OIL COOKERS

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1.0 SCOPE

This document provides loss prevention and protection guidance for industrial oil cookers/fryers. It does not cover associated processes or areas such as food preparation, other food treatment processes (e.g., freezing), packaging and storage areas.

1.1 Changes

April 2018. Interim revision. Minor editorial changes were made.

2.0 LOSS PREVENTION RECOMMENDATIONS

2.1 Introduction

Use FM Approved equipment, materials, and services whenever they are applicable. For a list of products and services that are FM Approved, see the *Approval Guide,* an online resource of FM Approvals.

2.1.1 Ignitable Liquid Hazard Scenario

Recommendations for passive and active fire protection features in this data sheet vary depending on the severity of the potential fire hazard. The consequences of an oil cooker fire are dependent on a number of factors, including the following:

- Quantity of oil involved
- Exposed surface area of the oil cooker
- Use conditions (e.g., temperature)
- Oil heating system
- Equipment location
- Equipment construction

The intent of this data sheet is to limit the amount of oil that can become involved in a fire. In evaluating the hazard associated with an oil cooker, the starting point is the exposed surface area of the oil cooker. The severity of an oil cooker fire is directly proportional to the surface area of the liquid. As such, the surface area and corresponding fire severity will be minimized if the oil can be contained within the cooker. A small oil cooker that is properly designed (e.g., noncombustible equipment, piping, etc.) will present a minimal fire hazard due to the small surface area of the tank.

An oil cooker with a larger surface area will result in an increased fire hazard, although damage can still be limited if a special protection system is installed and designed to quickly extinguish the fire. Damage to adjacent equipment will be minimized, while automatic sprinklers will limit damage to the building.

Regardless of the oil cooker size, if the oil cannot be confined to the equipment, the potential exists for the oil to be released into a room, and for a subsequent fire to extend well beyond the cooker area. The fire size will grow exponentially, possibly creating a large fire that will operate all exposed ceiling sprinklers. Any equipment that is exposed to the burning pool will be damaged. However, if overflow from the oil cooker is accounted for by designing the surrounding area as an ignitable liquid occupancy in accordance with Data Sheet 7-32, *Ignitable Liquid Operations,* damage may be effectively limited.

2.1.2 Liquid Evaluation

2.2 Construction and Location

2.2.1 Locate oil cookers and associated heating equipment in rooms of noncombustible construction.

2.2.2 Separate oil cooker areas from all other food production and storage areas.

2.2.3 Cut off heat transfer fluid (HTF) systems from the oil cooker areas by a minimum of 1 hour fire rated construction. Refer to Data Sheet 7-99, *Heat Transfer by Organic and Synthetic Fluids,* for additional information.

2.2.4 Do not locate oil cookers in below-grade locations. When below-grade installations are unavoidable, provide adequate access for manual firefighting efforts as coordinated with the local fire service.

2.2.5 Construct all oil cookers and associated equipment of noncombustible material on supports of heavy metal, reinforced concrete, or masonry.

2.2.6 Provide containment and emergency drainage for all oil cooker areas. Arrange the drainage path for any individual oil cooker to avoid exposing any other oil cookers or other combustibles located within the area. Design containment and emergency drainage in accordance with Data Sheet 7-83, *Drainage and Containment Systems for Ignitable Liquids.*

2.2.7 Construct, locate, and arrange cooking oil storage tanks in accordance with Data Sheet 7-88, *Ignitable Liquid Storage Tanks.*

2.2.8 Separate control equipment from oil cookers and provide conduit for wiring to minimize the potential fire exposure from any oil cookers and their associated heating equipment.

2.3 Occupancy

2.3.1 Detached Direct-Fired Heaters/Incinerators

2.3.1.1 Design fume incinerators in accordance with Data Sheet 6-11, *Thermal and Regenerative Catalylic Oxidizers.*

2.3.1.2. Avoid incinerating oil cooker fumes in detached, direct-fired oil heaters (i.e., within the combustion chamber/fire box).

2.3.1.3 Where oil fumes from the oil cooker are incinerated in the direct-fired oil heater, design the interconnecting ductwork and any related equipment between the oil cooker and oil heater to prevent flammable deposits or vapor from accumulating. Providing driplegs, scrubbers, and de-misters may be necessary. It also may be necessary to insulate and heat the ductwork.

2.3.1.4 Design oil heaters and oil fume flow conditions to prevent the accumulation of solids and condensation of vapor, which can cause a fire or explosion hazard.

2.3.1.5 Carefully design damper and fan arrangements to prevent oil fumes from pocketing in the oil heater/incinerator, ductwork, and related equipment.

2.3.1.6 Provide adequate access for inspecting, maintaining, and cleaning both the oil heater/incinerator and ductwork, particularly any oil cooker fumes (polluted-air) ductwork from the oil cooker.

2.3.1.7 Provide dampers to isolate any detached, direct-fired oil cooker heater/incinerator from any connected oil cooker. Arrange the damper(s) to close upon fire detection at the oil cooker or within the polluted-air ductwork. Provide readily accessible inspection ports along the length of the ductwork to allow for interior inspections and cleanings

2.3.2 Housekeeping

2.3.2.1 Develop and implement a documented housekeeping program with detailed written inspection and cleaning procedures for all oil cooker installations, with particular emphasis on inspecting and cleaning any polluted-air systems.

2.3.2.2 Develop and implement a housekeeping audit program completed at least semiannually. Ensure facility management reviews audit reports and takes action to promptly address any identified issues.

2.3.2.3 Clean oil residue regularly from oil cookers, conveyors, drainboards and drainboard collection areas, and from the insides of hoods and ducts. Arrange processes so that, under normal operating conditions, as little excess oil residue or crumbs/fines as possible collects on equipment and building surfaces. Base the frequency of cleaning on the specific cooking operation. Inspect and clean ductwork and building surfaces during this normally scheduled cleanup/maintenance period.

2.3.2.4 Provide a “clean in place” (CIP) system for oil cooker installations. Ensure the CIP system includes coverage for all cooking oil exhaust fumes (polluted-air) ductwork. Do not use the oil piping as a common means of circulating the CIP cleaning solution (i.e., provide an independent piping network).

2.4 Protection

2.4.1 Room Protection

2.4.1.1 Provide automatic sprinkler protection at ceiling level over any oil cookers and associated oil heaters/incinerators located within the cooker area. Design the system to provide 0.3 gpm/ft^2 over 2500 ft^2 (12 mm/min over 230 m^2).

2.4.1.2 In addition to sprinklers at the ceiling, provide automatic sprinklers under any obstruction that exceeds 3 ft (0.9 m) in width or diameter and 10 ft^2 (0.9 m^2) in area (e.g., under the oil cooker, mezzanines within the area, and over any shielded areas under or near any oil cookers if oily residue or crumbs/fines can accumulate). For example, some oil cookers have return belts and drip pans beneath the oil cooker pan, which create additional shielded fire hazard areas. For such cookers, provide complete sprinkler coverage beneath the cooker, over the return belt, and between the return belt and drip pan.

2.4.1.3 Arrange the sprinklers and equipment so sprinkler water cannot flow into the oil cooker and/or oil circulation system in appreciable quantities. Consider the use of a preaction sprinkler system over the return belt and drip pan. Interlock the preaction system's detection system with the conveyor to shut down in the event of a fire.

2.4.1.4 Provide a single quick response, ordinary temperature rated, K5.6 (K80) or larger sprinkler within 2 ft (0.6 m) vertically of central oil transfer pumps.

2.4.1.5 Protect conveyors in accordance with Data Sheet 7-11, *Conveyors.*

2.4.1.6 Protect exhaust systems in accordance with Data Sheet 7-78, *Industrial Exhaust Systems.* This includes oil cooker exhaust ductwork as well as other exhaust systems in the building.

2.4.2 Oil Cooker Protection

2.4.2.1 Provide one of the following FM Approved fixed special protection systems to protect oil cooker(s), drainboard areas, oil cooker filtration systems (e.g., inside drum filters), fines/crumb collection areas, and any other areas where fire might spread because of the presence of oil. The protection system may also be extended to cover takeout conveyor areas adjacent to the oil cooker, as an alternative to the protection recommended in Section 2.4.1.4.

A. Deluge water spray system

B. Water mist system FM Approved for the protection of industrial oil cookers

C. Foam-water deluge system

2.4.2.2 Automatically actuate special protection systems using FM Approved flame and/or heat detectors that are compatible with the extinguishing system and arranged in accordance with Data Sheet 5-48, *Automatic Fire Detectors.* Where a thermal detection system is used, provide detectors rated at least 50°F (28°C) above the normal oil cooker operating temperature.

2.4.2.3 Locate a detector in each oil cooker duct below any damper, and a detector within the hood for each 15 ft (4.6 m) length of oil cooker, or in accordance with the detector's listing in the Approval Guide.

2.4.2.4 When a deluge water spray system is provided to protect the oil cooker(s), adhere to the following design criteria:

A. Use FM Approved 1/4 in. (6.4 mm) orifice or smaller stainless steel, wide-angle (120° or greater), full cone discharge water spray nozzles.

B. Arrange water spray nozzles to provide complete coverage of the oil cooker surface with the hood in the raised position as shown in Figure 1.

C. Design the system to provide a minimum 0.5 gpm/ft^2 (20 mm/min) density for the oil surface and a minimum 0.1 gpm/ft^2 (4 mm/min) density for oil residue coated surfaces within the hood. Base the determination of density on the spacing of the nozzles rather than the surface area covered by the water spray discharge at the oil surface.

2.4.2.5 When a water mist system is provided to protect the oil cooker(s), use the following design criteria:

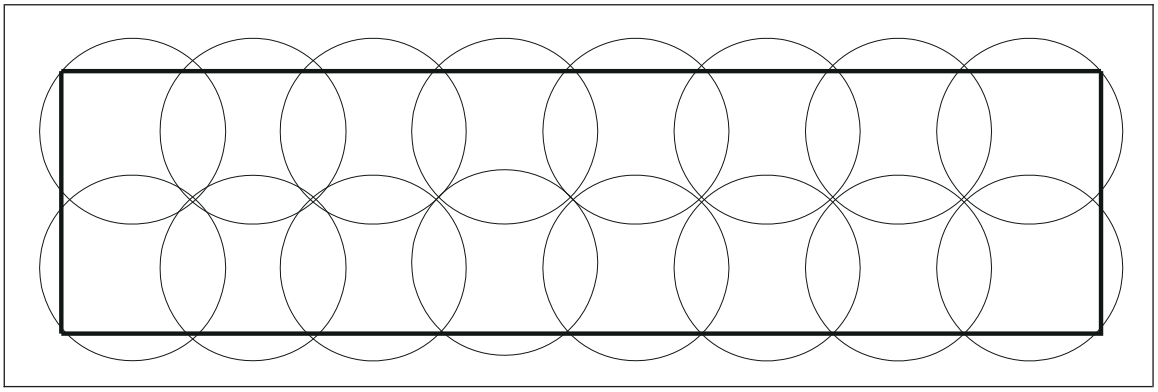

Fig. 1. Oil cooker nozzle spray coverage pattern.

A. Design and install the system in accordance with Data Sheet 4-2, *Water Mist Systems,* the manufacturer's instructions, and the *Approval Guide.* Only use water mist systems that have been FM Approved for the protection of "Industrial Oil Cookers."

B. Ensure all system limitations, such as protected oil cooker width, nozzle spacing, and nozzle height above the oil surface, are met.

C. Hydraulically design the water mist system in accordance with the manufacturer's instructions and the system's listing in the *Approval Guide.*

D. Design the water mist supply to provide water discharge for the time specified in the system's *Approval Guide* listing, but not less than 10 minutes.

2.4.2.6 When a foam-water deluge system is provided to protect the oil cooker(s), use the following design criteria:

A. Design and install the system in accordance with Data Sheet 4-12, *Foam-Water Sprinkler Systems,* the manufacturer's instructions, and the *Approval Guide.*

B. Arrange the sprinklers to provide complete coverage of the oil cooker surface with the hood in the raised position as shown in Figure 1.

C. Design the deluge system to provide a minimum 0.5 gpm/ft^2 (20 mm/min) density or the density specified in the system's *Approval Guide* listing, whichever is larger, over the full area of the oil cooker. Base the determination of density on the spacing of the nozzles rather than the surface area covered by the water spray discharge at the oil surface.

D. Design the foam concentrate supply to provide the full sprinkler discharge for a minimum of 10 minutes.

2.4.2.7 Provide a remote, readily accessible means of manual actuation for the oil cooker fire protection system.

2.4.2.8 Provide interlocks to accomplish the following upon actuation of the ceiling sprinkler system or fire protection systems provided for the oil cooker or other associated equipment:

A. Shut down the oil circulation and transfer system.

B. Shut down the oil cooker heating system.

C. Shut down the oil cooker conveyor system.

D. Shut down the oil cooker exhaust system.

E. If the oil cooker has a detached, direct-fired heater/incinerator, close the damper(s) in the polluted-air ductwork to the heater/incinerator and open the damper(s) in the oil cooker exhaust duct to atmosphere (see Figure 2). Ensure dampers fail safe in the desired position because power may be lost or shut off in the event of a fire.

F. Shut down any hydraulic oil systems.

2.4.2.9 Provide nozzle blowoff caps or other suitable FM Approved devices, where available, for all open discharge nozzles to prevent grease vapor, moisture, or other foreign matter from entering the piping and/or plugging the nozzles obstructing discharge. Inspect these devices weekly to ensure they remain intact and undamaged.

2.4.2.10 Provide a water supply capable of meeting the building protection criteria listed in Section 2.4.1, plus actuation of all water discharge devices within and around the largest oil cooker in the area. This may include protection installed under the hood, under the oil cooker, under drip pans and other shielded areas, and any similar areas associated with the largest oil cooker. Include a hose stream allowance of 500 gpm (1900 L/min), and design the system for a discharge duration of 60 minutes.

2.4.3 Direct-Fired Heaters

2.4.3.1 Protect the combustion chamber/fire box, where the cooking oil heat exchanger is located within the combustion chamber, in accordance with Data Sheet 7-99, *Heat Transfer by Organic and Synthetic Fluids.*

2.4.3.2 Provide interlocks to accomplish the following upon actuation of the fire protection system for the combustion chamber:

A. Shut off the heater.

B. Stop combustion air fans, shut any combustion air inlet dampers, and close any outlet dampers in the heater exhaust stack, where provided, if designed for pressure relief.

C. Stop the oil flow (but not drain the oil cooker).

D. Close the damper(s) in the polluted-air ductwork from the oil cooker to the heater/incinerator, and open the damper(s) in the oil cooker exhaust duct to atmosphere (see Figure 2). Ensure dampers fail safe in the desired position because power may be lost or shut off in the event of a fire.

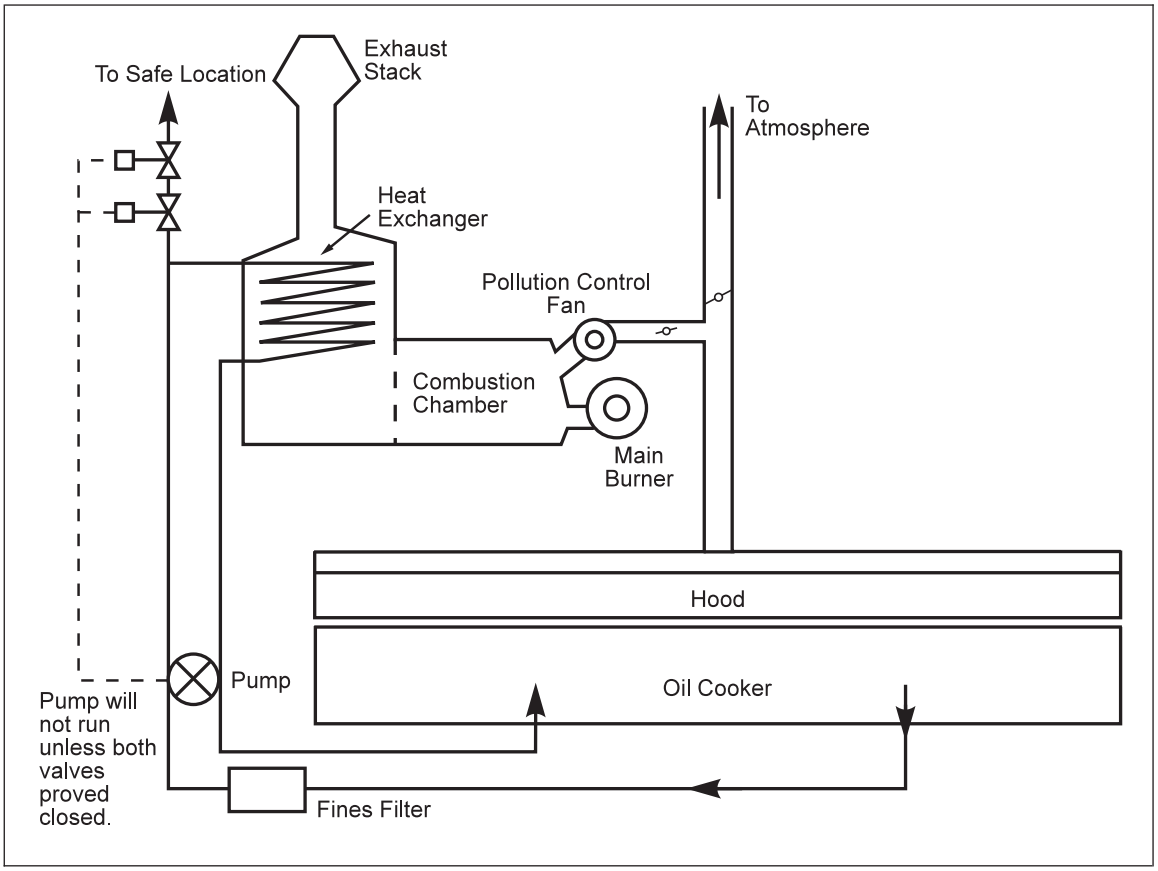

Fig. 2. Cooking oil heat exchanger venting arrangement for detached heater/incinerator.

2.4.3.3 Provide access ports into the combustion chamber/fire box to allow manual firefighting where oil can leak into the combustion chamber.

2.4.3.4 Protect the ductwork between the oil cooker and heater/incinerator in accordance with Data Sheet 7-78, *Industrial Exhaust Systems,* if oil vapor can condense and accumulate inside the ductwork.

2.4.3.5 Provide venting to a safe location for the cooking oil heat exchanger. Arrange vent piping so its equivalent length to atmosphere is substantially less than the equivalent length of oil piping back to the oil cooker. See Figure 2 for a suggested arrangement. An acceptable alternative is to provide isolation valves for the heat exchanger tube bundle, with a safety relief valve to atmosphere for the tube bundle.

2.4.4 Manual Protection

2.4.3.1 Provide FM Approved portable extinguishers in accordance with Data Sheet 4-5, *Portable Extinguishers.* Refer to Data Sheet 4-5 to determine effective sizes, types, and locations for the extinguishers.

2.4.3.2 Where small hose (1½ in. [38 mm]) stations are provided, space them to allow full coverage of the area being protected. Add a water demand of 50 gpm (190 L/min) to the combined sprinkler and hydrant demand for a single hose station. Add a water demand of 100 gpm (380 L/min) when more than one hose station is provided.

2.5 Equipment and Processes

2.5.1 Design and arrange piping systems in accordance with Data Sheet 7-32, *Ignitable Liquid Operations.*

2.5.2 Where hydraulically operated equipment is used, design the equipment in accordance with Data Sheet 7-98, *Hydraulic Fluids.*

2.5.3 Design exhaust systems in accordance with Data Sheet 7-78, *Industrial Exhaust Systems.*

2.5.4 Heat the oil using steam heating systems, or other means not requiring an open flame, to minimize the cooking oil overheat fire potential. Arrange heating equipment for automatic control.

2.5.5 Arrange heat transfer fluid (HTF) systems used for heating cooking oil in accordance with Data Sheet 7-99, *Heat Transfer by Organic and Synthetic Fluids,* as applicable.

2.5.6 Provide FM Approved combustion safeguards and fuel safety shutoff valves on all gas-fired and oil-fired heaters/burners. Refer to Data Sheet 6-4, *Oil-and Gas-Fired Single-Burner Boilers;* Data Sheet 6-5, *Oil- or Gas-Fired Multiple Burner Boilers;* and 6-10, *Process Furnaces,* as applicable.

2.5.7 Where emergency overflow drains or emergency bottom drains are provided for oil cookers, design them in accordance with Data Sheet 7-9, *Dip Tanks, Flow Coaters, and Roll Coaters.*

2.5.8 Alarms/Interlocks

2.5.8.1 General

2.5.8.1.1 Provide and arrange an FM Approved high-temperature limit switch to alarm and shut down the oil heaters or burners if the oil temperature in the cooker (or any associated heat exchanger feedline to the cooker) exceeds 50°F (28°C) above the normal maximum operating temperature. Ensure these high-temperature limit switches are independent of the normal heating system controls.

2.5.8.1.2 Provide and arrange an FM Approved low-liquid-level control for the oil cooker to alarm and shut off the heaters or burners when the cooking oil level drops below the recommended minimum operating level.

2.5.8.1.3 Provide high liquid level switches for automatic filling operations to prevent overflow of the oil cooker. Arrange the first high liquid level to sound an alarm. The location of this interlock will depend on the specific oil cooker and product being processed. Provide a second switch at a higher level designed to shut down all oil flow to the tank.

2.5.8.1.4 Provide a remote manual emergency shutoff switch for each oil cooker heating system.

2.5.8.2 Detached, Direct-Fired Heaters/Incinerators

2.5.8.2.1 Provide a combustibles analyzer in the heater/incinerator exhaust duct in accordance with Data Sheet 6-11, *Thermal and Regenerative Catalytic Oxidizers,* to sound an alarm if poor combustion conditions

are detected. Alternatively, provide a smoke opacity detector to alarm if abnormal levels of smoke are detected. Provide a continuous air washing system (i.e., jet of compressed air) for the lens of the smoke opacity detector.

2.5.8.2.2 Provide an FM Approved high-temperature indicator in the heater/incinerator exhaust duct, set at 50°F (28°C) above the maximum operating temperature, arranged to alarm, shut off the burners, and close the damper(s) between the heater/incinerator and the oil cooker. Refer to Data Sheet 6-11, *Thermal and Regenerative Catalylic Oxidizers,* for additional information.

2.5.8.2.3 Provide an airflow pressure switch for the polluted-air fan, arranged to close a damper in the polluted-air ductwork to the heater/incinerator upon failure or stoppage of the polluted-air fan. Interlock the burner(s)/heater to shut down upon loss of polluted-air flow.

2.6 Operation and Maintenance

2.6.1 Establish and closely supervise a preventive maintenance program for all oil cooker installations. Include the following actions in the program for oil cookers with gas- or oil-fired heating systems:

- Check daily for oil leaks, particularly within any detached heaters/incinerators, and immediately repair any that are discovered.
- Inspect and clean combustion chamber and burner system components, as necessary, during the normally scheduled oil cooker system cleanup/maintenance period (approximately weekly).
- Inspect cooking oil heat exchanger tube surfaces for overheating. Unusually colored tubes may indicate coking or plugging. Infrared scanners may be useful for a more precise examination.
- Perform internal solution cleaning of cooking oil heat exchanger tubes at least monthly to prevent excessive deterioration. Do not clean cooking oil heat exchanger tubes by drilling. Also, verify the integrity of the tubes through oil-flow testing.
- Leakage test oil heat exchanger tubes at least annually and after any opening or repair of the heat exchanger system.
- Determine useful tube life and replace tubes before the expiration of that period.
- Clean, service, inspect, and repair the polluted-air fan as necessary.

2.6.2 Test all system safety interlocks in accordance with manufacturer recommendations or at least quarterly. Maintain records of these tests.

2.6.3 Establish maintenance contracts with the equipment manufacturers, if available.

2.6.4 Develop and implement a formal operator audit procedure to ensure compliance with established standard operating and emergency response procedures. Conduct these audits at least semiannually.

2.6.5 Implement a management of change program. Have a full review of all planned changes conducted by qualified loss prevention consultants and all authorities having jurisdiction before the project begins.

2.7 Training

2.7.1 Provide operators with formal training in properly operating oil cooker systems, emergency procedures in case of process upset (e.g., cooking oil overheating), fire in or around the oil cooker, and fire in the oil heater/incinerator, as applicable. Train operators in manual firefighting procedures and manual actuation of oil cooker fixed fire protection systems, as necessary. Emphasize the importance of keeping the hood down in the event of an oil cooker fire to minimize the fire intensity and maximize the effectiveness of any fixed fire protection system.

2.8 Human Factor

2.8.1 Provide an operations manual detailing normal and emergency procedures at the operator's control station or room.

2.8.2 If a fire occurs in and around an oil cooker, ensure the emergency response team (ERT) notifies the fire service and attempts to manually fight the fire, if appropriate. Additionally, if the oil cooker's extinguishing system has not already actuated automatically, ensure the ERT manually actuates the system and shuts down all associated equipment as outlined in Section 2.4.2.8.

2.8.3 If an oil leak occurs in the combustion chamber of an oil cooker, ensure the ERT notifies the fire service and manually actuates the combustion chamber's extinguishing system if it has not already actuated automatically. Additionally, if associated equipment has not already been shut down by operation of the extinguishing system, ensure the ERT manually shuts down this equipment as outlined in Section 2.4.3.2.

2.8.4 If no fixed fire protection system is provided for the heater/incinerator, ensure the ERT takes the following actions upon detection of an oil leak/fire within the unit:

A. Call the fire service.

B. Shut off the burner(s).

C. Maintain the polluted-air/combustion-air flow and oil flow, while closely monitoring the oil temperature.

1. Continue to run the oil pump, provided the oil temperature starts to fall (i.e., the leaking, burning oil is not heating the circulating oil).

2. The cooking oil can be dumped to storage/holding tanks once the oil reaches a safe temperature, approximately 212°F (100°C).

3. However, if the oil temperature starts to rise (i.e., the leaking, burning oil is heating the circulating oil), stop the oil pump promptly. Do not drain the oil cooker.

D. Allow the oil leak/fire to burn out, or attempt to manually extinguish the fire, making sure the damper in the polluted-air ductwork is closed.

2.8.5 Establish a written policy for operators that safety controls and interlocks are not to be bypassed at any time.

2.8.6 Conduct periodic fire response planning with the public fire service for all oil cooker installations.

2.9 Ignition Source Control

2.9.1 Control all ignition sources in accordance with Data Sheet 7-32, *Ignitable Liquid Operations.*

3.0 SUPPORT FOR RECOMMENDATIONS

3.1 General

Oil cookers present the fire hazard of heated ignitable liquid in open tanks, as well as the fire and explosion hazards of the heating sources (e.g., boilers, furnaces, HTF heaters). Industrial oil cookers normally have large cooking surfaces, usually 50 ft^2 (4.6 m^2) or more and upwards of several hundred square feet (meters). They contain several hundred gallons (liters) to upwards of 5000 gallons (18.9 m^3) of cooking oil. See Appendix C for a description of the typical oil cooker heating system arrangements. Batch kettles heated by direct flame impingement and cookers with gas- or oil-fired cooking oil heaters, located directly below or detached, have the added danger of cooking oil leakage into the combustion chamber/fire box. Oil cookers with detached, direct-fired cooking oil heaters also frequently incinerate the oil cooker vapor in the combustion chamber directly or by mixing the vapor with the combustion air (frequently referred to as polluted-air combustion systems), which presents additional fire and explosion hazards.

Oil cookers typically have product conveyor systems (except for some batch kettles) and movable covers or hoods that also may be hydraulically operated. Product conveyor belts typically run inside the oil cooker pan. However, some cookers have return belts that run beneath the oil cooker pan, creating additional shielded fire hazard areas. Some cookers also have product hold-down belts running above the cooking oil surface. These hold-down belts may obstruct water discharge from spray nozzles located under the oil cooker cover or hood.

4.0 REFERENCES

4.1 FM Global

Data Sheet 3-26, *Fire Protection Water Demand for Nonstorage Sprinklered Properties*
Data Sheet 6-4, *Oil- and Gas-Fired Single-Burner Boilers*
Data Sheet 6-5, *Oil- and Gas-Fired Multiple Burner Boilers*
Data Sheet 6-10, *Process Furnaces*

Data Sheet 6-11, *Thermal and Regenerative Catalylic Oxidizers*
Data Sheet 7-9, *Dip Tanks, Flow and Roll Coaters, and Oil Cookers*
Data Sheet 7-32, *Ignitable Liquid Operations*
Data Sheet 7-78, *Industrial Exhaust Systems*
Data Sheet 7-83, *Drainage Systems for Ignitable Liquids*
Data Sheet 7-88, *Ignitable Liquid Storage Tanks*
Data Sheet 7-99, *Heat Transfer by Organic and Synthetic Fluids*

APPENDIX A GLOSSARY OF TERMS

Autoignition Temperature (AIT) Fire: A fire that occurs when oil is heated above its autoignition temperature, resulting in ignition and self-sustained combustion. An AIT fire creates an intense fire situation, producing large quantities of black smoke.

Ignitable Liquid: Any liquid or liquid mixture that is capable of fueling a fire, including flammable liquid, combustible liquid, inflammable liquid, or any other term for a liquid that will burn. An ignitable liquid is one that has a fire point.

FM Approved: References to "FM Approved" in this data sheet mean the products and services have satisfied the criteria for FM Approval. Refer to the *Approval Guide,* an online resource of FM Approvals, for a complete listing of products and services that are FM Approved.

Polluted air: Oil cooker exhaust fumes.

Polluted air combustion system: Pollution control system where the oil cooker exhaust fumes are incinerated in the combustion chamber of a detached gas-fired heater.

Detached direct-fired heater/incinerator: Detached (i.e., separate) gas-fired cooking oil heater in which the oil cooker exhaust fumes are also incinerated.

APPENDIX B DOCUMENT REVISION HISTORY

April 2018. Interim revision. Minor editorial changes were made.

April 2014. The following major changes were made:

A. Revised terminology and guidance related to ignitable liquid to provide increased clarity and consistency. This includes the replacement of references to "flammable" and "combustible" liquid with "ignitable" liquid throughout the document.

B. Reorganized the document to provide a format that is consistent with other data sheets.

C. Provided information to assist in evaluating the fire hazard scenario associated with industrial oil cookers, including the need to minimize the surface area of a fire by confining the ignitable liquid within the tank.

D. Expanded the guidance on the construction and location of oil cookers, including FM Global's current recommendations for ignitable liquid operations.

E. Updated the recommendations for containment and emergency drainage.

F. Provided recommendations for the construction and location of oil storage tanks.

G. Updated the building fire protection recommendations.

H. Added fire protection recommendations for conveyors and exhaust ducts.

I. Modified the fire protection recommendations for oil cookers, including the following:

1. Added a foam water deluge system as a method of protection for oil cookers.

2. Provided additional guidance on the design and installation of special protection systems for oil cookers.

J. Modified the recommended fire protection for direct-fired heaters.

K. Clarified the necessary interlocks associated with operation of the fire extinguishing system for the oil cooker and direct-fired heater.

L. Added reference to Data Sheet 7-32, *Ignitable Liquid Operations,* for the appropriate design of piping systems.

M. Added information related to human factor, ignition source control, and housekeeping.

N. Updated the cooking oil flash point and ignition temperature data.

September 2007. Added information on a water mist system that is FM Approved for oil cookers.

May 2003. Minor editorial changes were made for this revision.

September 2001. Recommended that oil cookers be protected with ¼-in (6.4 mm) orifice or smaller open, stainless steel, wide-angle (120° or greater) discharge water spray nozzles at an 0.50 gpm/ft^2 (20 mm/min) density (2.5.2.1).

Also, as part of revised 2.5.2.1, recommended a thermal detection system for actuation of oil cooker deluge water spray system protection with guidance on detector selection and location/spacing.

Added water demand guidance for oil cooker areas (2.5.5/2.5.5.1).

Emphasized keeping the oil cooker hood in the down position in the event of an oil cooker fire as part of operator emergency procedures training (addition to 2.7.1).

May 2000. This document represents a complete rewrite of the Oil Cookers section of FM Global Property Loss Prevention Data Sheet 7-9, *Dip Tanks, Flow and Roll Coaters, and Oil Cookers*. In particular, it incorporates modified loss prevention guidance primarily from Data Sheet 6-11, *Thermal and Regenerative Catalylic Oxidizers* and Data Sheet 7-99/12-19, *Heat Transfer by Organic and Synthetic Fluids*, as applicable, for detached direct-fired cooking oil heaters/incinerators. See Appendix A for a definition and Appendix C for a further description of detached direct-fired cooking oil heaters/incinerators.

The following significant changes have been made:

Added recommendation to apply Data Sheet 7-99/12-19, *Heat Transfer by Organic and Synthetic Fluids*, where a heat transfer fluid (HTF) system is used to heat the cooking oil (2.1.1).

Added recommendations to locate oil cooker installations in curbed and drained 1-hour fire rated cutoff areas (2.2.1, 2.2.2).

Added recommendation to avoid incineration of cooking oil fumes in detached direct-fired cooking oil heaters (2.3.3.1), but provided protection guidance recognizing incineration of oil cooking fumes is being done and will likely continue.

Provided additional housekeeping guidance for oil cooker system installations (2.3.4).

Added recognition of oil cooker crumb/fines fire hazard and provided protection/prevention guidance (2.3.4.2, 2.5.1, 2.5.2.1, and 3.2).

Recommended water spray protection for all detached direct-fired cooking oil heaters (2.5.3.1).

Recommended venting of the cooking oil heat exchanger if fixed protection is not provided for a detached direct-fired heater (2.5.3.4).

Provided additional inspection, maintenance and testing guidance for oil cooker system installations (2.6).

Recommended operator training and provided emergency procedure guidance in the event of a fire in or around an oil cooker or any associated detached direct-fired heater/incinerator (2.7).

APPENDIX C SUPPLEMENTARY INFORMATION

C.1 General

Industrial oil cookers are typically conveyorized fryers or occasionally batch kettles used in food processing plants for chicken, fish, potato products (e.g., fries/chips), snack products (e.g., potato chips/crisps), doughnuts and many other food products. Oil cookers are typically heated by one of the following arrangements:

- Circulation of oil through tubes in a combustion chamber direct-fired by gas or oil located directly below the oil cooker tank.

- Circulation of oil through tubes in a separate (detached) gas- or oil-fired furnace as shown in Figure 3; referred to as a ″detached, direct-fired heater or heater/incinerator″ in this data sheet.
- Heat transfer fluid (HTF) system with external HTF/cooking oil heat exchanger near the oil cooker, or HTF heat exchanger located within the oil cooker tank.
- Steam heating system with external steam/cooking oil heat exchanger near the oil cooker.
- Gas-fired radiant tubes beneath the oil cooker tank, or gas-fired immersion tubes at the bottom of the oil cooker tank.
- Direct flame impingement on the bottom of the oil cooker tank (primarily batch kettles).

Oil cooker exhaust fumes are normally incinerated or ″scrubbed,″ or occasionally discharged directly to atmosphere.

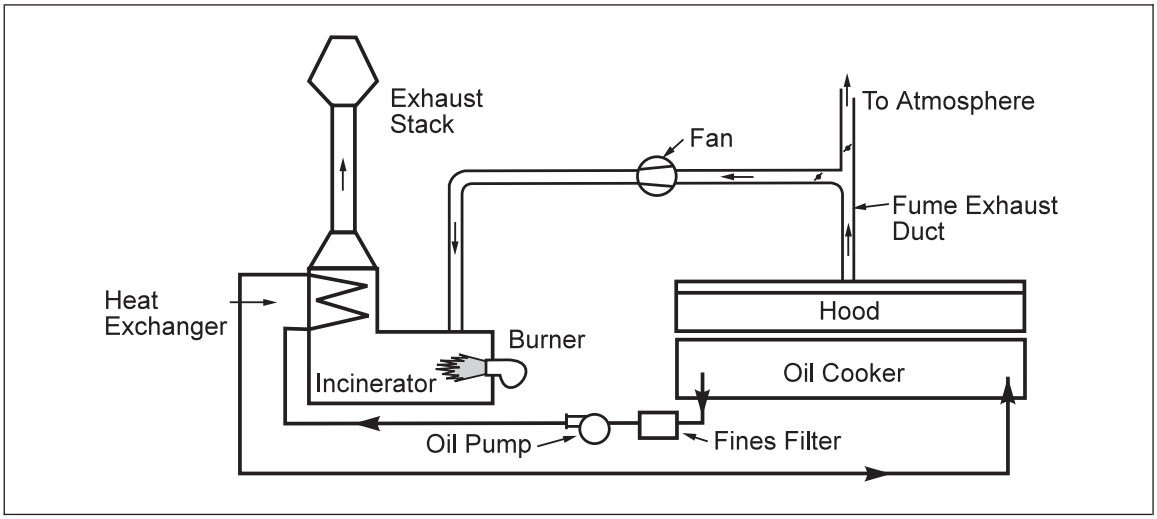

Fig. 3. Oil cooker with detached heater/incinerator.

C.2 Cooking Oils

Commonly used cooking oils are listed in Table 1. Flash point and autoignition temperature data is also provided, although the values listed in Table 1 will vary depending on the specific cooking oil used.

Table 1. Types of Cooking Oils

Type of Cooking Oil	*Flash Point, °F (°C)*	*Ignition Temperature, °F (°C)*
Canola	641 (338)	686 (363)
Corn	647 (342)	684 (362)
Cotton Seed	633 (334)	690 (366)
Palm	623 (328)	710 (377)
Peanut	659 (348)	698 (370)
Soybean (Soya)	631 (333)	710 (377)
Sunflower Seed	644 (340)	678 (359)