

Loss Prevention Standard

LPS 1263: Issue 1.4

Requirements for the LPCB approval and listing of the fire performance of grease filters used in commercial kitchen extract systems

This standard covers the test procedures for grease filters intended for the reduction of flammable and volatile grease droplets from the cooking exhausts of commercial cooking equipment in such situations as restaurant kitchens, canteens and similar food preparation areas where it is necessary to reduce the cooking exhaust via a ventilation system.

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PARTICIPATING ORGANISATIONS

This standard was approved by the LPC Fire and Security Board and Expert Group D. The following organisations participated in the preparation of this standard:-

Association of British Insurers
 Association of Building Engineers
 Association of Chief Police Officers
 Association for Specialist Fire Protection
 British Automatic Fire Sprinkler Association
 British Rigid Urethane Foam Manufacturers' Association
 British Security Industry Association
 Chief Fire Officers Association
 Door & Hardware Federation
 Electrical Contractors Association
 Engineered Panels in Construction
 EURISOL UK
 European Fire Sprinkler Network
 Fire Industry Association
 Glass and Glazing Federation
 Health & Safety Executive
 Heating, Ventilation and Air Conditioning Manufacturers' Association
 International Association for Cold Storage Construction (IACSC)
 Intumescent Fire Seals Association
 Metronet
 Modular & Portable Building Association
 National Access and Scaffolding Confederation
 Risc Authority
 Risk Engineering Data Exchange Group
 Royal Institution of Chartered Surveyors

REVISION OF LOSS PREVENTION STANDARDS

Loss Prevention Standards will be revised by issue of revised editions or amendments. Details will be posted on our website at www.redbooklive.com

Technical or other changes which affect the requirements for the approval or certification of the product or service will result in a new issue. Minor or administrative changes (e.g. corrections of spelling and typographical errors, changes to address and copyright details, the addition of notes for clarification etc.) may be made as amendments. (See amendments table on page 20)

The issue number will be given in decimal format with the integer part giving the issue number and the fractional part giving the number of amendments (e.g. Issue 3.2 indicates that the document is at Issue 3 with 2 amendments).

USERS OF LOSS PREVENTION STANDARDS SHOULD ENSURE THAT THEY POSSESS THE LATEST ISSUE AND ALL AMENDMENTS.

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FOREWORD

This standard identifies the evaluation and testing practices undertaken by LPCB for the purposes of approval and listing of products. LPCB listing and approval of products and services is based on evidence acceptable to LPCB:-

- that the product or service meets the standard
 - that the manufacturer or service provider has staff, processes and systems in place to ensure that the product or service delivered meets the standard
- and on:-
- periodic audits of the manufacturer or service provider including testing as appropriate
 - compliance with the contract for LPCB listing and approval including agreement to rectify faults as appropriate

This document should be read in conjunction with scheme document SD 198.

NOTES

Compliance with this LPS does not of itself confer immunity from legal obligations. Users of LPSs should ensure that they possess the latest issue and all amendments.

LPCB welcomes comments of a technical or editorial nature and these should be addressed to “the Technical Director” at enquiries@breglobal.co.uk.

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1 SCOPE

This standard covers the test procedures for grease filters intended for the reduction of flammable and volatile grease droplets from the cooking exhausts of commercial cooking equipment in such situations as restaurant kitchens, canteens and similar food preparation areas where it is necessary to remove the cooking exhaust via a ventilation system. It also provides a method of performance rating based on the results of the tests.

Under these procedures, grease filters are tested and categorized in order to establish their abilities to:

- a) Remove grease droplets of different sizes from grease laden air (Grease removal test).
- b) Collect the grease removed in such a way as to make it totally removable from the canopy plenum and ductwork system, such that it will not collect in the canopy plenum or ductwork system, nor fall back onto the cooking surface (Total efficiency test).
- c) Limit the penetration of flames downstream of the filter after the filter has been laden with grease following exposure to grease laden air, when subjected to a continuous flame source (Flame exposure test).

Compliance with the specifically expressed requirements of this Standard is an essential element of LPCB certification of grease filters, but may not be considered to be sufficient in itself if, when examined, the product is found to have other features which may compromise safe operation of the product.

The LPS 1263 performance rating (GF) for grease filters used in commercial kitchen extract systems required for a specific end use application will depend on factors including cooking risk (e.g. boiling, frying, open flame grilling), building type and its occupancy characteristics. It is recommended that the required performance rating is determined using a risk assessment approach (see for example; Recommendations for the fire risk assessment of catering extract ventilation – RC44, published by the Fire Protection Association, 2006).

2 DEFINITIONS

The following definitions are used in this standard;

MFL:	Maximum Flame Length in mm
DFP:	Duration of Flame Present in seconds
PRE:	Particle Removal Efficiency
d_{50} :	The smallest particle size of which 50% has been removed from the air
OI :	Oil Introduced in mg
PT :	Plenum Trough in mg
BP :	Back Plate in mg
RA :	Rated Airflow in m ³ /s
TRE:	Total Removal Efficiency in %

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ARE: Air stream Removal Efficiency in %
IC : Inlet Concentration in mg
OC : Outlet Concentration in mg
COE: Carry-Over Efficiency in %

3 REQUIREMENTS

3.1 General requirements for grease filters

3.1.1 Scope of requirements

Grease filters covered by these requirements are intended for the reduction of smoke and grease-laden vapours from commercial cooking processes

The test methods described in this Standard pertain to grease filters used primarily in exhaust systems with restaurant-type cooking equipment and intended for the reduction of flammable grease droplets and/or condensable oil vapours in air streams.

Grease filters are investigated to determine their abilities to:

- Remove grease droplets of different sizes from grease laden air (Grease removal test).
- Collect the grease removed in such a way as to make it totally removable from the canopy plenum and ductwork system, such that it will not collect in the canopy plenum or ductwork system, nor fall back onto the cooking surface (Total efficiency test).
- Limit the penetration of flames downstream of the filter after the filter has been laden with grease following exposure to grease laden air, when subjected to a continuous flame source (Flame exposure test).

3.1.2 Design of grease filters

The grease filter shall be constructed so that any and all parts of the filter that come into contact with the user's hands during cleaning or maintenance shall be free from sharp edges or projections.

The grease filter shall be designed with a robust handle or handles that will facilitate easy removal and replacement for cleaning and maintenance on a daily basis.

The grease filter shall not allow grease to be retained in any part of the grease filter or canopy plenum in such a way that it is separated from the direct flames of a potential kitchen fire by a single skin of steel.

The grease filter shall not allow grease to be retained in any part of the grease filter or canopy plenum such that it will accumulate and not be capable of removal by a normal daily cleaning process.

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3.2 Information to be supplied by the applicant

3.2.1 General

All documentation supplied shall be dated and given a reference number, issue and title. Where the test sponsor is not the manufacturer then written permission for testing from the manufacturer shall also be supplied.

3.2.2 Data

The following detailed information relating to the product to be tested shall be supplied.

- a) Manufacturing responsibilities:
 - i) Name of manufacturer.
 - ii) Place of manufacture.
 - iii) Year of manufacture.
 - iv) Relationship of applicant to manufacturer.
- b) Drawings of the components, including:
 - i) General arrangement drawings (sectional and external views).
 - ii) Engineering drawings identifying materials and finish.
- c) The range of sizes in which the grease filtration system is available.
- d) Fully dimensioned details of the fixing system, including a full specification of the individual components. Where alternative fixing systems are available, these should be separately detailed.
- e) Details of all other components used to assemble the grease filtration system.
- f) Assembly instructions detailing limitations and recommendations (including full details of the recommendations for support).
- g) Whether the grease filtration system is a prototype.

3.3 Specimens to be supplied for testing

The applicant shall supply the required number of specimens.

- a) The test samples shall be representative of manufacturing practice.
- b) The minimum thickness of material shall be tested.

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- c) The specimens supplied for test shall be installed by the client or his authorised agent in accordance with the instructions supplied.

4 TEST METHOD

4.1 General protocol

General laboratory procedures, confidential handling of specimens, event record requirements and presentation of the test report shall be in accordance with the requirements specified by LPCB.

These tests are inherently hazardous and adequate safeguards for personnel and property shall be employed in conducting such tests.

4.2 Flame Exposure Test

4.2.1 Test equipment for flame exposure test

The following equipment is to be used for the flame exposure test:

- a) A hood capable of holding different types of filters (minimum two of the same size) by means of using an adapter piece that represents the actual installation method of the filter. The hood must be equipped with a spigot for connection to an exhaust duct. This to be sized such that the airspeed through the spigot never exceeds 6 m/s. The hood is also to be provided with a plenum trough, removable back plate and collector cup, for collecting grease draining from the filters.
- b) A suitable adapter is to be provided to close the opening in the hood. Seal must be adequate to ensure that all air passes through the filters (same adapter plate as for grease removal efficiency test may be used).
- c) Access doors and observation windows are to be provided in the canopy and approach duct to facilitate the observance of the pan and the filter and effects on both sides of the filter. The doors and windows are to be gasketed to ensure an air tight seal.
- d) A measuring rod with good visible distance markers will be put on the downstream side of the filter in the direction of the airflow.
- e) An exhaust duct, 500 mm square.

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- f) A fan capable of overcoming the resistance to airflow offered by the filter under test plus the duct system shall be provided. The means for controlling the discharge from the blower is preferably done by electronic speed control. There is to be a distance of approximately 3.5m from the downstream face of a filter, as installed in the canopy, and the fan transition piece connected to the duct. The fan is to be equipped with a means for assuring an approach velocity relative to the rated airflow and filter area of the filter and properly distributed flow of air ahead of the filter location.
- g) A pan 300 mm long, 300 mm wide and 200 mm high with a gas fired broiler approx. 250mm x 250 mm on an adjustable frame in order to position the pan vertically and horizontal in relation to the bottom edge of the filter on test. (See Figure 1)

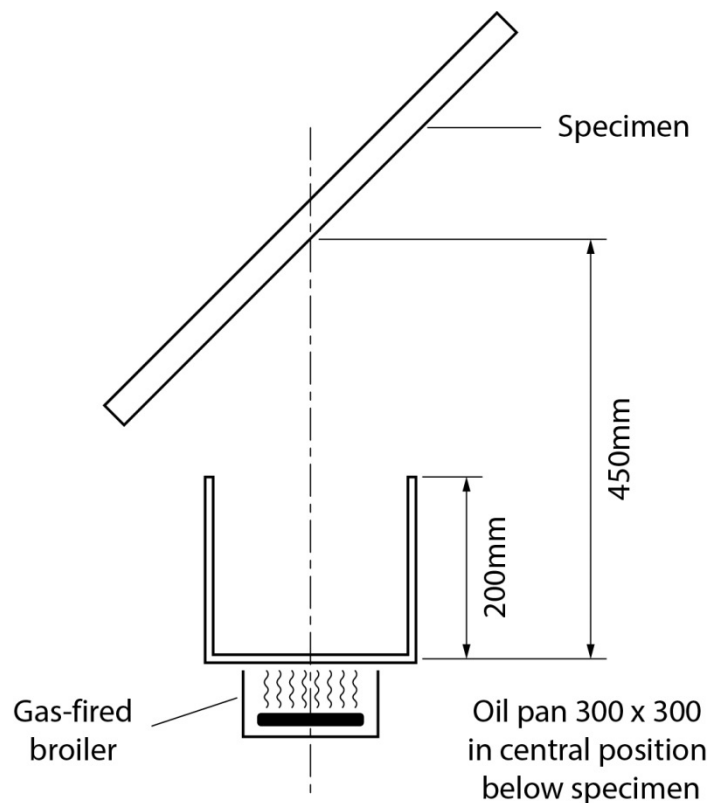


Figure 1. Test arrangement No.1

- h) Five litre transparent containers for water and cooking oil with appropriate copper tubing and valves for regulating flow.
- i) An inclined draft manometer, connected to a static pressure tap, is to be used to measure static pressure in the canopy plenum downstream of the filter.

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- j) The cooking oil utilised is to be sunflower oil.
- k) A digital video camera with minimum 1.2 million pixels.
- l) Appropriate software enabling analysis of the video at a density of 25 shots per second.

4.2.2 Test Procedure

4.2.2.1 Grease Loading Procedure:

- a) Prior to the flame exposure test the filters shall be loaded with grease according to the following method.
- b) A filter is to be mounted in the hood. If other sizes are utilised, a suitable adapter is to be provided to close the opening in the hood. Make sure to seal off properly in order not to allow air to pass into the plenum without having gone through the filters.
- c) The airflow is to be adjusted so that the rated flow of the filters is developed and sufficient to exhaust the vapours and smoke developed. The location of the oil pan and filter under test shall be as per figure 1. The pan is to be preheated to 300 °C and water and cooking oil allowed to drip into the pan at rates of 3:1 drops per minute, respectively achieving a grease level in the air of 100 mg/m³. The temperature of the pan, as determined by an iron-constantan thermocouple peened to the bottom, is to be maintained at 290 °C for 6 hours. When the power supply is turned off at the end of the 6-hour loading period, the filter is to remain in the hood, with air flowing through it for 30 minutes prior to weighing.
- d) The procedure is to be repeated on two additional grease filters.
- e) Observations are to be made to determine if any oil or grease collected on the filters falls or drops back onto the cooking surface. The filters are to be weighed before and after the test and the weight of the grease collected is to be determined.

4.2.2.2 Flame Exposure Procedure:

CAUTION:

THIS TEST IS EXTREMELY HAZARDOUS AND PRECAUTIONS AGAINST FIRE, EXPLOSION AND SEVERE BURNS SHALL BE OBSERVED AT ALL TIMES

- a) After the Grease Loading Procedure the loaded filter is to be inserted in the test hood and exposed to a test flame for 5 minutes as described in paragraphs f to i.
- b) A filter shall be mounted in the test canopy so as to effectively seal the adapter area of the duct. Any clips, wedges, or other securing means are to be of metal. No combustible tapes or cements are to be employed.
- c) The location of the oil pan and filter under test shall be as per figure 1

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- d) The pan is to contain 300ml of vegetable oil. The oil in the pan is to be brought to self ignition at a temperature of 320°C by means of a gas flame and lighting means are to be readied for effective and prompt ignition of the main burners. The test has to proceed until all of the oil is consumed.
- e) The pan is to be equipped with a lid that can be put over the pan in order to kill the flame in case of an emergency.
- f) The airflow in the test canopy is to be adjusted to the suppliers specifications. At least nine velocity measurements are to be taken one at the centre of each square area formed by dividing the area of the test duct into nine equal parts. Adjustments for establishing an average velocity are to be made prior to the ignition of any flame at nominal ambient temperatures. The average discharge volume in m³/s is to be equal to the rated airflow of the filter.
- g) Duration of the test or flaming period is to be 5 minutes. Observations are to be made and recorded on the condition of both faces of the filter and its components; the density, duration, and character of the products of combustion in the downstream section of the test duct; and the extent of travel of any flame or sparks within and beyond the downstream side of the filter.
- h) The total test must be video recorded enabling the rating of the filter in accordance with clause 5.1.2
- i) Repeat the test on two additional identical filters.

4.2.3 Conditions of Acceptance

- a) During the Flame Exposure Test, there shall be no flame extension beyond 450 mm on the downstream face of the filter, and;
- b) The filter shall remain intact throughout the test.
- c) No ignition of collected grease on the downstream side of the filter shall be observed
- d) There shall be no evidence that any of the grease collected on the filter falls back onto the cooking surface or continues to burn after the flame source has died.
- e) Maximum 120 seconds presence of flame on downstream side of the filter.

4.3 Grease Removal Test

4.3.1 Particle Removal Efficiency (PRE) Test

4.3.1.1 Test set-up

This test will be carried out in accordance with VDI 2052 part 1.

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4.3.1.2 Performance result:

The performance of the filter will be qualified looking at three performance results :

- d_{50} at rated airflow as specified by the manufacturer in μm (PRE I)
- d_{50} at rated airflow as specified by the manufacturer plus 20% in μm (PRE II)
- d_{50} at rated airflow as specified by the manufacturer minus 20% in μm (PRE III)

d_{50} defines the smallest particle size of which 50 % is removed from the air stream by the grease filter.

The result of PRE I will be inserted on the horizontal axes of the Grease removal rating matrix as shown in section 5.

4.3.1.3 Condition of acceptance

The maximum difference in d_{50} results between

PARTICLE REMOVAL EFFICIENCY I (PRE I) and PARTICLE REMOVAL EFFICIENCY II (PRE II)

and/or

PARTICLE REMOVAL EFFICIENCY I (PRE I) and PARTICLE REMOVAL EFFICIENCY III (PRE III)

is limited to 2 μm .

4.3.2 Total Removal Efficiency (TRE) Test

4.3.2.1 Test Equipment

The following equipment is to be used for this test:

- a) A hood which is capable of holding different types of filters (minimum two of the same size). This may be facilitated by means of an adaptor piece that represents the actual installation method of installing the filter. The hood must be equipped with a spigot for connection to an exhaust duct. It shall be sized such that the airspeed through the spigot never exceeds 6 m/s. The hood is also to be provided with a plenum trough, removable back plate and collector cup for collecting grease draining from the filters.
- b) A suitable adapter is to be provided to close the opening in the hood. This shall provide an adequate seal (e.g. by means of aluminium duct tape) so that air can only pass into the plenum through the filters.
- c) Access doors and observation windows are to be provided in the canopy and approach duct to facilitate the observance of the pan and the filter and effects on both sides of the filter. The doors and windows are to be adequately sealed.

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- d) An exhaust duct, 500 mm square, equipped with a controllable fan to permit adjustment of the rated airflow of the grease filter.
- e) An approach duct 500 mm square with peripheral openings at the bottom for the air to enter the duct in which the broiler and pan will be placed.
- f) A fan capable of overcoming both the resistance to airflow offered by the filter under test plus the duct system is to be installed. The means for controlling the discharge from the fan should preferably be done by electronic speed control (be sure to use screened wire for the electronic speed controller as electronic measuring equipment will be influenced by RF).
- g) An electric broiler, 250 mm long and 250 mm wide. A pan 300 mm long, 300 mm wide and 200 mm high.
- h) Five litre transparent containers for water and cooking oil with appropriate copper tubing and cocks for regulating flow. An inclined draft gauge, connected to a static pressure tap, is to be used to measure static pressure in the duct downstream of the filter.
- i) The cooking oil utilised shall be sunflower oil.
- j) Two sampling pipes adjustable in position in order to take air samples before and after the filter, each holding an impactor filter or optical particle counter (OPC).
- k) Vacuum pumps connected to the sampling pipes with adjustable flow rotameters in order to stabilise and adjust the sampled air. The sampling volume rate must be adjusted to 5 l/min. Special care must be given to ensure the air tightness of the sampling equipment in general.
- l) An electric drying oven with temperature control to dry the impactor filters (if used) before and after the test.
- m) Calibrated scales (one scale with 0.01 mg and one with 1 mg resolution with a max weight of 10 kg) to weigh the impactor filters (if used), tested filter, back plate and grease cup after the test.

The test arrangement is shown in Figure 2

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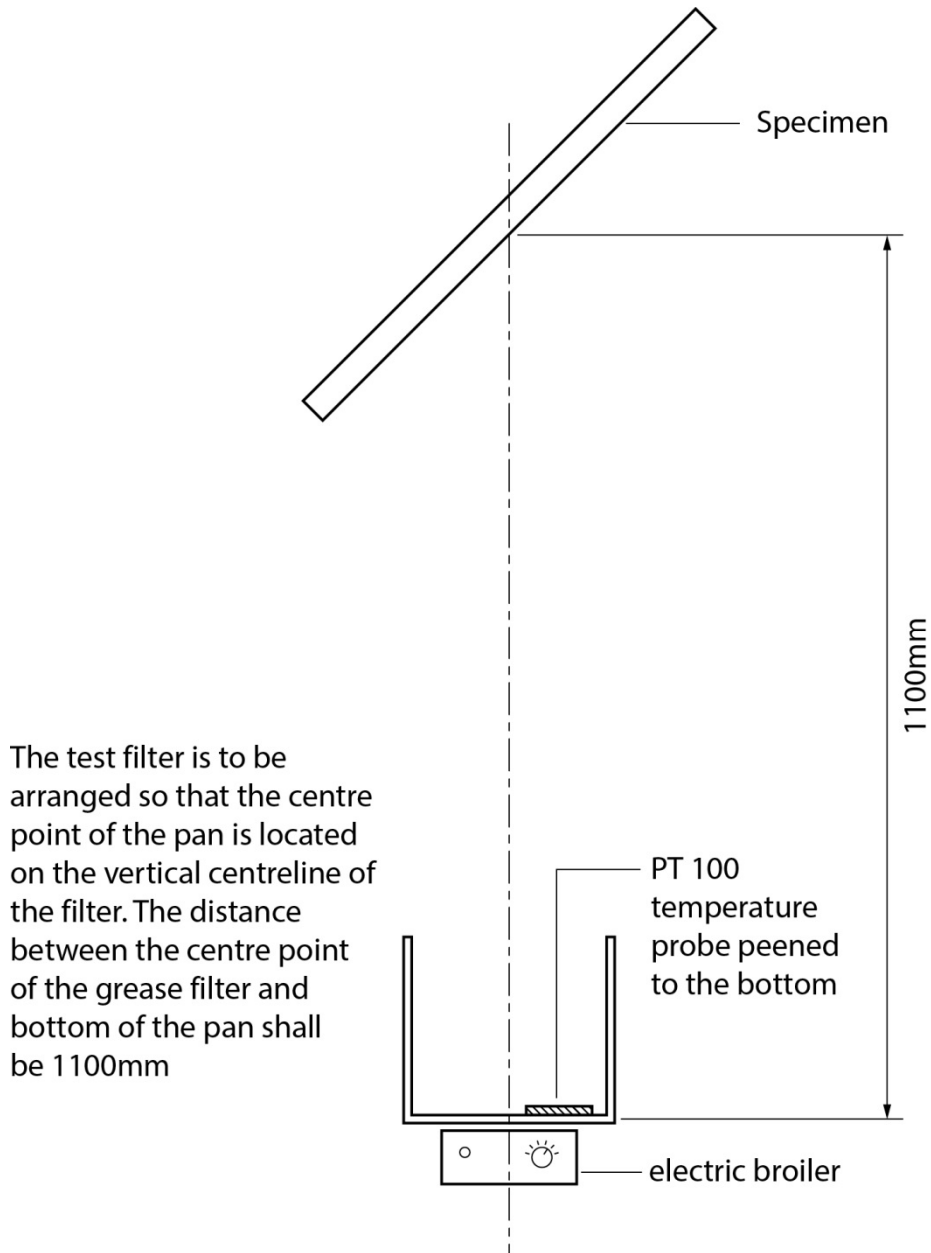


Figure 2. Test Arrangement No. 2

4.3.2.2 Test procedure

- a) Inspect grease extraction filter according to manufacturer's specification and verify dimensions and configuration (standard filter frames as per normal installation must be used). Close drain holes on filter with aluminium duct tape for referencing with total introduced oil mist (O).

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- b) Weigh test filter, plenum trough (*PT*), back plate (*BP*) and grease collector cup to the nearest mg.
- c) Measure airflow (Rated Airflow in m³/s) at inlet of the filter and at outlet of extraction system and adjust to manufacturer's specifications.
- d) Dry impactor filters for 20 minutes at 110 °C (if used). Record impactor filter mass to nearest 0.01 mg. Assemble and mark two monitor units. Alternatively, if an Optical Particle Counter (OPC) is used this instrument shall be calibrated for the sunflower oil aerosol (see VDI 3489-3 Particulate matter measurement - Methods of characterizing and monitoring test aerosols - Optical particle counter). By means of an aerosol generator which is generating sunflower oil aerosol a correction factor has to be determined. By this procedure precise mass concentration can be measured with the OPC.
- e) Place pan on broiler and allow warming up to 300 °C. The temperature of the pan, as determined by an iron-constantan thermocouple or PT 100 temperature probe peened to the bottom, is to be maintained at 290 °C (
- f) Test filter is to be so arranged that the centre point of the pan is located on the vertical centreline of the filter and distance between the centre point of the grease filter and bottom of the pan shall be 1100 mm. (see Figure 2)
- g) Start fan at required airflow.
- h) When constant temperature before and after filter is recorded, place impactor or the OPC at inlet and outlet sampling tube and activate vacuum pump. Use airflow of 5 l/min.
- i) Start oil mist production by dripping oil and water into the pan. Oil is to be sunflower oil. Oil supply is to be 5 g per minute and water supply to be 15 g per minute for air volume flow of 0.28 m³/s rated airflow. Oil and water flow to be adjusted linearly with rated airflow (*Rated Airflow*) of the test filter. Run test for 60 minutes.
- j) Dry filters of impactors @ 110° C for 20 minutes in drying oven before weighing (if used).
- k) Weigh impactor filters on scales to 0.01 mg and record on data sheet.
- l) Weigh back plate on scales and record on data sheet.
- m) Weigh plenum trough on scales and record on data sheet.
- n) Weigh grease cup on scales and record on data sheet.
- o) Weigh tested filter on scales and record on data sheet.

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- p) Perform calculations as per section 4.3.2.3 and record results.
- r) Clean back plate, plenum trough, collector cup and tested filter. Reweigh and repeat complete test two more times.
- s) Observations are to be made to determine if any oil or grease collected on the filters falls or drops back onto the cooking surface.
- t) Throughout the test, readings are to be taken on the manometer to determine the effect on the airflow imposed (= static pressure loss) by the filter while it collects the grease as well as impactor rotameter readings and temperature before and after filter.

4.3.2.3 Total Removal Efficiency calculation

The total removal efficiency (TRE) is calculated using the following factors (in %):
 Air stream removal efficiency (ARE)
 Carry-Over efficiency (COE)

$$\mathbf{TRE=100 - (100 - ARE) - (100 - COE) \%}$$

Air stream Removal Efficiency (ARE):

Determine oil mist concentration at filter inlet (Inlet Concentration (IC))

Mass after test - Mass before test = Oil mist concentration for 60 minutes
 (Mass = mass of impactor filter or calculated mass by OPC measurements; if coincidence range of OPC is exceeded a dilution system has to be used)

Determine oil mist concentration at filter outlet (Outlet Concentration (OC)).

Mass after test - Mass before test = Oil mist concentration for 60 minutes

Calculate Air stream Removal Efficiency (ARE) of filter

$$ARE = \frac{IC - OC}{IC} \times 100 \%$$

Carry-Over Efficiency (COE):

Determine mass of grease collected in the plenum trough (CPT) in mg.

Mass after test - Mass before test (Plenum Trough) = Oil mist collected during 60 minutes

Determine mass of grease collected on back plate (CBP) in mg.

Mass after test - Mass before test (Back Plate) = Oil mist collected during 60 minutes

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Determine mass of oil introduced (OI) during the test (60 minutes) in mg.

$$OI = \frac{(60 \text{ min} \times 5 \text{ mg / min}) \times RA (m^3 / s)}{0,28 m^3 / s}$$

Calculate Carry-Over Efficiency (COE) of filter:

$$COE = \frac{OI - (CPT + CBP)}{OI} \times 100 \%$$

4.3.2.4 Condition of acceptance.

Total Removal Efficiency (TRE) shall not be less than 55%.

4.4 Field of application of tests

The field of application of test results shall be limited to the grease filtration system tested and shall be defined prior to commencement of testing. Products not installed in accordance with the agreed specification shall not be considered as included within the field of application of test results.

5 CLASSIFICATION OF FILTER PERFORMANCE

5.1 General

This categorisation is based on the results of two methods of test, the flame exposure test results in accordance with UL 1046 (see 4.2 of this standard) and the grease removal test carried out in accordance with VDI 2052 part 1 (see 4.3 of this standard).

5.1.1 Conditions for filter approval

To achieve a filter rating in accordance with this standard, results from both tests (4.2 and 4.3) are required and the product shall have a minimum Total Removal Efficiency of 55% based on the test procedure in 4.3.2 and meet the conditions for acceptance listed in 4.2.3 and 4.3.1.3.

5.1.2 F class (Flame Retarding Capacity)

The rating of filters is basically carried out through analyses of the digital videotape of the test. The video is to be saved in *.avi format allowing analysis of the tape in 25 shots per second. Guidance on examining digital video for the purposes of this standard are given in LPCB internal guidance note GD 033.

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Filters will be rated for this test using the following criteria:

Maximum Flame Length (*MFL*) of the flame on the downstream side of the filter.
Duration of Flame Present (*DFP*) on the downstream side of the filter.

If the filter meets the test requirement of UL 1046 but no video record is available or the record is regarded as being inadequate, then the classification for this shall be taken as F0.

		Flame retarding capacity (F class)				
		Flame length (<i>MFL</i>) in mm up to				
		450	325	225	150	75
Duration (<i>DFP</i>) in seconds up to	120	F0	F2	F4	F6	F17
	80	F3	F4	F6	F13	F22
	50	F5	F7	F14	F19	F27
	30	F10	F15	F20	F25	F38
	15	F20	F24	F28	F38	F46

Example: *DFP* = 45

MFL = 250

***F class* = F 7**

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5.1.3 G class (Grease Removal Efficiency)

The G class of a filter is established using below table.

Grease removal efficiency (G class)						
		Particle Removal Efficiency (PRE) in μ				
		10 to 8	7,99 to 6	5,99 to 4,5	4,49 to 3	2,99 to 0
Total Removal Efficiency (TRE) in % up to	60	G0	G5	G10	G15	G20
	75	G1	G7	G13	G19	G25
	85	G3	G10	G17	G24	G31
	92	G6	G14	G22	G30	G38
	100	G10	G19	G28	G37	G46

Example: $PRE / = 3.62 \mu$

$TRE = 72\%$

G class = G19

5.2 Filter Rating

The filter rating is calculated as follows:-

GF class = 2 x F class + G class

Where F is determined from the result of the Flame Exposure Test described in 4.2 and G is determined from the result of the Grease Removal Test described in 4.3.

The highest filter rating (best performance) is GF138. The lowest filter rating (worst performance) is GF0.

Example:

A tested filter has following test results:-

F class = F10

G class = G19

Therefore LPS 1263 Filter Rating GF = 2 x F10+G19 = GF39

6 MARKING AND LABELLING

All products approved by the Loss Prevention Certification Board, shall be marked as specified in LPCB Scheme document SD 198

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7 PUBLICATIONS REFERRED TO

VDI 2052 Part 1 by Verein Deutscher Ingenieure, Düsseldorf 1999 ICS 91.140.30;97.040

Title: Ventilation equipment for kitchens. Determination of capture efficiency of aerosol separators in kitchen exhaust.

VDI 3489 Part 3 Particulate matter measurement - Methods of characterizing and monitoring test aerosols - Optical particle counter

UL 1046 By Underwriters Laboratories Inc. Second Edition July 30, 1979

Title: - Standard for Safety. Grease filters for exhaust ducts.

SD198, LPCB scheme document, Passive fire protection products.

Recommendations for the Fire risk assessment of catering extract ventilation – RC 44 published by the Fire Protection Association, 2006.

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Amendments Issued Since Publication

DOCUMENT NO.	AMENDMENT DETAILS	SIGNATURE	DATE
LPS 1263-1.1	Changes to copyright information	CJA	20/09/05
LPS 1263-1.2	<ol style="list-style-type: none"> 1. Optical particle counter added to 4.3.2.1 j) 2. Text in 5.1.2 simplified. 180 second line removed from F class table, table expanded to cover DFP 15, 30, 50, 80 and 120 seconds. 3. General editorial amendments. 4. Annex A removed. 5. Update to standard LPS template 	TB	22/10/10
LPS 1263-1.3	<ol style="list-style-type: none"> 1. New front cover 2. Title added to header 3. Notes added on Page 4 4. Repagination 5. Update to copyright information 	DC	Jan. 2014
LPS 1263-1.4	<ol style="list-style-type: none"> 1. Figures 1 and 2 added to clarify details of test arrangement. 2. Text in Clauses 4.2.2.1, 4.2.2.2 and 4.3.2.1 amended to reflect addition of figures. 3. References to SD135 updated to SD198. 	DC/DW	Mar. 2014