



**International  
Standard**

**ISO 15371**

**Ships and marine technology —  
Fire-extinguishing systems for  
protection of galley cooking  
equipment**

*Navires et technologie maritime — Systèmes d'extinction  
d'incendie des équipements de cuisine*

**Fourth edition  
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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at [www.iso.org/patents](http://www.iso.org/patents). ISO shall not be held responsible for identifying any or all such patent rights.

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 8, *Ships and marine technology*, Subcommittee SC 1, *Maritime safety*.

This fourth edition cancels and replaces the third edition (ISO 15371:2015), which has been technically revised.

The main changes are as follows:

- [Clause 2](#) and Bibliography have been added;
- [Clause 3](#), [4.4](#) and [5.4](#) have been modified.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

## Introduction

This document provides the marine industry with a means for evaluating the effectiveness of fire-extinguishing systems for a variety of grease-laden cooking equipment that can be found in a galley. This document is also referenced in the International Maritime Organization (IMO) International Convention for the Safety of Life at Sea (SOLAS), 1974, as amended<sup>[1]</sup>. This document aims to provide organizations who are party to SOLAS with a means of ensuring that deep-fat cooking equipment conforms to the fire suppression requirements prescribed in SOLAS.

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# Ships and marine technology — Fire-extinguishing systems for protection of galley cooking equipment

## 1 Scope

This document applies to the design, testing, and operation of pre-engineered fire extinguishing systems that protect galley hoods, ducts, fryers and other grease-laden cooking equipment.

This document provides requirements for the construction and performance of components within pre-engineered fire-extinguishing system units. This document also provides minimum requirements for the testing and evaluation of components.

A product that contains features, characteristics, components, materials or systems that are new or different from those covered by the requirements in this document and that involve a risk of fire, electric shock, or injury to persons, can be evaluated using the appropriate additional component and end product testing.

## 2 Normative references

There are no normative references in this document.

## 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

### 3.1 auxiliary equipment

equipment used in conjunction with the extinguishing system

Note 1 to entry: Auxiliary equipment can be used to shut down power, fuel supply or ventilation to the hazard area being protected or to initiate alarm or signalling devices.

### 3.2 cooking equipment

cooking device that has, or is capable of having, a surface of liquid grease or one involving cooking with grease

Note 1 to entry: Deep fat fryer, griddle, range, chain-broiler, electric char-broiler, charcoal broiler, mesquite broiler, gas radiant char broiler, wok, tilt skillet/braising pan and similar equipment.

Note 2 to entry: The protected area is limited to the cooking area of the equipment only.

### 3.3 cooking grease

vegetable shortening incorporating an antifoaming agent

**3.4**

**cylinder valve assembly**

container that incorporates a valve and that provides storage for the extinguishing agent and expellant gas until the valve is actuated

Note 1 to entry: For expellant-gas carriage operated units, this assembly includes the extinguishing agent storage container and cartridge mechanism.

**3.5**

**deep fat fryer**

commercially available cooking equipment in which cooking grease in depth are used

**3.6**

**discharge nozzle**

device that is used to distribute the extinguishing agent over or into a specific area

**3.7**

**discharge rate**

ratio of the quantity of the extinguishing agent discharged from a nozzle to the discharge time (time interval between the first appearance of the extinguishing agent at the nozzle and the time at which the discharge becomes predominantly gaseous or ceases to be measured to within  $\pm 1$  s)

Note 1 to entry: This rate is expressed in kg/s.

**3.8**

**duct**

**duct system**

continuous enclosed passage for the transmission of air and cooking vapours

**3.9**

**expellant gas**

dry nitrogen or other dry gas to facilitate the discharge of extinguishing agent from the cylinder valve assembly

**3.10**

**extinguishing system unit**

identified components that can be assembled into a system for the discharge of an extinguishing agent through fixed piping and nozzles for the purpose of extinguishing fires

**3.11**

**gas cartridge**

container that provides storage for an expellant gas only

**3.12**

**hood**

device provided as part of an exhaust system to direct and capture grease vapours and exhaust gases from a cooking equipment

**3.13**

**indicator**

mechanical or electrical device that shows when an extinguishing system or one of its critical components is ready to operate or has already operated

**3.14**

**inspection**

visual examination of the system or portion thereof to verify that it appears to be in operating condition and is free of physical damage

**3.15**

**low quality fatty beef steak**

beef steak containing 20 % to 30 % fat or gristle, well marbled and uniform in size

**3.16**

**maintenance**

work, including but not limited to repair, replacement and service, performed to ensure that the cooking equipment operates properly

**3.17**

**manual means of actuation**

means of system actuation in which a system is discharged by manual means

**3.18**

**manufacturer's installation and maintenance manual**

document containing the design, installation and maintenance instructions which is a complementary part of the extinguishing system

**3.19**

**multiple-vat deep fat fryer**

multiple electric fryers that are mechanically joined together

Note 1 to entry: Each vat incorporates a separately controlled heating source.

**3.20**

**operating devices**

mechanical, electrical or pneumatic devices involved in the operation of a system

**3.21**

**owner's manual**

pamphlet containing the manufacturer's recommendations for proper inspection and operation, which is prepared as a complementary part of the extinguishing system

**3.22**

**plenum**

volume of enclosed space between the grease filters and the portion of the *hood* (3.12) above the grease filters in a hood and *duct system* (3.8)

**3.23**

**pre-engineered extinguishing system**

system that is tested in accordance with the limitations prescribed by the manufacturer for the maximum and minimum pipe lengths, accessories, number of fittings, number and types of nozzles, nozzle placement, types of fire risk and the maximum dimensions, volumes and areas of the equipment, *hoods* (3.12) and *ducts* (3.8) to be protected

Note 1 to entry: The hazards protected by these systems are specifically limited as to type and size by testing on actual fires.

Note 2 to entry: The limitations on hazards that are permitted to be protected by these systems and piping and nozzle configurations are those contained in the *manufacturer's installation and maintenance manual* (3.18).

**3.24**

**cylinder**

container that provides storage for the expellant gas and extinguishing agent, or the extinguishing agent only when the expellant *gas cartridge* (3.11) is operated

**3.25**

**product**

fire-extinguishing system or any part thereof covered by the requirements of this document

**3.26**

**shut-off device**

device that operates simultaneously with the extinguishing system to shut off fuel and power to the equipment protected by the system and other equipment required to be shut off upon operation of the system

**3.27**

**signal**

status indication communicated by electrical or other means

**3.28**

**split-vat deep fat fryer**

electric fryer that incorporates a divided partition which splits the fryer into sections

Note 1 to entry: Each split-vat fryer incorporates a separately controlled heating source.

**3.29**

**tilt skillet**

**braising pan**

cooking device which is intended to braise, simmer, sauté, or fry foods

## **4 Components**

### **4.1 General**

System components referenced or permitted in the manufacturer's installation and maintenance manual or alternative components that are intended for use with the specific extinguishing system shall be used.

### **4.2 Detectors**

Detectors shall be positioned for detecting fire in the galley hoods, ducts, fryers and other grease-laden cooking equipment.

### **4.3 Discharge nozzles**

**4.3.1** The nozzles shall be provided with an internal strainer located immediately up-stream of the nozzle.

**4.3.2** The nozzles shall be constructed of brass, stainless-steel, or other corrosion-resistant materials, or be protected inside and out against corrosion.

**4.3.3** The nozzles shall be made of non-combustible materials and shall withstand the expected fire exposure without deformation.

**4.3.4** The nozzles shall be permanently marked for identification.

**4.3.5** All the nozzles shall be provided with caps or other suitable devices to prevent the entrance of grease vapours, moisture, or other foreign materials into the piping.

**4.3.6** The caps or other protection devices shall blow off, open or blow out upon agent discharge.

### **4.4 Operating devices**

**4.4.1** Operating devices shall be designed for the service they will encounter and shall not be rendered inoperative by, or be susceptible to, accidental operation.

**4.4.2** Operating devices shall be designed to function properly through a temperature range from 0°C to 49°C; such range shall be marked to indicate the temperature limitations.

## 4.5 Manual means of actuation

4.5.1 Manual means of actuation shall not require a force of more than 178 N.

4.5.2 Manual means of actuation shall not require a large movement (e.g. more than 356 mm) to secure operation.

4.5.3 All manual actuators shall be provided with operating instructions. These instructions can include the use of pictographs and shall have lettering at least 6 mm in height.

4.5.4 All remote manual operating devices shall be marked to identify the associated hazards.

## 4.6 Shut-off devices

4.6.1 Upon activation of any cooking equipment or hood/duct fire-extinguishing system, all sources of fuel and electric power that produce heat to all equipment protected by the system shall have shut off capability.

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

4.6.3 Exhaust fans and dampers are not required to be shut off on system actuation if the fire-extinguishing system has been tested under both zero and high-velocity flow conditions.

4.6.4 If the expellant gas is used to pneumatically operate the shut-off devices, the gas shall be sourced prior to its entry into the agent storage cylinder.

4.6.5 Shut-off devices shall require manual resetting prior to fuel or power being restored.

## 4.7 Pipe, fittings, tubing and hose

4.7.1 Pipe and associated fittings shall be of non-combustible material having physical and chemical characteristics compatible with the extinguishing agent.

4.7.2 The pressure rating of the pipe, fittings and connection joints shall be determined and documented to withstand the maximum expected pressure in the piping system.

4.7.3 Pipe, tubing, hose and fitting materials and types shall be in accordance with the manufacturer's installation and maintenance manual.

## 4.8 Extinguishing agent

4.8.1 The agent used shall be identified for the particular system in the operation and maintenance manual, as recommended by the manufacturer of the system.

4.8.2 Agents from different manufacturers shall not be mixed.

## 4.9 Indicator

Systems shall be provided with an audible or visual indicator to show that the system is in a ready condition or requires recharging.

## 5 System requirements

### 5.1 General

Fire-extinguishing systems shall meet the requirements of [6.4](#).

### 5.2 Use

**5.2.1** Cooking equipment that can be protected against fire hazard includes:

- a) cooking hoods, plenums, ducts, and filters with their associated cooking equipment including deep fat fryers, ranges, broilers, griddles and similar cooking equipment;
- b) special grease removal devices;
- c) energy recovery devices installed in the exhaust system.

### 5.3 Applications

**5.3.1** The manufacturer's installation and maintenance manual shall be consulted for the system's limitations and the applications for which the system is considered to be satisfactorily protected.

**5.3.2** Each protected cooking equipment, individual hood and branch exhaust duct directly connected to the hood, shall be protected by a system or systems designed for simultaneous operation.

**5.3.3** Where two or more hazards can be simultaneously involved in fire by reason of their proximity, the hazards shall be protected by either of the following:

- a) individual systems installed to operate simultaneously;
- b) a single system designed to protect all hazards that can be simultaneously involved.

**5.3.4** Any hazard that allows fire propagation from one area to another shall constitute a single fire hazard.

### 5.4 System actuation

**5.4.1** All systems shall have a manual method of actuation or both manual and automatic actuations. In the case of a CO<sub>2</sub> fire extinguishing system, only manual activation is allowed.

**5.4.2** The automatic and manual means of system actuation, external to the control head or releasing device, shall be separated and independent of each other so that a failure of one will not impair the operation of the other.

**5.4.3** When a releasing mechanism is used, employing a single line for the mechanical detection and the remote manual control, the remote manual control shall be installed inline, prior to all detection devices, so that a malfunction of one does not impede operation of the other.

**5.4.4** Automatic detection and system actuation shall be in accordance with the manufacturer's installation and maintenance manual.

NOTE The installation of detection is required by SOLAS Convention Chapter II-2.[1](#)

**5.4.5** The devices necessary for the proper operation of the system shall function simultaneously with the system operation.

**5.4.6** Operation of any manual actuator shall be all that is required to bring about the full operation of the system.

**5.4.7** At least one manual actuator shall be provided for each system.

**5.4.8** All operating devices shall be designed, located, installed or protected so that they are not subject to mechanical, environmental or other conditions that can render them inoperative or cause inadvertent operation of the system.

**5.4.9** An audible or visual indicator shall be provided to show that the system has operated, that personnel response is needed and that the system requires recharge.

**5.4.10** The extinguishing system shall be connected to the fire alarm system, if provided, so that actuation of the extinguishing system will sound the fire alarm as well as provide the function of the extinguishing system.

**5.4.11** A readily accessible means for manual actuation shall be located in a path of egress or outside the space of the fire hazard. When manual activation is used for cooking related protection, the manual activation device shall be installed no more than 1 450 mm and no less than 1 000 mm above the floor. The manual activation device shall clearly identify the hazard against which it protects.

**5.4.12** Automatic systems protecting common exhaust ducts shall not require a remote manual actuator.

**5.4.13** The means for the manual actuator(s) shall be mechanical and shall not rely on electrical power for actuation.

**5.4.14** Electrical power is permitted to be used for manual actuation if a reserve power supply is provided or if supervision in accordance with 5.5 is provided.

## **5.5 Supervision**

**5.5.1** Where supervision of any of the following is provided, it shall be designed to indicate problems or failure:

- a) automatic detection system;
- b) electrical actuation circuit;
- c) electrical power supply.

**5.5.2** Signals indicating the failure of the supervised devices or equipment shall give prompt and positive indication of any failure. These signals shall be distinctive from signals indicating operation or hazardous conditions.

## **5.6 System location**

**5.6.1** If ambient temperatures outside the manufacturer's operating temperature range are expected, protection shall be provided to maintain the temperature within the specified range.

**5.6.2** Agent containers and expellant gas assemblies shall not be located where they can be subjected to mechanical, chemical, or other damage.

**5.6.3** Where damage due to chemical or mechanical exposure is expected, protective devices such as enclosures or guards shall be provided.

**5.6.4** Agent containers and expellant gas assemblies shall be accessible for inspection, maintenance, and recharge.

**5.6.5** Agent containers and expellant gas assemblies shall be located near the protected area but not at the position where they will be exposed to the fire of the protected area.

## **5.7 Discharge nozzles**

**5.7.1** All discharge nozzles shall be designed and subsequently located, installed, or protected so that they are not subjected to mechanical, environmental, or other conditions that can render them inoperative.

**5.7.2** Discharge nozzles shall be connected to piping that is supported.

## **5.8 Protection to multiple equipment**

**5.8.1** Systems protecting two or more hoods or plenums, or both, shall be installed to ensure the simultaneous operation of all systems protecting the hoods, plenums and associated cooking equipment located below the hoods.

**5.8.2** A single detection device shall be permitted for more than one equipment when installed according to the manufacturer's installation and maintenance manual.

**5.8.3** At least one heat detector or fusible link shall be installed within each exhaust duct opening, in accordance with the manufacturer's installation and maintenance manual.

**5.8.4** A heat detector or fusible link shall be provided above each protected cooking equipment and in accordance with the manufacturer's installation and maintenance manual. This requirement shall apply to heat detectors or fusible links located at or within 300 mm from the exhaust duct opening and above the protected equipment.

**5.8.5** Where the pipe or other conduit penetrates a duct or hood, the penetration shall have a liquid tight continuous external weld or shall be sealed.

## **5.9 Protection of common exhaust duct**

**5.9.1** Common exhaust ducts shall be protected by one of the following methods:

- a) simultaneous operation of all independent hood, duct, and equipment protection systems;
- b) simultaneous operation of any hood, duct, and equipment protection system and the system(s) protecting the entire common exhaust duct.

**5.9.2** A heat detector or fusible link shall be located at each branch connection to the common exhaust duct.

**5.9.3** The heat detector or fusible link specified in [5.9.2](#) shall be installed in the common duct to detect fire. Alternatively, independent heat detectors shall be installed in each branch of the common duct to detect fire in the duct system.

**5.9.4** All sources of fuel or heat to the equipment served by the common exhaust duct shall be shut down upon actuation of any protection system.

**5.9.5** Ignition sources contained within any exhaust system shall be protected and have a separate detection system in accordance with the manufacturer's installation and maintenance manual.

**5.9.6** Moveable cooking equipment shall be provided with a means to ensure that it is correctly positioned in relation to the equipment discharge nozzles during cooking operations.

## 6 Test methods

### 6.1 Cooking equipment extinguishing tests

#### 6.1.1 General

**6.1.1.1** An extinguishing system unit shall meet the coverage and nozzle placement limitations for each type of cooking equipment with which it is intended to be used. When the coverage and nozzle placement limitations from the results of successful deep fat fryer testing meet the requirements for any other cooking equipment installations, further testing is not required (see [6.1.2](#)). For cooking equipment with different nozzle coverage, placement limitations, or with obstructions of agent discharge spray patterns, fire tests are required.

Specific fire extinguishing test methods are given in [6.4](#). Additional testing on splashing during the discharge of a system, in accordance with [6.2](#), shall also be provided.

For hood, duct and plenum testing only, grease shall be new or used vegetable shortening, or rendered animal fat.

**6.1.1.2** When tested with a cooking equipment, the extinguishing system unit shall:

- a) result in the flame in the equipment being completely extinguished in one minute or less;
- b) ensure that after 10 s from the start of the discharge of the extinguishing agent, the flames are no bigger than those prior to the start of the discharge of the agent;
- c) for deep fat fryers, woks and ranges, not permit reigniting of the grease for 20 min or until the temperature of the grease decreases to at least 33,3 °C below its observed auto-ignition temperature, whichever is longer; and
- d) not permit re-ignition of the grease for 5 min for all equipment other than deep fat fryers, woks and ranges.

**6.1.1.3** Unless otherwise noted, each fire test shall be conducted using the minimum quantity of agent and the minimum discharge rate condition. This is achieved by assembling the extinguishing system using its maximum piping limitations with respect to the number of fittings and the size and length of the pipe, in accordance with the manufacturer's installation and maintenance manual.

**6.1.1.4** The cylinder valve assembly shall be filled to its rated capacity and the cylinder or gas cartridge pressurized with the expellant gas to the normal operating pressure at 21 °C [see [7.2 k](#)]. The cylinder/valve assembly or gas cartridge used for these tests shall be conditioned for at least 16 h at the minimum storage temperature specified in the manufacturer's installation and maintenance manual. As an alternative to the conditioning, stored pressure units can be under-pressurized to simulate the pressure at the minimum operating temperature.

**6.1.1.5** Extinguishing tests shall be conducted with both the maximum and minimum nozzle heights, with each nozzle positioned in the most difficult location and orientation permitted by the manufacturer's installation instruction regarding fire extinction. Splash tests shall be conducted at the minimum nozzle height, with the nozzle positioned in the most difficult locations and orientations permitted by the manufacturer's installation and maintenance manual.

**6.1.1.6** The length and width of the cooking area of the equipment being tested shall correspond to the maximum area coverage and dimension limitations specified in the manufacturer's installation and maintenance manual.

**6.1.1.7** Multiple-equipment protection for single discharge nozzle coverage shall be tested as per the manufacturer's installation and maintenance manual.

**6.1.1.8** A larger equipment shall not be protected with multiple nozzles, unless:

- a) a deep fat fryer protected by multiple nozzles does not exceed a total cooking surface area of 0,55 m<sup>2</sup>; and
- b) the area of coverage for each nozzle does not exceed its single equipment coverage.
- c) and d) are exceptions to the requirements in a) and b).
- c) when compliance with the deep fat fryer requirements is demonstrated using the specified cooking surface area of coverage, the protection of a deep fat fryer with a total cooking surface area greater than 0,55 m<sup>2</sup> can be used;
- d) the requirement of a total surface cooking area of 0,55 m<sup>2</sup> does not apply to tilt skillets/braising pans.

**6.1.1.9** Prior to the conduct of each extinguishing test, the equipment shall be cleaned and provided with new cooking grease.

## **6.1.2 Deep fat fryer**

**6.1.2.1** The deep fat fryer used for this test shall be a commercially available natural gas, propane, or electric deep fat fryer, at least 230 mm deep, having a cooking surface area as specified in the manufacturer's installation and maintenance manual. For a deep fat fryer with an integral drip board, the calculated cooking area, along with the drip area, shall be as indicated in the manufacturer's installation and maintenance manual.

**NOTE** On certain electric fryers, the heating elements can be damaged due to the high temperatures during the fire testing; therefore, natural gas- or propane-fuelled units are commonly used for the fire tests.

**6.1.2.2** All deep fat fryers that are tested in accordance with [6.1.2.1](#), and [6.1.2.3](#) to [6.1.2.8](#) shall demonstrate an average heating rate of not less than 7 °C per minute and an average cooling rate of not more than 3 °C per minute. The average heating and cooling rates shall be determined by heating the liquid grease in an uncovered fryer at the fryer's maximum energy input. The time required to heat the grease from 260 °C to 315 °C shall be used to calculate the rise in temperature of the equipment. When the temperature of the liquid grease reaches 325 °C, the fryer's energy source shall be immediately shut off. The temperature of the cooling liquid grease shall then be monitored. When the temperature of the grease returns to 315 °C, the cooling rate, in °C/min, shall be measured between the temperatures of 315 °C and 260 °C. The fryer shall be tested with an ambient temperature of (21 ± 5) °C throughout the duration of the test. The thermocouple monitoring the grease temperature shall be installed as indicated in [6.1.2.6](#).

**6.1.2.3** Multiple-vat and split-vat deep fat fryers shall be tested separately with the discharge nozzle positioned in the most difficult location and orientation permitted in the manufacturer's installation and maintenance manual.

**6.1.2.4** To test split-vat fryers, one or more of the vats adjacent to the vat which is spontaneously ignited shall be filled with liquid cooking grease and heated to a temperature range of 175 °C to 190 °C. The energy shall be shut-off for all vats when the extinguishing system is actuated.

If saponified foam from the adjacent vat(s) rolls over into the burning vat after system actuation, the grease temperature of the adjacent vat(s) shall be reduced to the point where foam rollover does not occur, or a means shall be provided to prevent foam from rolling over into the burning vat.

**6.1.2.5** The fryer shall be filled with new, unused liquid grease until the grease level is 75 mm below the top edge of the fryer (see [6.1.1.9](#)). During the testing, the auto-ignition temperature shall not be less than 358 °C and an auto-ignition shall start by the time when the oil temperature reaches 363 °C followed by free burning for 2 min. For a deep fat fryer with an internal drip board, the grease level shall be at the fryer wall/drip board interface when the grease is at a temperature range of 175 °C to 190 °C. In no case shall the

grease level for any type of fryer be more than 75 mm below the top of the vat when the grease temperature is between 288 °C to 315 °C.

**6.1.2.6** The grease temperature during testing shall be measured with a thermocouple located 25 mm below the grease surface. The thermocouple shall be located not closer than 75 mm to any side of the fryer.

**6.1.2.7** The liquid grease in the fryer shall be heated by its heating source until auto-ignition occurs. The fire shall burn freely with the fryer's heating source remaining on for a period of not less than 2 min. After the free-burn period, the heating source shall be shut off and the extinguishing system shall be manually discharged.

**6.1.2.8** Upon complete discharge of the extinguishing agent, the deep fat fryer shall have complied with the requirements in [6.1.1.2](#).

### **6.1.3 Griddle**

**6.1.3.1** The griddle used for the fire test shall be constructed of sheet metal at least 2 mm thick and shall be 25 mm deep.

**6.1.3.2** The griddle shall be filled with liquid grease to a depth of 6 mm.

**6.1.3.3** The liquid grease in the griddle shall be heated by the griddle's heating source until spontaneous ignition occurs. After the cooking area is fully involved in flames, the fire shall burn freely for a minimum of one minute, with the heating source remaining on, after which the heating source shall be shut off and the extinguishing system unit shall be discharged.

**6.1.3.4** Upon complete discharge of the extinguishing agent, the griddle shall comply with the requirements of [6.1.1.2](#).

### **6.1.4 Range top**

**6.1.4.1** The range top used for the test shall be a commercially available electric, natural gas- or propane-fired range top or a commercial range top burner constructed to simulate variable range top configurations. When a manufacturer references protection for a range top incorporating a back shelf, a back shelf of the maximum size and located at the minimum height as specified in the manufacturer's installation and maintenance manual shall be used for the test. The cooking surfaces of the range top shall be the maximum as specified for coverage in the manufacturer's installation and maintenance manual.

**6.1.4.2** The following test vessels shall be used for the tests:

- a) a cast iron skillet having a diameter of 330 mm to 360 mm at the top and having sides 45 mm to 60 mm high, measured from inside the skillet;
- b) a stainless-steel pot having a diameter of  $(255 \pm 6)$  mm at the top and having sides of 180 mm to 200 mm high.

**6.1.4.3** Separate extinguishment tests shall be conducted using each test vessel.

**6.1.4.4** For the test with the cast iron skillet, the skillet shall be filled with liquid grease to a depth of 25 mm. For the test with the stainless-steel pot, the pot shall be filled with liquid grease to a depth of 100 mm. The grease level shall be measured when the grease temperature is between 288 °C to 315 °C.

**6.1.4.5** The two-minute free burn shall start at auto-ignition or at a grease temperature of 363°C, whichever occurs last. The grease temperature shall be measured with a thermocouple located 12,5 mm below the grease surface and not closer than 75 mm to the test vessel wall.

**6.1.4.6** The test vessel shall be positioned on a burner in a location determined to be the most difficult to achieve fire extinguishment. For the skillet test, the 255 mm pot shall be located adjacent to the skillet in a location determined to be the most difficult with respect to achieving fire extinguishment. The range top burner for the test vessel shall be adjusted to the maximum intensity position and the grease continuously heated until auto-ignition occurs. After auto-ignition, the fire shall burn freely with the burner at its maximum intensity for a period of at least 2 min. After the free-burn period of at least 2 min, the heating source shall be shut off and the extinguishing system unit shall be discharged.

**6.1.4.7** Upon complete discharge of the extinguishing agent, the range top shall comply with the requirements of [6.1.1.2](#).

## **6.1.5 Gas radiant char broiler**

**6.1.5.1** This test shall use a commercially available gas radiant char-broiler or a char-broiler constructed to simulate a commercially available gas radiant char-broiler. The char-broiler shall have a drip pan at least 12,5 mm deep located below the heating source. An extinguishing system unit shall be capable of being used with an electric char-broiler based on a successful extinguishment test using a gas radiant char-broiler, which uses identical coverage and nozzle placement limitations.

**6.1.5.2** A thin plastic sheet, such as a plastic food wrap, containing steaks and grease, shall be placed on a flat surface at a location away from the char-broiler. The plastic sheet shall be covered with 6 mm of semi-solid grease. Low quality fatty beef steaks shall then be placed on top of the grease-laden plastic sheet so as to cover an area equal to 80 % to 90 % of the char-broiler grate area. The drip pan shall be filled with 3 mm of liquid grease.

**6.1.5.3** The char-broiler's radiant panels shall be heated with the burners at their maximum intensity so that they are hot enough to ignite drops of liquid grease. When this occurs, the plastic sheet, grease and steaks shall be placed on the broiler's grill in the normal cooking position. The char broiler shall become quickly involved in flames. The heating source shall be shut off and the extinguishing system discharged after the cooking area has been fully covered with flames for one minute and the peak flame height is at least 900 mm.

**6.1.5.4** Upon complete discharge of the extinguishing agent, the gas radiant char-broiler shall comply with the requirements in [6.1.1.2](#).

## **6.1.6 Electric char-broiler**

**6.1.6.1** This test shall use a commercially available electric char-broiler, or a char-broiler constructed to simulate a commercially available electric char-broiler.

**6.1.6.2** The test shall be conducted in the same manner as the gas radiant test specified in [6.1.5.1](#) to [6.1.5.4](#).

## **6.1.7 Lava, pumice or synthetic rock char-broiler**

**6.1.7.1** Identical coverage and nozzle placement limitations for lava rock, pumice stone or synthetic rock type char-broilers shall be used based on a successful extinguishment test of a lava rock type char-broiler. A gas or electrically heated char-broiler shall be used, and an extinguishing system unit can be used with either heat source based on a successful extinguishment test.

**6.1.7.2** This test shall use a commercially available lava, pumice or synthetic rock char-broiler, or a char-broiler constructed to simulate a commercially available lava, pumice or synthetic rock char-broiler.

**6.1.7.3** This test shall be conducted in the same manner as the gas radiant test specified in [6.1.5.1](#) to [6.1.5.4](#), except that the lava, pumice, or synthetic rock shall be heated in lieu of heating the gas radiant panels. The

grate shall be covered with two layers of lava, pumice, or synthetic rock, whichever is being used for test purposes.

#### **6.1.8 Natural charcoal broiler**

**6.1.8.1** This test shall use a commercially available charcoal broiler or a charcoal broiler constructed to simulate a commercially available charcoal broiler.

**6.1.8.2** A thin plastic sheet, such as plastic food wrap, containing steaks and grease, shall be placed on a flat surface at a location away from the charcoal broiler. The plastic sheet shall be covered with 6 mm of semi-solid grease. Low quality fatty beef steaks shall then be placed on top of the grease-laden plastic sheet so as to cover an area equal to 80 % to 90 % of the cooking area.

**6.1.8.3** The fuel grate shall then be covered with charcoal briquettes to the maximum depth limitation specified in the manufacturer's installation and maintenance manual. In any case, the charcoal depth shall not be less than two layers of briquettes.

**6.1.8.4** The charcoal briquettes shall then be heated until they are covered with ash. When this occurs, the plastic sheet, grease and steaks shall be placed on the broiler's grill in the normal cooking position. The broiler shall become quickly involved in flames. The fire shall burn freely until the cooking area is fully involved in flames having a height of 900 mm, and the fire shall be allowed to burn for at least 30 s. When the cooking area is fully involved in flames and after 30 s or longer of flaming, the extinguisher system unit shall be discharged.

**6.1.8.5** Upon complete discharge of the extinguishing agent, the charcoal broiler shall comply with the requirements in [6.1.1.2](#).

#### **6.1.9 Mesquite wood char-broiler**

**6.1.9.1** A commercially available mesquite wood char-broiler or a char-broiler constructed to simulate a commercially available mesquite wood char-broiler shall be used for the test. The test shall be conducted using the type of mesquite wood, such as the maximum depth of hips, chunks or logs, that is intended to be used with the char-broiler.

**6.1.9.2** The test shall be conducted in the same manner as the natural charcoal broiler test specified in [6.1.8.1](#) to [6.1.8.5](#), except that the fuel depth shall be the maximum specified by the manufacturer, and in no case less than 75 mm, and mesquite wood shall be used instead of charcoal.

#### **6.1.10 Upright broiler**

**6.1.10.1** This test shall use a commercially available upright broiler or an upright broiler constructed to simulate a commercially available upright broiler. The broiling chamber shall be located at or roughly at the mid-height of the broiler and shall incorporate a broiling grate. A drip pan shall be placed directly below the broiling chamber. The bottom of the broiling chamber shall slope downward towards the drip pan and have an opening to allow the drainage of the grease from the broiling chamber. The broiling chamber is also to incorporate a completely enclosed warming chamber directly above the broiling chamber. The broiling chamber shall be connected by internal passages to the top of the broiler to provide for exhaust of the grease-laden vapours. The broiler shall incorporate a grease trap.

**6.1.10.2** The drip pan below the broiler chamber shall be filled with preheated grease. The inner surfaces of the broiling chamber, the exhaust passages, and the grease trap in the back of the broiler shall be coated with the liquid grease to obtain a minimum loading of 1,5 kg/m<sup>2</sup>.

**6.1.10.3** Following the grease loading, low quality fatty beef steaks shall be placed on the broiler grate so as to cover an area of between 80 % and 90 % of the cooking area.

**6.1.10.4** The grease in the drip pan and broiling chamber shall be heated with a torch until the broiler is well involved in flames. This usually requires 2 min to 3 min. After complete flame coverage of the drip pan, the broiler shall then burn freely for an additional 30 to 60 s, after which the extinguishing system unit shall be discharged.

**6.1.10.5** Upon complete discharge of the extinguishing agent, the upright broiler shall comply with the requirements in [6.1.1.2](#).

#### **6.1.11 Chain broiler**

**6.1.11.1** This test shall use a commercially available chain broiler or a chain broiler constructed to simulate a commercially available chain broiler. The bottom of the broiling chamber shall slope downward toward a drip pan and have an opening to allow the drainage of the grease from the broiler chamber.

**6.1.11.2** The drip pan below the broiler chamber shall be filled with preheated grease. The inner surfaces of the broiler chamber, cooking portion and grease trap shall be coated with liquid grease to obtain a minimum loading of 1,5 kg/m<sup>2</sup>. Grease shall also be sprayed on all areas of the chain by causing the chain to rotate. When this is complete, 80 % to 90 % of the chain's cooking area shall be covered with fatty hamburgers (i.e. meat that is 70 % lean) and the chain rotation stopped.

**6.1.11.3** The grease in the drip pan and the broiler chamber shall be heated with the broiler's burners and a torch or with a torch only until the broiler is well involved in flames. This usually requires 2 min to 3 min. The broiler is then to burn freely for an additional 30 to 60 s after which the extinguishing system unit shall be discharged.

**6.1.11.4** Upon complete discharge of the extinguishing agent, the chain broiler shall comply with the requirements in [6.1.1.2](#).

#### **6.1.12 Wok**

**6.1.12.1** The minimum and maximum wok sizes specified in the manufacturer's instruction and maintenance manual shall be tested. The wok sizes shall be determined by the minimum and maximum height and diameter.

**6.1.12.2** The heating source used for the tests shall be a commercially available electric, natural gas, or propane fired range top.

**6.1.12.3** Separate extinguishment tests shall be conducted using the smallest and the largest representative wok.

**6.1.12.4** Each wok shall be tested with a liquid grease level at a depth that provides a 75 mm freeboard measured from the top edge of the wok, or a minimum grease level of 25 mm, whichever provides greater depth of grease. The grease level shall be measured when the grease temperature is between 288 °C to 315 °C.

**6.1.12.5** The two-minute free burn shall start at auto-ignition or at a grease temperature of 363°C, whichever occurs last. The grease temperature shall be measured with a thermocouple located 12,5 mm below the grease surface not closer than 75 mm to the test vessel wall.

**6.1.12.6** The wok shall be positioned on a burner in a location determined to be the most difficult to achieve fire extinguishment. For the minimum size wok test, a maximum size wok shall be located adjacent to the test wok representing the location most difficult to achieve fire extinguishment. The range top burner for the test wok shall be adjusted to a maximum intensity position and the grease continuously heated until auto-ignition occurs. After auto-ignition, the fire shall burn freely with the burner at maximum intensity for a period of at least 2 min. After the free-burn period of at least 2 min, the heating source shall be shut off and the extinguishing system unit shall be discharged.

**6.1.12.7** Upon complete discharge of the extinguishing agent, the wok shall comply with the requirements in [6.1.1.2](#).

## 6.2 Splash tests

### 6.2.1 General

Unless otherwise noted, each splash test shall be conducted using the maximum quantity of agent and the maximum discharge rate condition which is achieved by assembling the extinguishing system using its minimum piping limitations with respect to the number of fittings and the size and length of the pipe in accordance with the installation and maintenance manual.

The cylinder valve assembly shall be filled to its rated capacity and the cylinder or gas cartridge pressurized with the expellant gas to the normal operating pressure at 21 °C (see [7.2 k](#)). The cylinder valve assembly or gas cartridge used for these tests shall be conditioned for at least 16 h at the maximum storage temperature specified in the installation and maintenance manual. As an alternative to the conditioning, stored pressure units can be over-pressurized to simulate the pressure at the maximum operating temperature.

### 6.2.2 Deep fat fryer extinguishing splash tests

**6.2.2.1** When tested as described in [6.2.2.3](#) to [6.2.2.9](#), an extinguishing system unit shall:

- a) result in the fire in a deep fat fryer being completely extinguished, and
- b) result in no splashing of burning droplets of grease due to the extinguishing system unit operation, as evidenced by the presence of burning grease dispersed outside the fryer.

**6.2.2.2** The deep fat fryer used for this test shall be as specified in [6.1.2](#).

**6.2.2.3** The nozzle shall be located at the minimum height specified by the manufacturer's installation and maintenance manual and positioned in the orientation most likely to create splashing of the hot grease.

**6.2.2.4** The fryer shall be filled with liquid grease as specified in [6.1.2.5](#).

**6.2.2.5** The grease temperature during testing shall be measured with a thermocouple installed as specified in [6.1.2.6](#).

**6.2.2.6** The liquid grease shall be heated as specified in [6.1.2.7](#).

**6.2.2.7** The fire shall burn freely until the cooking area is fully involved in flames and shall be allowed to burn for at least 2 min. At the end of 2 min, the heat source shall be shut off and the extinguishing system unit released manually.

**6.2.2.8** When the cooking area is fully involved in flames, the extinguishing system unit shall be discharged and the discharge effects observed to determine compliance with the requirements in [6.2.2.1](#). Foaming over the edge of the fryer and dispersion of residual extinguishing agent on the surrounding surface area in the vicinity of the discharge nozzle is acceptable.

**6.2.2.9** Upon complete discharge of the extinguishing agent, the deep fat fryer shall comply with the requirements in [6.1.1.2](#).

### 6.2.3 Deep fat fryer cooking temperature splash test

**6.2.3.1** When tested as described in [6.2.3.2](#) to [6.2.3.7](#), an extinguishing system unit shall not splash grease droplets in excess of 5 mm diameter.

**6.2.3.2** The deep fat fryer used for the tests shall be as specified in [6.1.2](#).

**6.2.3.3** The nozzle shall be located at the minimum height specified by the manufacturer's installation and maintenance manual and positioned in the orientation most likely to create splashing of the hot grease.

**6.2.3.4** The fryer shall be filled with liquid grease until the grease level is 75 mm below the top edge of the fryer. The grease level shall be measured when the grease temperature is within the range of 177 °C to 191 °C.

**6.2.3.5** The grease temperature during the test shall be measured with a thermocouple as indicated in [6.1.2.6](#).

**6.2.3.6** A flat metallic surface at least 760 mm wide having not more than a 1,6 mm deep layer of sodium bicarbonate dry chemical placed on top of the surface shall be prepared around the front and sides of the fryer to detect splashing grease. The liquid grease in the fryer shall be heated by its heating source until a grease temperature within the range of 177 °C to 191 °C is achieved. The extinguishing system unit shall then be discharged for 3 s to 5 s. The metallic surface shall be removed from around the fryer at the end of the discharge to prevent foaming over the edge from contaminating the results.

**6.2.3.7** The discharge effects shall be observed to determine compliance with the requirements in [6.2.3.1](#). Foaming over the edge of the fryer and dispersion of residual extinguishing agent on the surrounding area in the vicinity of the discharge nozzle is acceptable.

#### **6.2.4 Range top extinguishing splash tests**

**6.2.4.1** When tested as described in [6.2.4.2](#) to [6.2.4.6](#), an extinguishing unit shall:

- a) result in the fire in a cast iron skillet being completely extinguished; and
- b) result in no splashing of the burning grease due to the extinguishing system unit operation, as evidenced by the presence of burning droplets of grease dispersed outside the cast iron skillet.

**6.2.4.2** The range top used for this test shall be as specified in [6.1.4](#) and the cast iron skillet as specified in [6.1.4.2](#) a).

**6.2.4.3** The cast iron skillet shall be filled with liquid grease as specified in [6.1.4.4](#).

**6.2.4.4** The grease temperature during the testing shall be measured as specified in [6.1.4.5](#).

**6.2.4.5** The cast iron skillet shall be positioned on a burner located so as to result in the splashing of grease. The range top burner for the skillet shall be adjusted to the maximum intensity position and the grease heated with the skillet uncovered until auto-ignition occurs. After auto-ignition, the fire shall burn freely with the burner at its maximum intensity for a period of not less than 2 min, after which the heat source shall be shut off and the extinguishing system unit discharged.

**6.2.4.6** The discharge effects shall be observed to determine compliance with the requirements in [6.2.4.1](#).

#### **6.2.5 Range top cooking temperature splash tests**

**6.2.5.1** When tested as described in [6.2.5.2](#) to [6.2.5.5](#), an extinguishing system unit shall not splash grease droplets in excess of 5 mm diameter.

**6.2.5.2** The test requirements specified in [6.1.4.2](#), [6.1.4.4](#) and [6.1.4.5](#) shall be used for the test.

**6.2.5.3** The cast iron skillet shall be filled with liquid grease until the grease level is 25 mm below the edge of the skillet. The grease level shall be measured when the grease temperature is within the range of 177 °C to 191 °C.

**6.2.5.4** A flat metallic surface at least 760 mm wide having not more than a 1,6 mm deep layer of sodium bicarbonate dry chemical placed on top of the surface shall be prepared around the front and sides of the range top to detect splashing grease. The liquid grease in the skillet shall be heated by its heating source until a grease temperature within the range of 177 °C to 191 °C is achieved. The extinguishing system unit shall then be discharged for 3 s to 5 s.

**6.2.5.5** The discharge effects shall be observed to determine compliance with the requirements in [6.2.5.1](#).

## **6.2.6 Wok extinguishing splash tests**

**6.2.6.1** When tested as described in [6.2.6.2](#) to [6.2.6.5](#), an extinguishing unit shall:

- a) result in the fire in a wok being completely extinguished; and
- b) result in no splashing of the burning grease due to the extinguishing system unit operation, as evidenced by the presence of burning droplets of grease dispersed outside the wok.

**6.2.6.2** The wok used for this test shall be as specified in [6.1.12](#).

**6.2.6.3** The wok shall be filled with liquid grease as specified in [6.1.12.4](#).

**6.2.6.4** The grease temperature during the testing shall be measured as specified in [6.1.12.5](#).

**6.2.6.5** The wok shall be positioned on a burner located so as to result in the splashing of grease. The range top burner for the wok shall be adjusted to the maximum intensity position and the grease heated with the wok uncovered until auto-ignition occurs. After auto-ignition, the fire shall burn freely with the burner at its maximum intensity for a period of not less than 2 min, after which the heat source shall be shut off and the extinguishing system unit discharged.

**6.2.6.6** The discharge effects shall be observed to determine compliance with the requirements in [6.2.6.1](#).

## **6.2.7 Wok cooking temperature splash tests**

**6.2.7.1** When tested as described in [6.2.7.2](#) to [6.2.7.6](#), an extinguishing system unit shall not splash grease droplets which are greater than 5 mm diameter.

**6.2.7.2** The woks used for this test shall be as specified in [6.1.12](#).

**6.2.7.3** The test requirements specified in [6.1.12.4](#) to [6.1.12.6](#) shall be used for the test.

**6.2.7.4** The wok shall be filled with liquid grease until the grease level is 75 mm below the top edge of the wok. The grease level shall be measured when the grease temperature is within the range of 177 °C to 191 °C.

**6.2.7.5** A flat metallic surface at least 762 mm wide having not more than a 1,6 mm deep layer of sodium bicarbonate dry chemical placed on top of the surface shall be prepared around the front and sides of the range top to detect splashing grease. The liquid grease in the skillet shall be heated by its heating source until a grease temperature within the range of 177 °C to 191 °C is achieved. The extinguishing system unit shall then be discharged for 3 s to 5 s.

**6.2.7.6** The discharge effects shall be observed to determine compliance with the requirements in [6.2.7.1](#).

### 6.3 Hood and duct (full scale) extinguishing test

#### 6.3.1 General

**6.3.1.1** An extinguishing system unit intended to protect the hood and duct of a galley cooking area shall be tested as described through [6.3.2](#) to [6.3.4](#).

#### 6.3.2 Hood

**6.3.2.1** The hood dimensions shall be the maximum as specified in the manufacturer's installation and maintenance manual. Refer to [Figure 1](#).

**6.3.2.2** The hood shall be at least 1,2 m wide, increasing in increments of 0,3 m only.

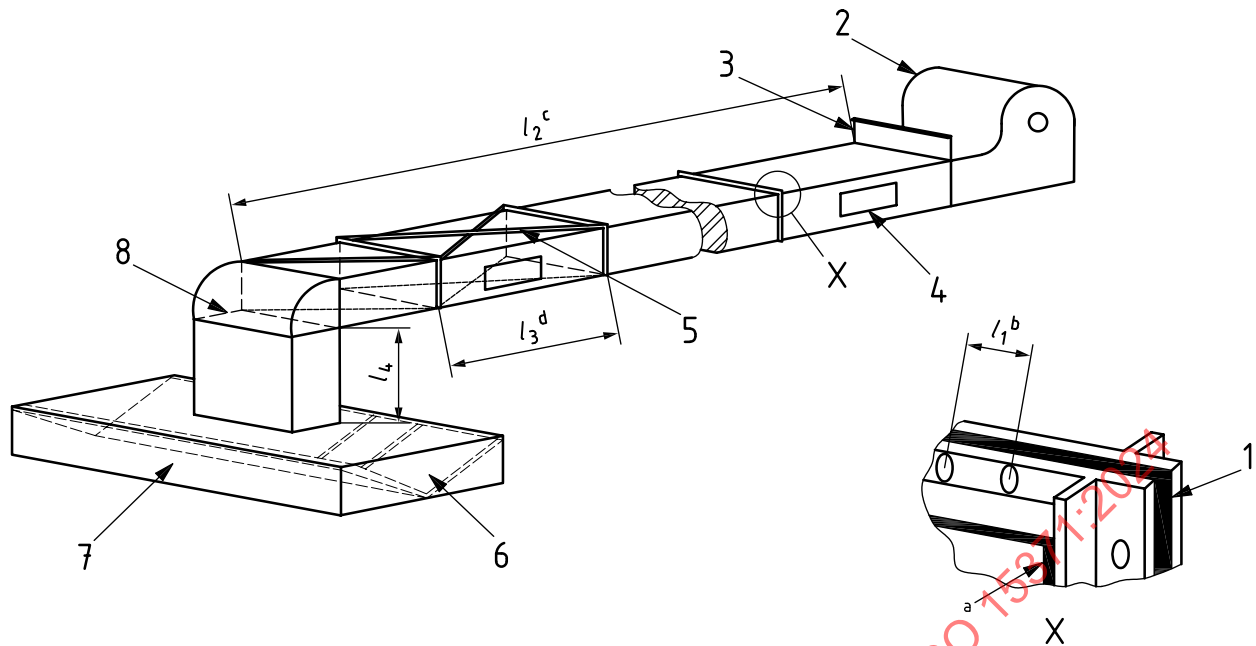
**6.3.2.3** The length of the hood can be 1,2 m, 1,7 m, 2,4 m, 3,6 m, 4,2 m, 4,9 m, 6,1 m or 7,3 m taking into account the actual use. Hoods longer than 7,3 m shall be in increments of 1,8 m.

**6.3.2.4** The hood shall be constructed of sheet metal having a minimum thickness of 2 mm.

#### 6.3.3 Filter and frame

**6.3.3.1** The filter frame shall be a "V" type extending the full length of the hood. The bottom portion of the filter frame shall be constructed of 50 mm by 50 mm angle iron, having a minimum thickness of 3 mm. Steel mesh type filters shall be installed at a  $(45 \pm 10)^\circ$  inclined position on both sides of the "V". During the extinguishing tests, the cooking equipment shall be located below the hood and filters. The hood and filters shall extend beyond each end of the equipment. See [Figure 1](#).

The filter frame is not required to be a "V" type when another type of filter frame configuration, such as one using a single bank of filters, is specified in the manufacturer's installation and maintenance manual.



#### Key

- 1 gasketing material
- 2 blower capable of providing 2,54 m/s to 5,08 m/s air velocity (approximately equivalent to 500 ft/min to 1 000 ft/min)
- 3 damper
- 4 access ports provided every 2,43 m or less (approximately equivalent to 8 ft)
- 5 angle iron supports to minimize warping and flexing
- 6 filters, 50,8 mm thickness (equivalent to 2 in), steel mesh type
- 7 hood
- 8 dam, 12,7 mm (equivalent to 1/2 in), optional

NOTE The duct can be located in the middle or end of the hood.

- a Welded seam all around.
- b Space between bolts, all around.
- c Minimum dimension; for unlimited duct length specification, see the manufacturer's installation and maintenance manual.
- d Duct sections.
- $l_1$  102 mm (approximately equivalent to 0,33 ft)
- $l_2$  22 900 mm (approximately equivalent to 75 ft)
- $l_3$  1 200 mm (approximately equivalent to 4 ft)
- $l_4$  0 mm to 900 mm (approximately equivalent to 0 ft to 3 ft)

Figure 1 — Typical test apparatus for hood and duct testing

### 6.3.4 Duct

**6.3.4.1** The duct shall be rectangular or round, and an extinguishing system unit tested using a rectangular duct can be used in a round duct with a circumference equal to or less than the perimeter of the rectangular duct. An extinguishing system unit to be used with round ducts shall be tested using a round duct only. See [Figure 1](#).

**6.3.4.2** The duct perimeter shall be the maximum specified in the manufacturer's installation and maintenance manual.

**6.3.4.3** The perimeter of a rectangular duct shall be 1,24 m or less, 1,90 m, 2,54 m, 3,17 m, 3,81 m or 7,62 m or larger. The diameter of a circular duct shall be 0,61 m, 0,81 m, 1,02 m, 1,22 m, or 2,4 m or larger. A rectangular duct shall be installed with the longest side horizontal. The ratio between vertical and horizontal shall be 1:2,  $\pm 10\%$ .

**6.3.4.4** The duct shall be 6,1 m, 15,2 m, 22,9 m long or other intermediate lengths as specified by the manufacturer of the extinguishing system unit. If the 22,9 m length is used, the extinguishing system unit should be capable of being installed without limitation to the maximum duct length. Access ports shall be provided at least every 2,4 m along the duct to permit the inspection and greasing of the duct. Duct sections shall be provided with gaskets to prevent the leakage of grease at the point of connection. The gasket material shall be made of a material that withstands the heat exposure generated during the test. The duct shall be supported at least every 2,4 m to help maintain the duct integrity.

**6.3.4.5** The duct shall have a downward slope toward the hood of 25,4 mm to 76,2 mm for every 3 m of duct length so that a stream of liquid grease, for test purposes, flows from the duct onto the filters. The duct shall have a riser that is 0 mm to 900 mm high, to connect the hood and the horizontal run of the duct. At the point where the horizontal run of the duct connects to the riser, a 12,5 mm high dam shall be used on the bottom of the duct to allow an amount of grease to remain in the duct throughout the test period.

**6.3.4.6** At the outlet of the duct, an exhaust blower and damper shall be provided to permit adjustment of air velocity through the filters and the duct.

## 6.4 Extinguishing system unit test

### 6.4.1 Preparation

**6.4.1.1** Representative samples of the extinguishing system units shall be subjected to the tests specified in [6.4.2](#).

**6.4.1.2** Hood and duct extinguishment shall be conducted using the minimum discharge rate condition for the test nozzles.

**6.4.1.3** To obtain the minimum discharge rate condition, an extinguishing system unit shall be assembled using its maximum piping limitations with respect to the number of fittings and the size and length of pipe. The cylinder shall be filled to its rated capacity and the cylinder or gas cartridge pressurized with the expellant gas to the normal operating pressure at 21 °C [see [7.2 k](#)]. The cylinder or gas cartridge used for these tests shall be conditioned, after charging, for at least 16 h at the minimum storage temperature prior to the tests. As an alternative to conditioning at the minimum storage temperature for 16 h, extinguishing system units that utilize dry nitrogen or dry air as an expellant gas shall be tested by under-pressurizing the cylinder or gas cartridge at the ambient temperature to simulate the minimum operating temperature.

**6.4.1.4** Using the test arrangement described in [6.4.1.3](#), the nozzles shall be placed at the most difficult location and orientation permitted by the manufacturer's installation and maintenance manual regarding achieving extinguishment.

**6.4.1.5** The test fuel used to load the cooking equipment shall be new vegetable shortening incorporating an antifoaming agent. The test fuel used to load the duct, filters and hood for full scale testing shall be either vegetable shortening incorporating an antifoaming agent or rendered animal fat.

**6.4.1.6** For the temperature measurement, the interior of the duct shall be provided with thermocouples located 3,6 m and 6,1 m from the duct entrance. The thermocouples shall be the K type (chromel-alumel) of 0,82 mm<sup>2</sup> or 0,52 mm<sup>2</sup> wire with an untwisted welded bare bead junction not more than 1,27 mm in diameter. The thermocouples shall be located at the centre of the cross-section of the duct and shall be connected to chart recorders or other equivalent means for monitoring thermocouple temperature.

**6.4.1.7** Each full-scale test shall be conducted with a deep fat fryer located under the hood and directly below the duct entrance. The distance between the deep fat fryer and the hood entrance shall be convenient for the test installation. The deep fat fryer shall be fully involved in flames prior to the 30 s countdown specified in [6.4.3.3](#).

## **6.4.2 General test procedures**

**6.4.2.1** An extinguishing system unit intended for use with the hood and duct systems shall be tested as described in [6.4.2.2](#) to [6.4.5.2](#).

**6.4.2.2** Hood and duct (full scale) testing shall be conducted using a deep fat fryer as specified in [6.1.2.1](#).

In lieu of using the fryer specified in [6.1.2.1](#), it is permitted to use a fryer that has the same cooking surface area specified in the manufacturer's installation and maintenance manual and is fabricated of sheet metal at least 2 mm thick, and at least 230 mm deep.

**6.4.2.3** The test apparatus for the hood and duct (full scale) testing shall be as specified in [6.3.2](#) to [6.3.4](#).

**6.4.2.4** An extinguishing system unit shall be tested using the maximum coverage limitations specified in the manufacturer's installation and maintenance manual.

**6.4.2.5** The test fuel grease shall be heated until liquefied and poured into a device required for uniformly coating the inside surfaces of the duct and plenum chamber, such as a nine-litre stored pressure water fire extinguisher pressurized in the normal manner. When an extinguisher is used, a discharge assembly other than that provided with the extinguisher can be used to provide for a spray discharge. The interior surfaces of the duct and plenum chamber shall be evenly coated with the grease to obtain a minimum loading of 1,5 kg/m<sup>2</sup>. Additional grease can be used, particularly on large size ducts, to obtain the required sustained fire. Alternative grease application methods that achieve equivalent results can be used. The filters shall be loaded with a minimum of 3,7 kg/m<sup>2</sup> of filter area. This shall be done by spraying, dipping or spreading solid grease onto each filter.

**6.4.2.6** Duct air flow tests shall be conducted in the following airflow/damper conditions:

- a) duct outlet is open at all times with no exhaust blower assistance after ignition;
- b) duct outlet is closed by the damper immediately before system actuation;
- c) 150 m/min to 300 m/min velocity in the duct, achieved by using the exhaust blower assistance. The airflow in the duct shall be adjusted after ungreased filters are installed to obtain the appropriate discharge rates specified below. Instruments such as velometers or piezometers shall be used for checking the air velocity and making adjustments. A minimum of nine measurement points shall be averaged to determine the velocity in the duct. The measurements shall be taken downstream of the hood and determined by dividing the cross-section of the duct into 16 equal subsections. The measuring device shall be located at the point of intersection of the boundaries forming each section. An alternative means for measuring velocity shall be used when judged to provide equivalent results.

## **6.4.3 Fuel ignition and extinguishing system unit operation**

**6.4.3.1** The ignition of the fire in the fryer, hood, and duct shall be initiated by external sources. Gas burners, propane burners, hand-held propane torches, or similar items are sources of ignition. Previous testing has indicated that external heating sources applied under the hood and generating a heat output of between 15 800 kJ/min and 21 100 kJ/min are capable of igniting the hood area and duct. The ignition of the grease in the deep fat fryer shall be made using the fryer's integral or an external heating source. Flammable liquids, such as diesel fuel or gasoline, shall not be used as ignition sources for the hood and duct.