



Property Risk Consulting Guidelines

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DEEP FAT FRYERS

INTRODUCTION

Many facilities have deep fat fryers, including industrial food manufacturers, restaurants, and facilities with cafeterias, such as hospitals, stores, colleges, universities, manufacturing plants and offices. Deep fat fryers contain heated oil or fat in which food is immersed to cook. Oil volume in fryers varies from a few quarts (a few liters) to several hundred gallons (thousands of liters) for industrial use. Potato chip cookers and doughnut makers are among the largest fryers.

The primary hazard of a deep fat fryer is overheating the cooking oil. Prolonged overheating degrades the oil and lowers its flash and ignition points. When the oil ignites, fire burns intensely on the oil surface and flashes through the cooking equipment, ventilation system and everywhere else an oil film has accumulated.

Overheating may also cause ignition of oil deposits on filters. When fryers are shut off and exhaust fans stop, cooling air no longer passes through the filters. This loss of cooling might allow localized hot spots on filters to ignite the oil. Fires also occur when substances, including cooking oils and the food being cooked, contact heating elements or other hot surfaces.

This section describes the fire hazards of deep fat fryers and their associated ventilation equipment and specifies how to protect them.

POSITION

Arrange and protect cooking appliances and their associated ventilation equipment in accordance with NFPA 96 and this section.

Management Programs

Develop and implement written management programs as described in AXA XL Risk Consulting's *OVERVIEW*. Include the following areas in these programs:

Employee Training

Train employees in the safe operation of deep fat fryers, including maximum acceptable temperature settings, proper oil levels, and correct procedures for cooking food. Include the following points:

- Allow for heat expansion when filling the tank with cold oil. This will prevent operating with too high an oil level and will reduce chance of overflow.
- Do not overload the tank, which can cause spilling or overflow.
- Do not drop food into the tank, which can cause oil to splash onto heated surfaces.

- Do not add enough water to the tank to cause expansion, frothing and slopping over. Placing large amounts of frozen food in the tank may cause this.
- Do not use the fryer without the ventilation system filters in place.

Housekeeping

Strict control of oil buildup can prevent fires in cooking appliances from spreading and causing serious damage. Include the following guidance in housekeeping programs for cooking equipment:

- Do not permit oil to accumulate on or near either active or inactive heating elements.
- Lock out the heat source before cleaning any part of the fryer or ventilation system.
- Frequently remove oil accumulations from all nonheated portions of cooking equipment and all ductwork interior. See NFPA 96.
- Clean or replace filters in conjunction with removing oil accumulations.
- Keep the exterior tank surface clean so that any oil leaks may be quickly identified and repaired.

Heater Controls

Deep fat fryers can be heated by gas, oil, electricity or steam. Design the heating system and its safety controls in accordance with the standard applicable to the particular heating system, e.g., NFPA 86 or NFPA 70.

Equip deep fat fryers with a fail safe, high temperature limit control to shut off the fuel or energy when the oil temperature 1 in. (25.4 mm) below the liquid surface reaches 475°F (246°C). This high temperature cutout should be separate from and electrically independent of the operating control.

Provide a pilot light to show when the heating element is being powered.

Hood and Exhaust System

Provide hood and exhaust systems for deep fat fryers. Construct the exhaust system of metal, with liquid-tight joints and seams. Duct the exhaust system outside the building along the most direct possible route. Locate vertical ducts outside or enclose them with a noncombustible, fire-resistive material. Provide 18 in. (457 mm) minimum clearance between the ducts and any unprotected combustible materials. Terminate vents or stacks at least 40 in. (1016 mm) above the roof surface.

Do not install dampers in exhaust systems. Keep the exhaust system running during idle periods unless shutdown is specifically required to properly operate the extinguishing system. Maintain at least 1500 ft/min (7.6 m/s) air velocity in the ducts.

Grease Extractors and Filters

Install grease extractors or filters in the exhaust system of all deep fat fryers. Use only extractors or filters specifically listed by a nationally recognized testing laboratory for cooking applications.

Equipment Locations

Locate deep fat fryers in sprinklered areas, preferably in noncombustible buildings. Locate deep fat fryers at least 16 in. (406 mm) from any open flames on adjacent cooking equipment.

Special Extinguishing Systems

Install automatic fire extinguishing systems to protect the deep fat fryer, adjoining range surfaces, the hood, the entire duct system and the grease removal devices. Sprinkler or water spray systems are preferred, but carbon dioxide, wet chemical or dry chemical systems are also acceptable. The part of the special extinguishing system protecting the fryer itself must pass UL 300.

Even though grease extractors reduce the fire hazard in exhaust ducts, AXA XL Risk Consulting recommends an automatic fire extinguishing system for the duct, the grease removal devices and the hoods, even when a listed grease extractor is installed.

Actuate all extinguishing systems with fixed temperature devices. The extreme variation in temperature inside the hood and exhaust ducts makes rate-of-rise detectors impractical.

Interlock actuation of the extinguishing system to automatically shut off the heat source for the protected appliance, whether it is gas, oil, electricity or steam. This can prevent the cooking oil from reigniting. Also interlock the heat sources of adjacent units.

Provide remote manual releases at readily accessible locations to actuate the automatic fire extinguishing systems.

Sprinkler Or Water Spray Systems

Install closed head sprinkler and water spray systems in accordance with NFPA 13. Install open head water spray systems in accordance with NFPA 15.

Use sprinklers or water spray nozzles listed specifically for protecting deep fat fryers by a nationally recognized testing laboratory. These heads or nozzles discharge a fine spray with an umbrella-shaped pattern that will not add excess water to the fryer tank.

Replace solder-link sprinklers and water spray nozzles at least annually. Replace quartzoid bulb sprinklers and water spray nozzles and open nozzles whenever enough oil buildup occurs to impair their proper operation.

Carbon Dioxide Systems

Design carbon dioxide systems specifically for deep fat fryers. A local application system with an extended discharge is acceptable. Protect filters, exhaust ducts, cooking surfaces and the exhaust hood plenum chamber in accordance with NFPA 12.

Carbon dioxide total flooding systems can be used in enclosures, which prevent carbon dioxide from leaking and dissipating. Make sure the enclosure is tight enough to maintain an inert blanket until the tank of cooking oil has been cooled below its flash and ignition points and other sources of ignition have been eliminated.

Install connected reserve supplies on both local application and total flooding systems.

Dry Or Wet Chemical Systems

Design dry or wet chemical systems specifically for deep fat fryers. Install these systems in accordance with NFPA 17 or NFPA 17A. A single shot installation is acceptable if the extinguishing system is returned to full service prior to restarting the protected cooking appliance.

Hose Connections

Provide hand hose stations equipped with fine spray nozzles, and locate them to allow safe approach of the deep fat fryer from two directions. Never discharge a solid water stream on a fire in a tank of oil.

DISCUSSION

Processing or cooking food often involves immersing the food in a deep fat fryer containing heated oil or fat. The heated cooking medium releases fumes or vapors. While these vapors may not be visible, they condense into an oily film on cooler surfaces in the immediate area.

The typical fire in a deep fat fryer usually results from heating the cooking medium to its autoignition temperature. Burning continues until the temperature is lowered below the flash point. Cooling the liquid below its flash point takes a long time in large, well insulated tanks.

Animal fats used in deep fat fryers have flash points between 450°F and 475°F (232°C and 246°C), and autoignition temperatures around 600°F (316°C). Vegetable oils are now more common in deep fat fryers. These oils have higher autoignition temperatures than the animal fats. Therefore, they have higher initial flame temperatures. This combined with the better insulation provided on new fryers makes it very hard to cool the oil. Fire control is much more difficult.

A common source of overheating is failure of the heating controls. Several serious fires in electrically heated deep fat fryers have occurred when the electrical supply contactor welded itself closed. Operating and high limit controls used the same contactor, which, when welded, caused the control system to overheat the oil. Wiring separate operating and high limit contacts in series avoids this problem.

Since oil fire temperatures range from 2500°F (1371°C) to 3500°F (1927°C), a fire in a deep fat fryer can easily spread to other areas. The sudden flare-up after ignition frequently ignites accumulations of oily film. Oily film burning, particularly in exhaust ducts, has resulted in fire spreading to areas remote from the fryer.

Grease filters trap grease in the air stream and, therefore, tend to become saturated or loaded. A loaded filter reduces the exhaust system efficiency, allows grease to pass into the exhaust system, increases the fire hazard, and contributes to fire spreading in the exhaust system. A loaded filter can become the seat of an intense fire, and can reignite the liquid in the fryer below when burning grease or molten metal falls into the fryer from the filter elements. An adequate cleaning and replacement schedule for filters can prevent serious fires in deep fat fryers and associated equipment.

By reducing deposits in exhaust ducts, grease extractors reduce fire hazards and housekeeping problems of deep fat fryers. The complete filtering system normally consists of a stainless steel hood, a grease extraction chamber, a water system for removing grease deposits, an automatic fire control system, and a system of electrical controls. Listed grease extractors are available as complete factory built assemblies or as assemblies built from one or more listed subassemblies.

An automatic sprinkler or water spray system is preferred for most large industrial installations, such as potato chip and doughnut lines. The heat absorbing properties of water spray and resulting steam generation are effective in cooling and extinguishing a cooking oil fire, particularly near areas that might be extensively contaminated by other extinguishing agents.

If dry or wet chemical agents are used, those that saponify oil and fat, i.e., stearated sodium bicarbonate and aqueous potassium carbonate, are preferred. Such chemicals react with burning animal fat to create a soap-like, noncombustible foam that covers the burning surface and smothers the fire. The burning surface may be a pool of burning oil or a film of oil on a vertical surface. As the soap-foam blanket disintegrates, it releases trapped vapor, such as carbon dioxide, which assists in the extinguishing process.

Either dry or wet chemical extinguishing systems are acceptable, but there are some disadvantages. Both these agents will contaminate cooking oil and possibly food products in process and storage. Cleanup will also be more extensive and take longer.

No matter what type of extinguishing system is chosen, it is important that the part of the system protecting the fryer itself pass the UL 300 test. This test proves the ability of the system to extinguish fire in unsaturated vegetable oils used in today's well insulated deep fat fryers. These oils are not as readily saponified by chemical extinguishing agents as the animal fats and saturated oils that were once more common. As a result, more effective extinguishing systems are needed to extinguish fires in deep fat fryers using these vegetable oils. Systems passing UL 300 should be installed on all new fryers and on any fryers being modified or overhauled.

When the extinguishing system actuates, it should simultaneously shut off the fuel or heat source and stop automated production lines. It should also turn off adjacent cooking ranges. This reduces possible reignition from heat sources. In addition, gas or oil burner flames may be extinguished by the extinguishing agent. Unconsumed fuel may then accumulate and compound the fire hazard.