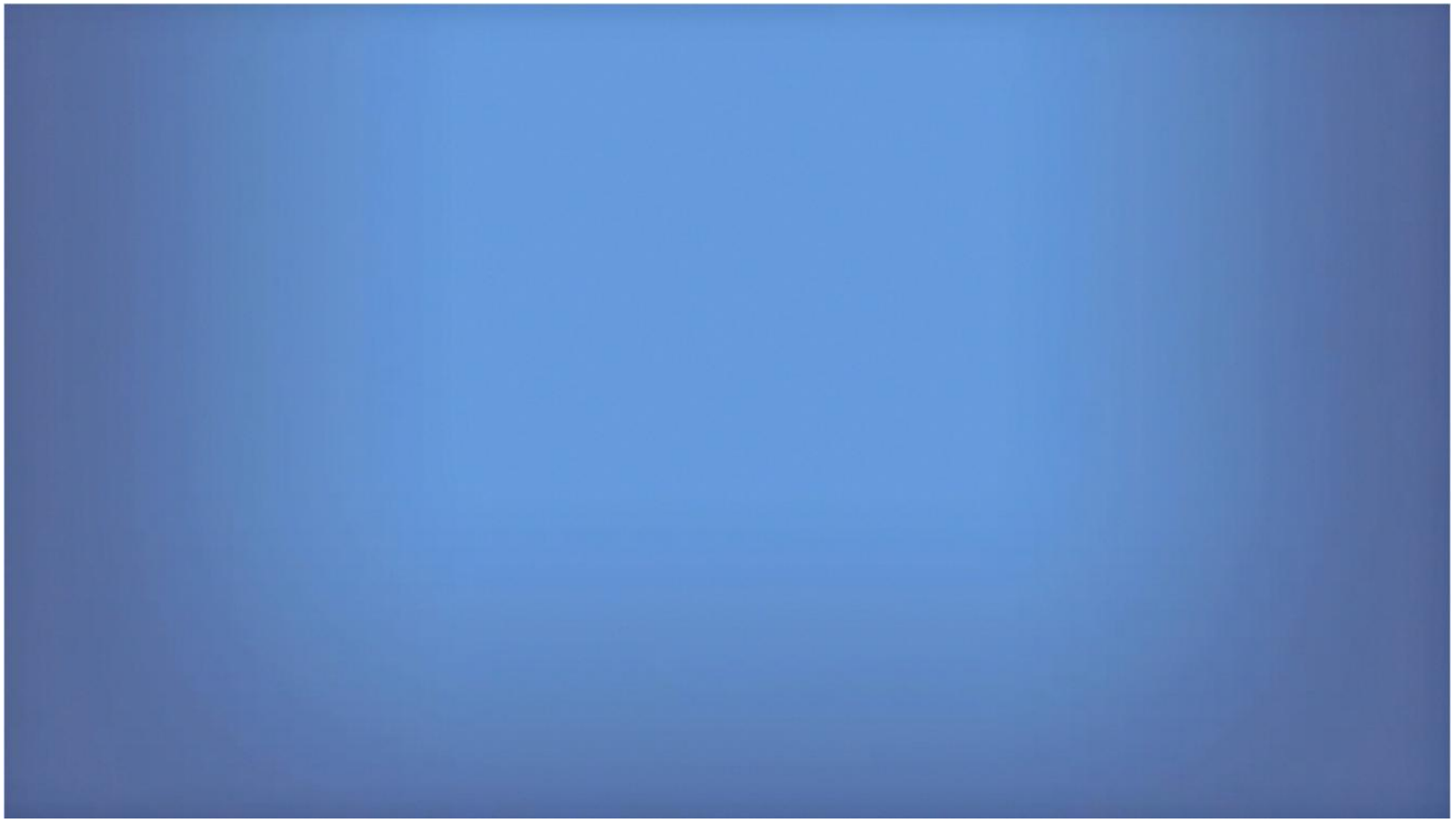
Member of the FM Global Group

Industrial Oil Cooker Case Studies

Case Study One

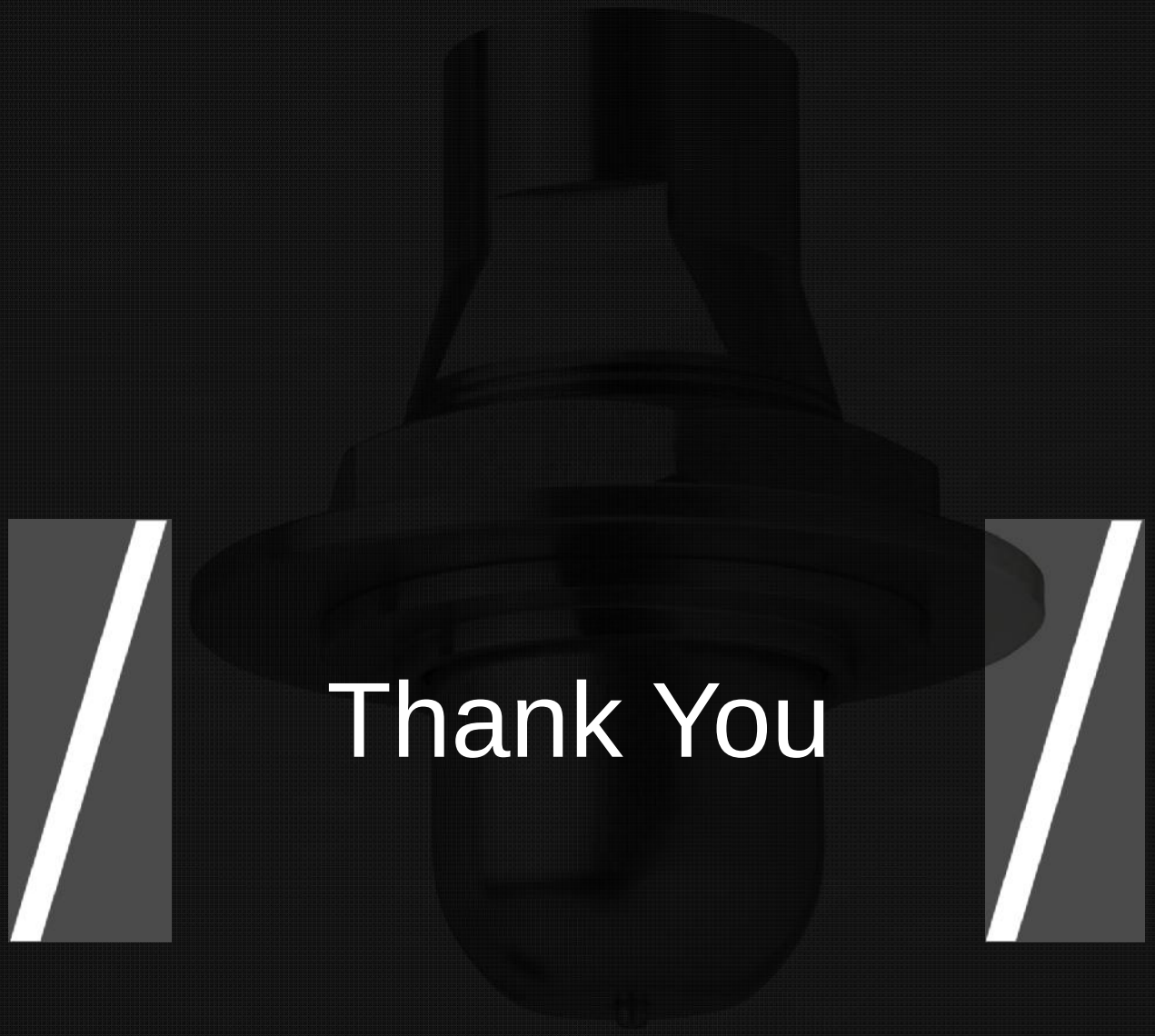
- Multi-national snack manufacturer
- Arson total facility loss
- Insurance lead
- Full facility protection
  - 17 Fryers
  - Central water supply
- Pump-based system with directional valves but flow capability of all fryers at once!

Case Study One



Case Study Two

- Multi-national Food manufacturer
- Infrastructure upgrade
- No civil infrastructure available
  - Water Supply “Stand-alone” Tank
  - No Power Supply available



Thank You