Kitchen Fire Suppression System – An Overview



Agenda

1) Introduction

Restaurant fire statistics

History of Kitchen fire suppression system

2) Codes & Standards

UL 300, NFPA 17A, NFPA 96 & SCDF Fire code

3) Wet chemical system

Typical Components & operation

4) New height nozzle technology

Aesthetic solution & high height nozzle

5) Water & Water Mist

Does it work?

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Restaurant Fires in Singapore

- In 2015, there were **50** reported cases of fires occurring in eating establishments. (i.e., restaurants, coffee shops, canteens and hawker centers).SCDF data -2015
- Unattended cooking (30%).
- Grease build up.
- Accumulated flammable gas.







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Restaurant Fires- Singapore

6th January at Four Seasons Hotel Singapore along 190 Orchard Boulevard at 11.20 pm.



15th January fire that broke out at 313@Somerset shopping mall



Restaurant Fire broke out in Singapore

Fire breaks out at Broadway Hotel along Serangoon Road, 2 injured



A fire broke out at a hawker stall in the popular Whampoa Makan Place at 90 Whampoa Drive on Sunday



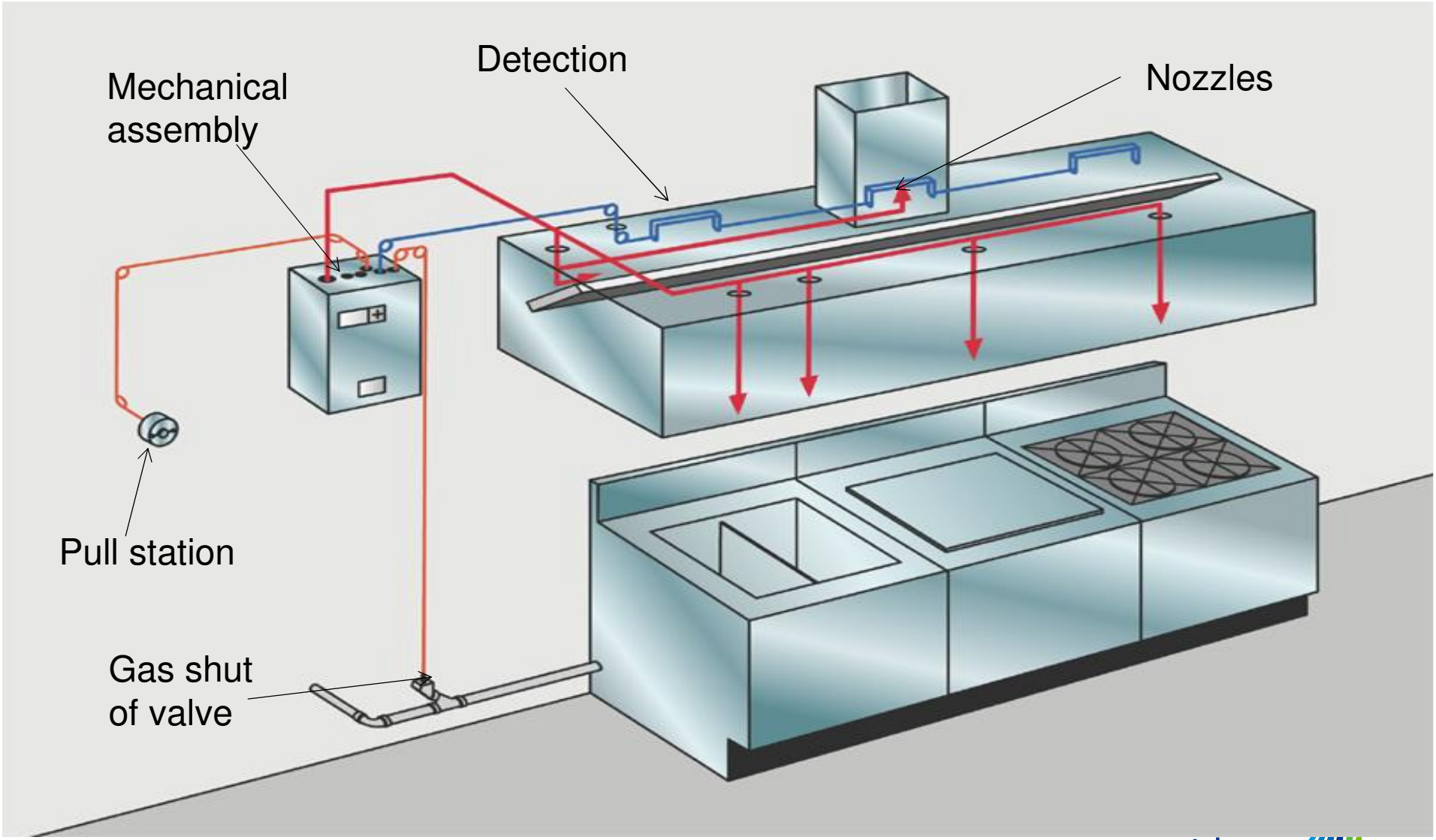
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Restaurant Fire broke out in Singapore



- Fire breaks out at Lucky Plaza
- The smoke was emitting from restaurant Warung Surabaya.

Kitchen fire protection layout



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Typical components

Pre Engineered Cartridge Operated Systems



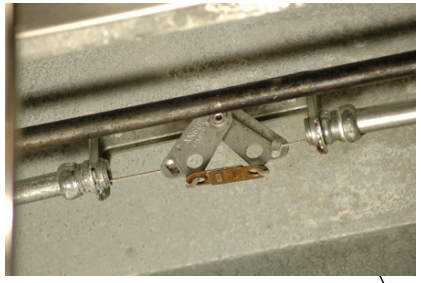
Wet chemical system

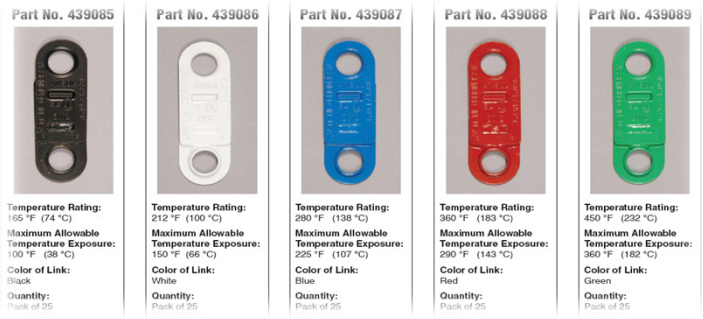


Hybrid system (Wet chemical + Water)

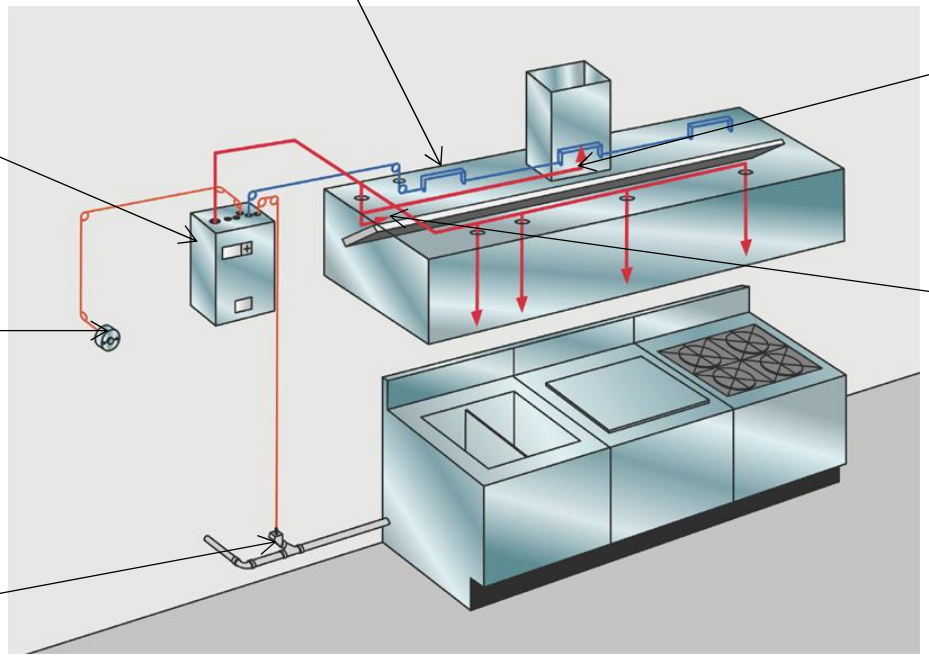
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Wet chemical agent components











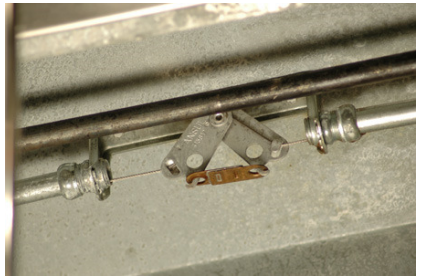






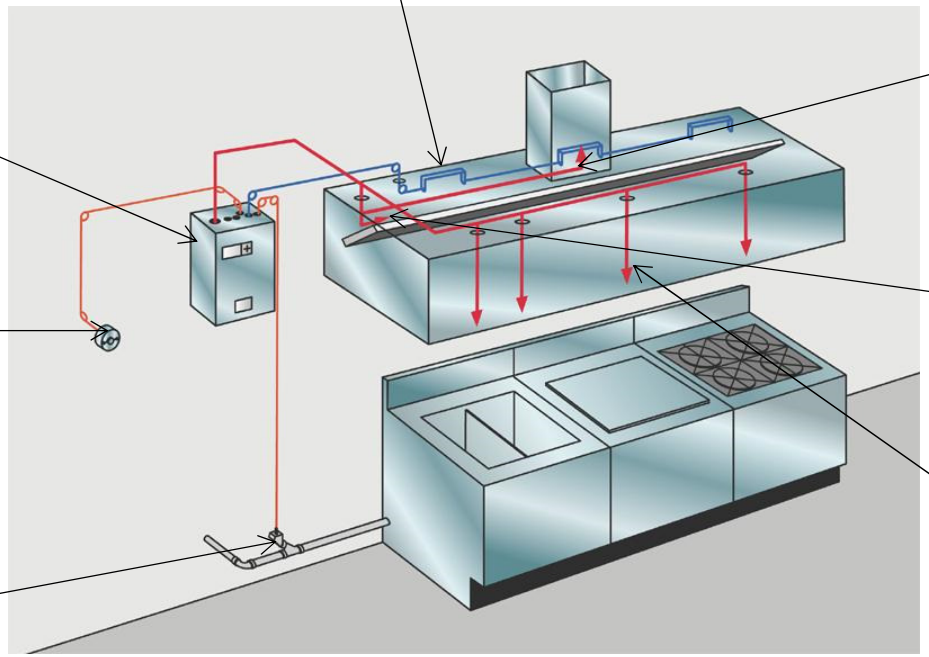
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Hybrid System (Wet Chemical + Water)

















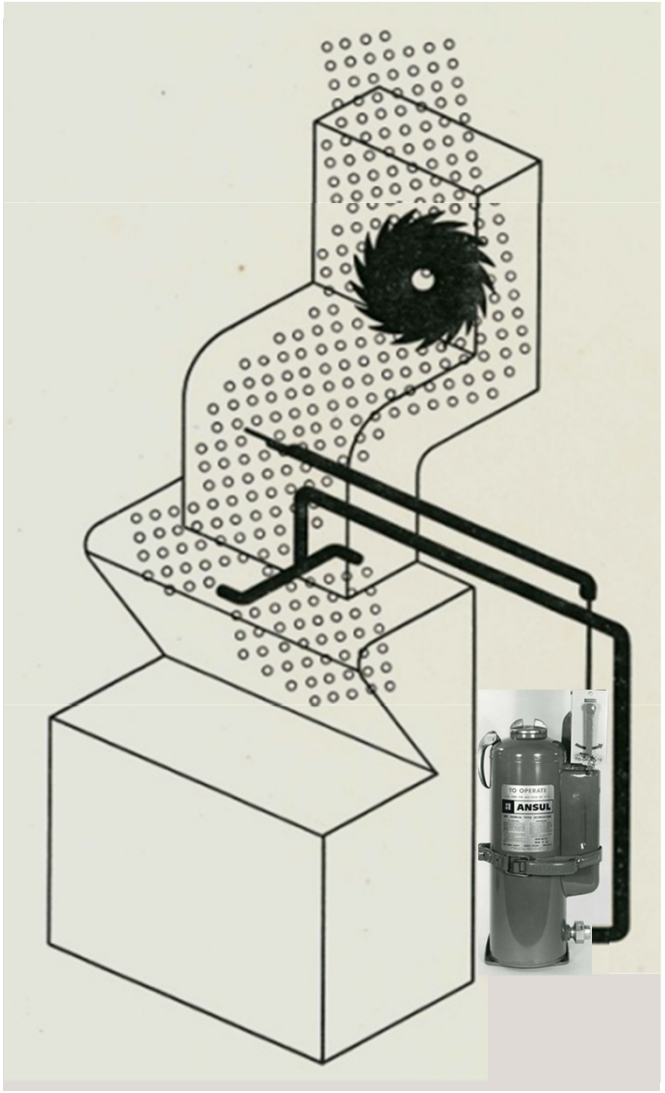


Restaurant System History

Where did it all begin?

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Restaurant System History -Where did it all begin?



1) Late 1950's / early 1960's - Concerns over losses in restaurants due to grease fires in hoods, ducts and cooking appliances
   - ❑ Resulting in escalating insurance premiums or worse, . . .

2) The Ansul Company - Was asked to develop an effective low cost automatic fire extinguishing system:
   - ❑ Modified 30 lb. cartridge operated extinguisher
   - ❑ Connected to fixed piping and nozzles
   - ❑ With mechanism for automatic detection and operation



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Restaurant System History

- Early years - hood and duct protection only
- Mid 1960's :- UL 300 –dry powder standard created to use as a test Standard including appliances
- Late 1970's – Wet Chemical Systems introduced
- 1994 – UL 300 Standard Approved and Implemented



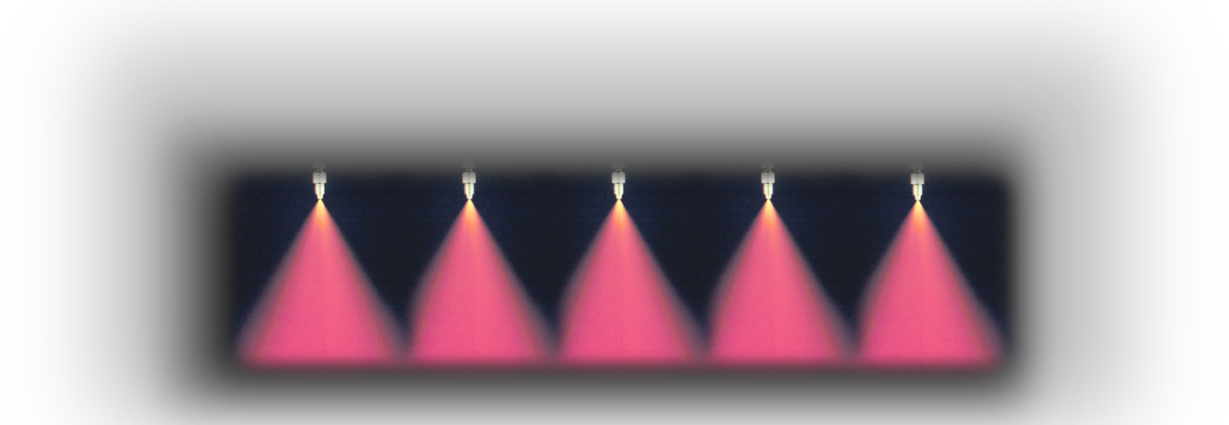


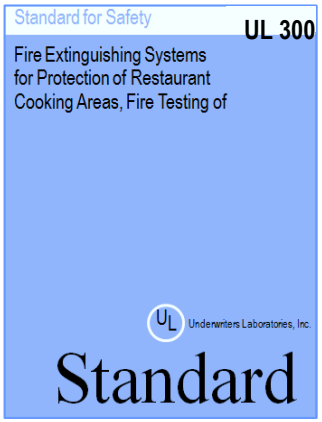
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Restaurant System History:
1990's

1997 - First dual agent system

- Wet chemical discharge and water following
- 15x faster cool down than conventional wet chemical systems
- UL 300 Overlapping protection







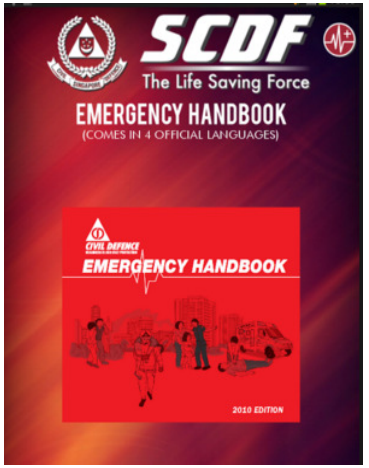
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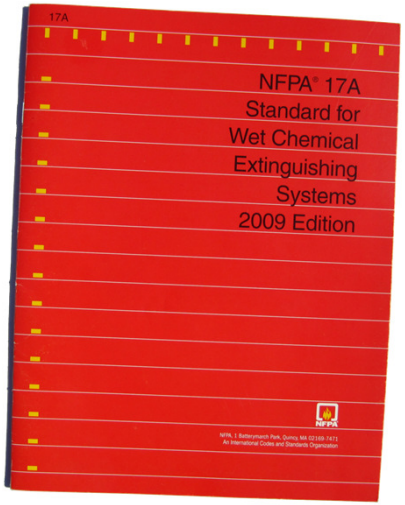
Codes & Standards

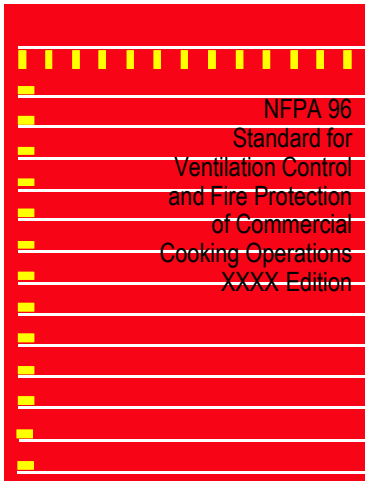
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Codes and Standards

- UL300
- NFPA 17A is for Wet Chemical Systems
- NFPA 96 is for Ventilation
- SCDF-Fire Code 2013-Chapter 7.1.7(b)



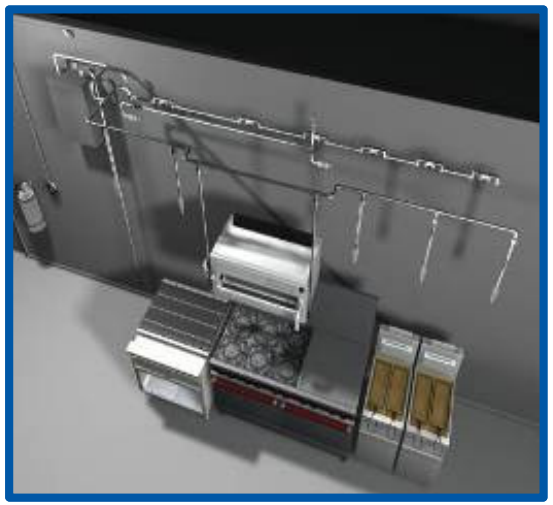




UL300 & NFPA 17A

Pre-engineered System

A.3.3.13 Pre-Engineered Systems. Pre-engineered systems should be listed by a testing laboratory. The maximum and minimum pipe lengths and the number of fittings should be permitted to be expressed in equivalent feet (meters) of pipe. The hazards protected by these systems should be limited as to type and size based on actual fire tests. Limitations on hazards that are permitted to be protected by these systems are contained in the manufacturer's design, installation, and maintenance manual, which is part of the listing of the system.



- System limitations, & associated components are **PERFORMANCE TESTED**
  1) Verified by testing laboratories (UL)
  2) Published in manufacturer's design, installation and maintenance manual.

A.4.5.1 Pre-engineered systems do not need calculations for flow rate, pressure drop, and nozzle pressure, since they have been tested for fire extinguishment with minimum and maximum piping limitations and minimum and maximum temperature limitations. These limitations have been verified by testing laboratories and are published in the manufacturer's design, installation, and maintenance manual. Therefore, it is not necessary for a professional engineer or architect to seal the design of these systems.

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NFPA 96-Ventilation Control and Fire Protection



Chapter 10 Fire-Extinguishing Equipment

10.1 General Requirements.

10.1.1 Fire-extinguishing equipment for the protection of grease removal devices, hood exhaust plenums, and exhaust duct systems shall be provided.

10.1.2* Cooking equipment that produces grease-laden vapors and that might be a source of ignition of grease in the hood, grease removal device, or duct shall be protected by fire-extinguishing equipment.

10.2.3* Automatic fire-extinguishing systems shall comply with ANSI/UL 300 or other equivalent standards and shall be installed in accordance with the requirements of the listing.

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NFPA 17A –Wet Chemical Agent

Wet Chemical System Agents – NFPA 17A

A.4.6.1 A wet chemical solution generally includes, but is not limited to, a potassium carbonate–based, potassium acetate–based, potassium citrate–based solution or a combination thereof and is mixed with water to form an alkaline solution capable of being discharged through piping or tubing when under expellant gas pressure.

The solution's effect on fires in common cooking oils and fats is to combine with these materials to form a vapor suppression foam that floats on a liquid surface, such as in deep fat fryers, effectively preventing re-ignition of the grease.

Wet Chemical

- Potassium carbonate
- Potassium acetate
- Potassium citrate

Suppression

- Breaks fire chemical reaction
- Cools
- Vapor suppression foam – Saponification



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NFPA 17A – Special Requirements

5.6 Special Requirements.

5.6.1.4 . . At least one detector in each duct

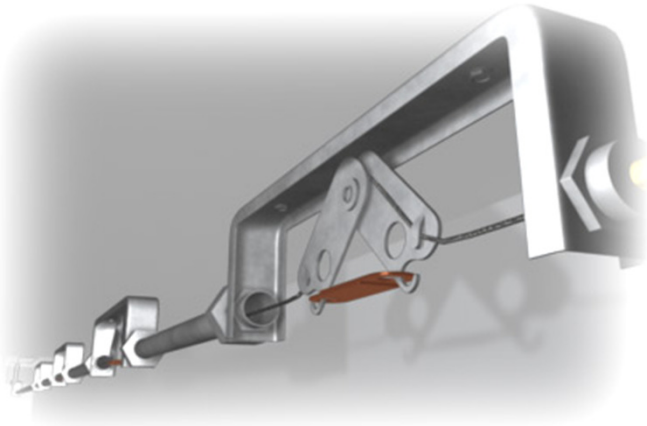
5.6.1.4 . . At least one detector above each appliance . . not directly below detector at duct opening.

5.6.1.4 At least one fusible link or heat detector shall be installed within each exhaust duct opening in accordance with the manufacturer's listing.

5.6.1.5 A fusible link or heat detector shall be provided above each protected cooking appliance and in accordance with the extinguishing system manufacturer's design, installation, and maintenance manual.

5.6.1.5.1 Fusible links or heat detectors located at or within 12 in. (305 mm) into the exhaust duct opening and above the protected appliance shall be permitted to meet the requirements of 5.6.1.5.

5.6.1.5.2 A single listed detection device shall be permitted for more than one appliance when installed in accordance with the system's listing.





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NFPA 96-Ventilation Control and Fire Protection

10.2 Types of Equipment

10.2.1 Fire-extinguishing equipment shall include both

1) Automatic fire-extinguishing systems as primary protection and . . .

2) Portable fire extinguishers as secondary backup.

1.



2.



NFPA 96
Standard for
Ventilation Control and
Fire Protection of
Commercial Cooking
Operations
2014 Edition

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Automatic fuel or power shutoff (NFPA 96 /17A)

NFPA 96 / **17A** – Sources of fuel and electric power that produce heat to all equipment





4.4.4 Shutoff Devices.

4.4.4.1 On actuation of any cooking equipment fire-extinguishing system, all sources of fuel and electric power that produce heat to all equipment protected by the system shall be shut down.

4.4.4.2 Gas appliances not requiring protection but located under the same ventilation equipment shall also be shut off.

10.4 Fuel and Electric Power Shutoff.

10.4.1 Upon activation of any fire-extinguishing system for a cooking operation, all sources of fuel and electrical power that produce heat to all equipment requiring protection by that system shall automatically shut off.

10.4.3 Any gas appliance not requiring protection but located under ventilating equipment where protected appliances are located shall be automatically shut off upon activation of the extinguishing system.

10.4.4 Shutoff devices shall require manual reset.

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NFPA 96 / 17A – System Activation

NFPA 96 - 10.5 Manual Activation.

10.5..1 . . . (42 to 48 in.) above the floor, in a path of egress.

10.5.1.1 . . . (10 - 20 ft.) from protected hood, . . . ***Or alternate location acceptable to AHJ***.



NFPA 96

10.5 Manual Activation.

10.5.1 A readily accessible means for manual activation shall be located between 1067 mm and 1219 mm (42 in. and 48 in.) above the floor, be accessible in the event of a fire, be located in a path of egress, and clearly identify the hazard protected.

10.5.1.1 At least one manual actuation device shall be located a minimum of 3 m (10 ft) and a maximum of 6 m (20 ft) from the protected hood exhaust system(s) within a path of egress or at an alternative location acceptable to the AHJ.

6.4.6 Building Alarm System.
Where the system is connected to a building Alarm System, verification that Alarm-sounding or Notification devices and remote annunciation devices are functional shall be required.

NFPA 17A

5.2.1.10* A readily accessible means for manual actuation shall be located in a path of egress.

5.2.1.10.1 When manual actuation is used for cooking-related protection, the manual actuation device shall be installed no more than 48 in. (1200 mm) and no less than 42 in. (1067 mm) above the floor.

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SCDF Fire Code 2013-Chapter 7.1.7(b)

(ii) For restaurants

(1) the restaurants that are sharing the same kitchen exhaust system shall be located next to each other and be on the same storey;

(2) the aggregate floor area of the restaurants shall not exceed 1,000m^2;

(3) common duct shall be provided with common exhaust fan;

(4) there must be provision for maintenance and cleaning of the common exhaust system;

(5) the common kitchen exhaust system shall be degreased and cleaned regularly;

(6) the building shall be protected by an automatic fire sprinkler system;

(7) the exhaust hood shall be fitted with a wet chemical fire extinguishing system; and

(8) the fire rating of the common kitchen exhaust duct running outside the restaurants shall have fire resistance rating of at least 1 hour or shall not be less than that for the elements of structure, whichever is the higher.

EXPLANATIONS & ILLUSTRATIONS	7.1.7(b)

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UL300 Testing

Performance Requirements (Fryer example)

1) Energy Efficient Cooking Equipment (Commercially Available)

- More Robust Heating - heating rate at least 12° F / min.
- Insulation – cooling rate not to exceed 5° F / min.



2) Vegetable Oil Utilized

- High Auto-ignition Temperatures 685°- 725°
- Lower Levels of Fatty Acid - Reduced Saponification.



3) Two Minute Pre-Burn Time

- (2) Minute Pre-Burn - begins after auto-ignition.
- Fuel Source - to remain “ON” until agent discharge
- Longer burn time = higher oil temperatures.



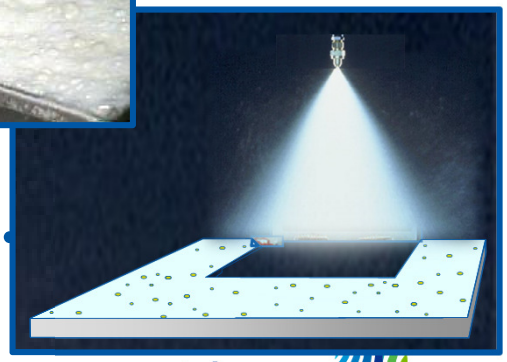
4) No Re-Ignition

- No Re-ignition for 20 minutes
- Or until grease/oil temperature is below 600º F below observed auto-ignition temperature.



5) Splash Testing

- After successful fire testing, splash testing is required.
- No splashing grease droplets in excess of 3/16 in. diameter



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Pre-engineered System – Trained Distributor

DESIGN MUST BE : By a trained and authorized distributor.

- NFPA 17A : Clause 3.3.18 Trained

A person who had undergone the instructions necessary to safety design, install and reliably perform the maintenance and recharge service in accordance with the manufacturer's design, installation& maintenance manual..(Typical product certification valid for 3 years).

- NFPA 17A : Clause 7.3 Maintenance

A Services Technician who perform maintenance on an extinguishing system shall be trained and shall have passed a written or online test that is acceptable to the authority having jurisdiction.

- NFPA 17A : Clause 6.2 Review & Certification.

Design & installation of Systems shall be performed only by persons properly trained and qualified to design and / or install the specific system being provided. The Installer shall provide certification to the authority having jurisdiction that the installation compiles with the terms listed and the manufacturer's instructions and / or approved design.

- NFPA 17A : Clause 6.4.10.3 Return of System to Operation Condition.

The Installation Contractor shall complete and sign an acceptance test report acceptable to the authority having jurisdiction.

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Aesthetic issues & Solutions in Restaurant Fire protections systems

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Current Nozzle Installation- 1.2 meter height

Problem Statement:

With the increase in exhibition kitchens (front-of-the house cooking), aesthetics for the high priced ventilation systems has become increasingly important to restaurant owners who desire to enhance the dining experience



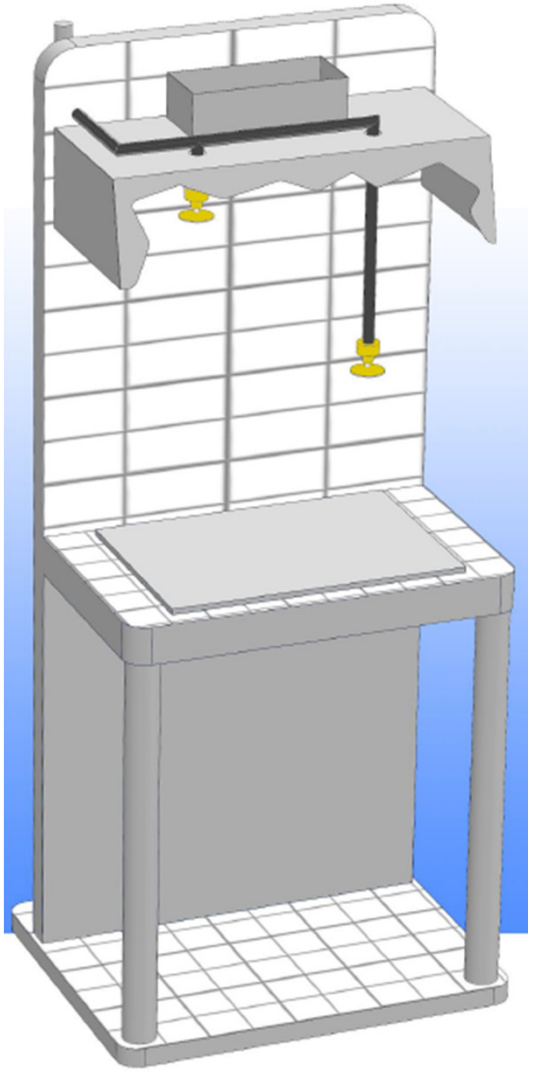


Solution:

To develop a fire suppression solution with nozzle placement at higher vertical heights

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Taking Restaurant Fire Suppression to New Heights



- UL Listed



2.1 m Height from Appliance

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Current installations



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Future installations



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Sprinklers & Watermist

Does it work?

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Why not Sprinkler ?



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Why not Watermist?



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Thank You

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