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Wet Chemical Pre-Engineered Restaurant System / Water Sprinkler System Comparison

The current state of the art fire suppression system most recognized by the fire protection industry is known as the wet chemical pre-engineered fire suppression system. Wet chemical systems are specifically designed, tested, and approved or listed to provide fire protection for commercial kitchen hoods, ducts, and appliances. They provide efficient, automatic detector response with fast acting fire suppression and no danger of re-flash or re-ignition.

Recently, the industry has witnessed the use of water sprinkler system protection, on a limited basis, in place of pre-engineered wet chemical systems. Water sprinkler systems are usually used where water supply is readily available or where a water sprinkler system already exists in the building and can be extended to provide restaurant protection.

Factors used to promote water sprinkler components and systems as substitutes for wet chemical pre-engineered systems are:

- Listed by Underwriters Laboratories Inc.
- Recognized by NFPA Standards
- Constant source of agent for extinguishment
- Reduce clean-up time
- Lower installation service cost

Further investigation of these factors indicate that water sprinkler systems do not always compare favorably with wet chemical systems and, in fact, there are some important reasons why wet chemical systems are most often preferred by the industry's authorities having jurisdiction and end users.

Comparisons of water sprinkler and wet chemical systems are as follows:

LISTED BY UNDERWRITERS LABORATORIES INC.

Underwriters Laboratories Inc. (UL) is a non-profit, independent organization that tests devices, systems, and materials for public safety. Manufacturers of products submitted have entered into an agreement with UL for the use of its Listing Mark and maintenance of quality that complies with the requirements of UL. However, UL states that listed products are not necessarily equivalent in quality or merit.

Water sprinklers, as components only, and wet chemical systems are listed by Underwriters Laboratories. However, there are some distinct differences regarding the thoroughness and scope of each listing. Water sprinkler listing is found under “Nozzles - Spray Type - Fixed (VGYZ)” in the UL 1990 Fire Equipment Protection Directory.

The standard used to investigate products is UL 199, “Automatic Sprinklers for Fire Protection Service”. The UL 199 standard does not address specific restaurant hood, duct, or appliance testing, but only requires generic functional, strength, corrosion, and nozzle coverage criteria for automatic sprinklers.

On the other hand, wet chemical pre-engineered systems are UL listed as complete systems intended for use for commercial restaurant hazards and are found under “Wet Chemical Solution Extinguishing System Units (GOAS)” in the UL 1990 Fire Equipment Protection Directory. Wet chemical systems are performance tested under the guidelines of UL test standard Subject 300 “Fire Testing for Extinguishing System Units in Restaurant Cooking Appliances”. Subject 300 standard contains requirements for full scale fire and flow testing that require strict performance of the system to extinguish fire on duct, hood, and all types of cooking appliances including deep fat fryers, griddles, gas, electric char and chain broilers, and other types of appliances. Fire tests of duct, hood, and appliances are conducted. The duct and hood are coated and filters are packed with cooking grease and appliances are located directly below the duct entrance to simulate a burning run back, worst case situation. Tests are performed with a specified airflow through the hood and duct systems and with no airflow to evaluate performance under each condition. The system must successfully extinguish the fire in all areas without splashing or re-ignition of cooking grease. All wet chemical pre-engineered system parts are listed and labeled by UL certifying compliance with national standards setting down product safety performance and reliability requirements.

When comparing the strict performance test requirements for wet chemical systems to the generic and limited testing of water sprinkler systems, it is often recognized by authorities having jurisdiction that water sprinkler performance testing does not consider all of the variables, lacks coverage definition, and is not tested to worst case situations.

Recognized by National Fire Protection Association

The National Fire Protection Association (NFPA) is an independent, voluntary membership, non-profit organization. Its mission is to safeguard man and his environment from destructive fire. NFPA’s basic activity involves development of fire code standards intended to minimize the possibility and effects of fire. The published National Fire Code Standards are available for voluntary adoption by all levels of government, local to national, and other authorities having jurisdiction.

NFPA does not accept any liability resulting from compliance or noncompliance with the provisions given, for any restrictions imposed on materials or processes, or for the completeness of the text. NFPA has no power or authority to police or enforce compliance of NFPA Fire Codes.

Both water sprinkler and wet chemical systems are recognized by several NFPA Fire Codes.

The use of water sprinkler systems for restaurant hood, duct, and appliance protection is limited in scope and basically adopts standard water sprinkler calculations and applies

standard automatic sprinkler system practices to the unique hazard of restaurant duct, hood, and appliances.

Wet chemical systems, however, are specifically designed and tested for use on restaurant duct, hood, and appliances only and are not used for any other hazard application.

Automatic Water Sprinkler Systems are recognized by:

NFPA 96 - “Installation of Equipment for the Removal of Smoke and Grease Laden Vapors from Commercial Cooking Equipment” - 1987 Edition

- Chapter 7 recognizes sprinkler systems when installed in compliance with NFPA 13, with exceptions:

- Exception 1:

- A sprinkler system does not require manual actuation. The lack of manual actuation removes the flexibility and potential backup often necessary to activate the system and extinguish the fire before it becomes catastrophic. If manual actuation were used to discharge the water system, the potential for excess flooding and water damage exists. (Wet chemical systems require manual actuation in accordance with NFPA 17A and no flooding or overflow will occur.)

- Exception 2:

- Simultaneous automatic operation of all sprinkler heads in a single hazard area is not required. If all sprinkler heads are not actuated simultaneously and a single sprinkler head does not extinguish the fire, potential exists for a fire to increase substantially before additional sprinklers operate. (Wet chemical systems require simultaneous actuation and discharge of all nozzles in all hazard areas.)

NFPA 15 - “Water Spray Fixed Systems for Fire Protection” - 1985 Edition

- NFPA 15 includes no specific application requirements related to commercial restaurant cooking hazards. (Wet chemical systems are specifically recognized in NFPA 17A standard for fire extinguishment in order to eliminate fire danger, damage, and downtime.)
- 4-6.2 - Adequate provisions shall be made for sprinkler system drainage. (Wet chemical systems do not require drainage as danger of agent flooding is not present.)

NFPA 13 - “Installation of Sprinkler Systems” - 1989 Edition

- Chapter 4-4.17 recognized additional sprinklers or automatic spray nozzles to protect commercial type restaurant cooking equipment.
 - Standard sprinklers shall be located to provide protection. (Wet chemical systems apply nozzles specifically designed for restaurant duct, hood, and appliances.)
 - Exhaust ducts require nozzles at duct entrance and at the top and midpoint of each vertical riser.

- Horizontal ducts require nozzles at duct entrance and at 10 ft. centers. (Wet chemical systems only require nozzle at duct entrance with fan on or off.)
- Each hood duct collar shall have one automatic spray nozzle. (No nozzle required by wet chemical systems.)
- Sprinklers subject to freezing shall be properly protected. (Wet chemical systems nozzles do not require freezing protection.)
- An approved line strainer shall be installed in the main water supply. (Wet chemical systems do not require line strainers.)
- Sprinklers and automatic spray nozzles shall be replaced annually except if no buildup of grease or other material is present. (Wet chemical systems nozzles do not require annual replacement as they are protected with blow off caps and piped using Teflon tape to prevent grease entry and buildup.)
- Baffles are required midway between sprinklers when sprinklers are less than 6 ft. apart to prevent wetting of adjacent sprinklers, thus delaying their operation. (Baffles are not required between wet chemical nozzles as all nozzles discharge simultaneously to provide complete coverage over all hazard areas.)

Wet Chemical Pre-Engineered Systems are recognized by:

NFPA 96 - “Installation of Equipment for the Removal of Smoke and Grease Laden Vapors from Commercial Cooking Equipment” - 1987 Edition

- Chapter 7 recognizes wet chemical pre-engineered systems when installed in compliance with NFPA 17A.

NFPA 17A - “Wet Chemical Extinguishing Systems” - 1990 Edition

- Recognizes wet chemical pre-engineered system as having predetermined flow rates, nozzle pressures, quantities of liquid agent, and types of nozzles and all system components specifically applied to commercial restaurant duct, hood, and appliances prescribed by a testing laboratory. Wet chemical listed components consist of agent tank, nozzles, releasing device, fuse link detection, manual pull station, and gas/electric shutoff devices.

Constant Supply of Agent for Extinguishment

An important difference between water sprinkler systems and wet chemical systems is the quality and quantity of agent applied to restaurant hazards.

Water sprinkler systems have an unlimited source of supply and often a large quantity of water is used to insure extinguishment and securement of restaurant hazards that are ladened with cooking grease.

Water agent extinguishes restaurant hazards by smothering, producing steam, and surface cooling below auto ignition temperature. Nozzle discharge tests have demonstrated that the initial application of water onto a deep fat fryer may result in a violent action resulting in a

fireball effect. Constant application of water eventually stabilizes the grease fire and extinguishment takes place. The violent action of a fireball creates a potential danger to restaurant employees and could spread the fire to other hazard areas.

Constant agent supply sometimes results in application of too much water. Upon actuation of sprinkler heads, water will remain discharging until the fire department or knowledgeable person shuts off the system's main shutoff valve. In a panic situation, an excessive amount of water could be discharged unnecessarily. The discharge resulting from only one UL listed nozzle is as follows:

<u>Nozzle</u> <u>Minutes</u>	<u>Flow Rate</u>	<u>1 Minute</u>	<u>DISCHARGE DURATION</u>	
			<u>5 Minutes</u>	<u>10</u>
1/4" orifice nozzle at 50 psi	10 gal per minute	10 gal	50 gal	100 gal
1/2" orifice nozzle at 50 psi	40 gal per minute	40 gal	200 gal	400 gal

Constant agent supply could result in an overflow situation causing water and cooking grease to spill over, whereby the required drainage facilities may not handle the overflow and/or the adjacent area could become slippery creating a danger to employees or firemen.

Wet chemical pre-engineered systems are designed to discharge a predetermined quantity of agent in accordance with the UL test criteria and listing. A typical wet chemical system discharges three to four gallons of agent in approximately 30 seconds. This limited quantity of agent has proven to be effective because of the characteristics of wet chemicals, its composition, and the way it reacts to fires involving grease laden restaurant hazards. Wet chemical agents extinguish by cooling the grease surface and reacting chemically (saponification produces a layer of soap-like foam on the surface of the grease). This acts as insulation between the hot grease and the atmosphere, thus helping to prevent the escape of combustible vapors.

When applying wet chemical agent, there is no need for a constant supply of agent. There is no need to manually shut off the system, and no danger of violent agent reaction that may spread flame or spill cooking oil that could potentially injure personnel.

Reduced Cleanup Time

Prolonged cleanup time and damage to the restaurant facility as a result of a fire protection discharge can be very costly to the restaurant owner as interruption downtime of his business can result in lost customers and costly service.

Cleanup time and expense is often directly proportional to the quantity and length of time the agent is discharged.

The quantity of water that flows from water sprinkler systems is unpredictable. It depends upon the number of sprinkler heads that actuate, the size and length of distribution pipe used, nozzle pressure, and most importantly, how long the water system is allowed to discharge before the shutoff valve is manually closed. The water discharge could cause an overflow

situation, damage to electrical control equipment, a hazard to employees and firemen, and a prolonged downtime.

Wet chemical systems discharge a limited quantity of agent, will not cause overflow, require less downtime, and are less costly to recharge.

Surfaces coated with wet chemical agent must be cleaned as soon as possible with soap and water to avoid staining of appliances, keeping cleanup to a minimum.

Lower Cost Installation

The installation of a water sprinkler system for restaurant cooking appliances is not always as simple as just adding on to the existing sprinkler system that protects the remaining portion of the building. The piping configuration can be more complicated than wet chemical systems especially in the duct area. Standard sprinklers or automatic spray nozzles are required to protect exhaust ducts, hoods, duct collars, and hood plenum chambers. Nozzles are required at duct entrances, the top of each vertical riser, and at midpoint of each duct offset. Horizontal ducts require sprinklers every ten feet of duct. There are listed wet chemical pre-engineered systems that only require nozzles located at the duct entrance and they are listed for unlimited duct lengths.

Sprinklers or automatic spray nozzles in the exhaust duct subject to freezing must be protected against freezing by insulating coverings, frost proof casings, etc. Wet chemical systems are dry pipe systems and do not require freeze protection of any kind.

Access doors or panels must be provided for all sprinklers or automatic spray nozzles for examination or replacement. Wet chemical pre-engineered system nozzles do not require access doors or panels as all nozzles are accessible for servicing.

Additional components such as an indicating valve, line strainers, and a system test connection are also required as part of sprinkler or automatic spray nozzles installations. Also, 6" x 8" metal baffles are required between sprinklers that are installed within six feet of each other to avoid delay of the adjacent sprinkler operation.

Wet chemical pre-engineered systems require no special distribution components but include a hardware package consisting of an agent tank, agent, fusible link detection system, releasing device, manual actuator, and gas and/or electric shutdown devices.

Conclusion

The discussion in this text compares differences in the application of both water sprinkler and wet chemical systems to commercial restaurant duct, hood, and appliance fire hazards.

The most important factor of all is that wet chemical pre-engineered systems provide complete protection to all hazards simultaneously and are UL tested and listed specifically for restaurant hazard applications.

Agent characteristics, simultaneous coverage, and specific test criteria make wet chemical pre-engineered systems the state-of-the-art fire protection system for restaurant application and the choice of the industry's buying influences.

Summary

The following chart summarizes characteristics discussed:

<u>CHARACTERISTICS</u> <u>CHEMICAL SYSTEM</u>	<u>WATER SPRINKLER SYSTEM</u>	<u>WET</u>
Underwriters Laboratories Listing Directory, Wet Solution	1990 Directory, Nozzles	1990
Extinguishing Systems (GOAS)	Spray Type Fixed (VGYZ)	Chemical
300 requires tests specific application	UL 199 Test Standard	
	does not address restaurant protection	Units
		UL Subject full scale for restaurant
<u>NFPA STANDARD</u> <u>17A</u>	<u>NFPA 96, 13, & 15</u>	<u>NFPA 96 &</u>
Freeze Protection Required	Yes	No
Nozzles Required Through Duct	Yes	No
Annual Nozzle Replacement Required	Yes	No
Baffles Between Nozzles Required	Yes	No
Overflow Likely	Yes	No
Potential Fireball Reaction	Yes	No
Manual Actuation Backup Required	No	Yes
Manual Shutoff Required	Yes	No
Nozzle Access Doors Required	Yes	No
Drain Facilities Required	Yes	No
Simultaneous Discharge of All Nozzles	No	Yes
Prolonged Cleanup Time	Probable	No

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