	Date	Theme:
Webinar	6th May:	Kitchen ventilation
Webinar	13th May:	Ventilation requirements, quality and trends
Webinar	6th May:	Moisture control

SINTEF

Webinar 6 May

Theme 1:
Kitchen ventilation

15:00	Welcome Chair: Kari Thunshelle, SINTEF
15:05	Documentation of cooker hood performance, a laboratory prespective *Svein Ruud, RISE, Sweden*
15:25	Extract cooker hoods – possibilities and challenges *Haavard Augensen, Røros Metall, Norway*
15:40	Recirculationg cocker hoods – possibilities and challenges *Martin Oberhomburg/Reinhard Wiedenmann, BSGH, Germany*
15:55	Experiences from assessing in-situ effectiveness of cooker hoods *Iain Walker, LBNL, USA*
16:10 - 16:30	*Q&A poll* *Workshop discussion* *Moderator: Peter Schild, OsloMet*

Webinar 13 May

Theme 2:
Ventilation requirements, quality, and trends

15:00	Welcome Chair: Kari Thunshelle, SINTEF
15:05	Ventilation and IAQ in Nordic countries – Status, trends and opportunities *Kari Thunshelle, SINTEF, Norway*
15:25	A developer's perspective on urban home ventilation issues *Ole Petter Haugen, Selvaag Bolig, Norway*
15:45	nZEB temperature zoning – "Fresh" bedrooms and a warm living room *Laurent Georges, NTNU, Norway*
16:05 -16:30	*Q&A poll* *Workshop discussion* *Moderator: Peter Schild, OsloMet*

Webinar 19 May

THEME 3:
Moisture control

15:00	Welcome Chair: Kari Thunshelle, SINTEF
15:05	Strategies for avoiding too high or too low relative humidity in dwellings *Sverre Holøs, SINTEF, Norway*
15:25	Moisture buffering in modern timber constructions *Dimitrios Kraniotis, OsloMet, Norway*
15:45	Understanding moisture recovery in heat/energy recovery ventilation as the basis for new market solutions *Peng Liu, SINTEF, Norway*
15:45 -16:30	*Q&A poll* *Workshop discussion* *Moderator: Peter Schild, OsloMet*

SINTEF

webinar
2020. 05.06

Urban Home Ventilation

Part 1: Kitchen Ventilation

15:00 | **Welcome**, *Kari Thunshelle, SINTEF*
15:05 | **Documentation of cooker hood performance, a laboratory perspective**,
Svein Ruud, RISE, Sweden
15:25 | **Recirculating cooker hoods – possibilities and challenges**,
Martin Oberhomburg , BSH, Germany
15:40 | **Experiences from assessing in-situ effectiveness of cooker hoods**,
Iain Walker, LBNL, USA
16:00 | **Extract cooker hoods – possibilities and challenges**,
Håvard Augensen, Røros Metall, Norway
16:15 | **Q&A poll & Workshop discussion**, *Peter Schild, OsloMet*
16:30 | **End of webinar**

webinar
2020. 05.06

Part 1: Kitchen Ventilation - Speakers


Svein Ruud,
(RISE, SE)


Martin Oberhomburg
(BSH, DE)


Iain Walker
(LBNL, USA)


Håvard Augensen,
(Røros Metall, NO)


Kari Thunshelle
(SINTEF, NO)


Peter Schild
(OsloMet, NO)


Maria Kapsalaki
(INIVE, BE)


Valérie Leprince
(INIVE, BE)

webinar
2020. 05.06

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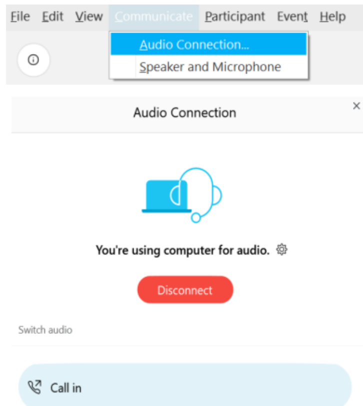
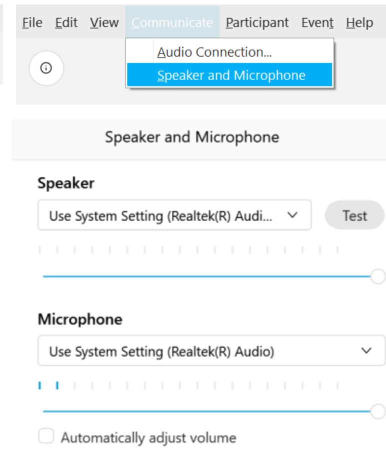
If you still can't hear, run a Speaker Audio Test to make sure the correct output is selected [To run the test, click on Communicate / Speaker and Microphone]

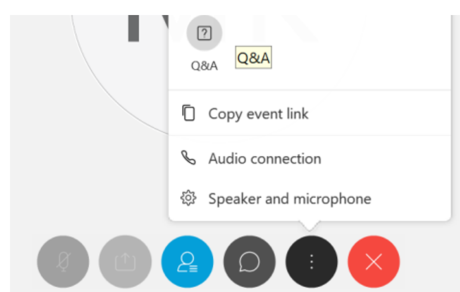




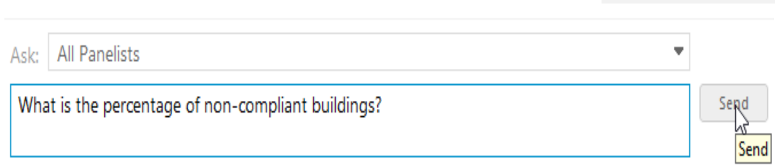
webinar
2020. 05.06

How to ask questions during the webinar

Locate the Q&A box



Select **All Panelists** | Type your question | Click on Send



NOTES:

- The webinar presentations will be recorded and published at *http://aivc.org/resources/collection-publications/events-recordings* within a couple of weeks, along with the presentation slides.
- Short Q&A Poll before workshop discussion
- After the end of the webinar you will be redirected to our post event survey. Your feedback is valuable so please take some minutes of your time to fill it in.

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SINTEF

SINTEF

— 70 years —
1950-2020

Technology for a better society

SINTEF AIVC OSLOMET

Urban Home Ventilation — Webinar 6-13-19 May 2020

Webinar 6 May

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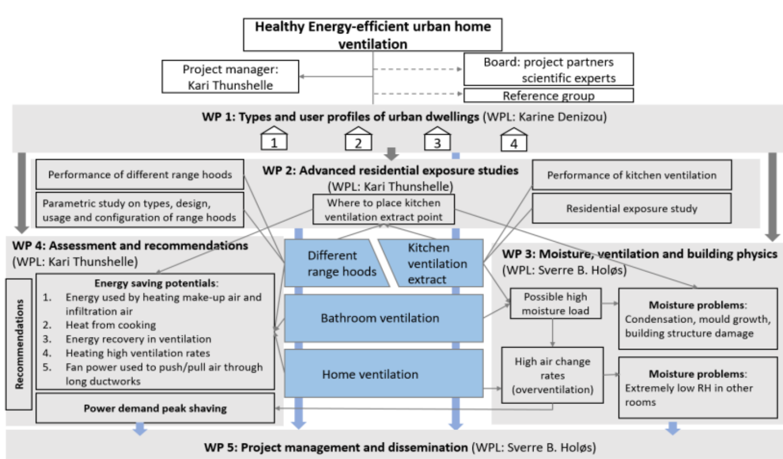
Healthy Energy-efficient Urban Home Ventilation

4 year research project in Norway



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AIVC (Air Infiltration & Ventilation Centre)

-IEA information centre on energy efficient ventilation

- Events
  - Organization of **CONFERENCES** & **WORKSHOPS** (typically an annal conference in autumn and a workshop in spring)
  - Organization of **WEBINARS**
- Publications (all free available)
  - Ventilation Information Papers (**VIP**)
  - Technical Notes (**TN**)
  - Contributed Reports (**CR**)
  - Conference & Workshop **PROCEEDINGS**
  - **NEWSLETTERS** in collaboration with venticool and TightVent
  - …
- **AIRBASE**

AIRBASE Click here for searching in a database of 22707 publications with 16232 pdf documents

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70 years
1950-2020

Technology for a better society

Documention of cooker hood performance,

a laboratory perspective

Urban Home Ventilation
webinar 6 May 2020

Svein Ruud
RISE Research Institutes of Sweden

Different standards used at our laboratory - beginning more than 30 years ago

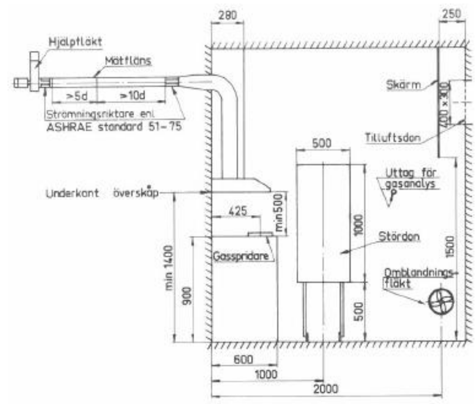
Standard	Test time	Disturbance	Tracer substance	Total amount of tracer substance	Air intake with diffuser plate	Dimensions of pan/spreader	Temperature	Height above hob	Test room volume	Temperature test room	Temperature inlet air
Swedish Standard SS 433 05 01	10 min	Yes	N_2O	510 liter	Close to the ceiling	Ø = 200 mm H = 20 mm	200 ± 5 °C	≥ 500 mm *	23 ± 1 m³	20 ± 5 °C	20 ± 2 °C
"Hybrid method" (mix of SS 433 0501 and IEC 61591)	10 min	Yes	MEK	100 g	Close to the ceiling	Ø = 200 mm H = 25 mm	170 ± 10 °C	≥ 500 mm *	23 ± 1 m³	20 ± 5 °C	20 ± 2 °C
IEC 61591:2019	30 min	No	MEK	312 g	Close to the floor	Ø = 200 ± 20 mm H = 125 mm	170 ± 10 °C	600 mm	22 ± 2 m³	23 ± 2 °C ***	No requirements
EN 13141-3:2017 **	10 min	Yes	MEK	100 g	Close to the floor	Ø = 200 ± 20 mm H = 45 ± 2 mm	170 ± 5 °C	≥ 600 mm	22 ± 2 m³	No requirements	No requirements

*) Distance to the front lower edge of the test object, transparent hood not included (or other height specified by the manufacturer)
**) Before 2017 EN 13141-3 used the same testing procedure for odour reduction as in IEC 61591
***) Before 2019 the requirement was 20 ± 5 °C

Swedish Standard SS 433 05 01

- Published in 1981
- Used for testing of cooker hoods with or without a built in fan
- Disturbance in front of hob
- Only for extract air cooker hoods
- **Gives reasonable odour extraction**

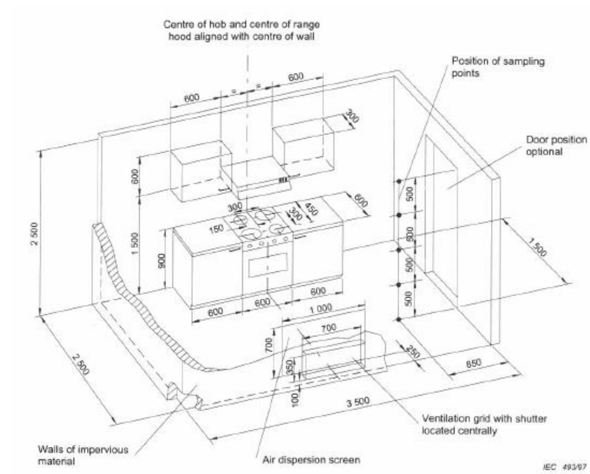
For recirculating cooker hoods a hybrid metod has been used where $N_2$0 had been exchanged with MEK as in EN 13141-3:2017



IEC 61591:2019

- First published in 1997
- Only used for testing of cooker hoods with built in or dedicated roof fan
- No disturbance in front of hob
- Both for extract and recirculating air cooker hoods
- **Gives unrealisticly high odour reduction**

Based on a German method for mainly testing the performance of carbon filters in range hoods with recirculating air.

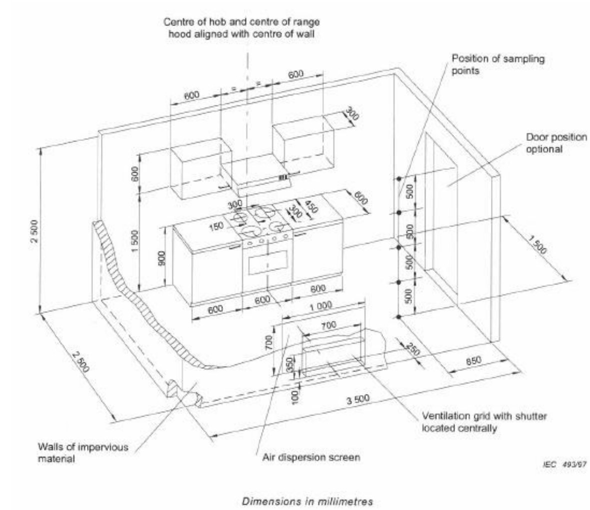


Dimensions in millimetres

EN 13141-3:2017

- Before 2017 the same test method for odour reduction as in IEC 61591 was used
- Only used for testing of cooker hoods witout built in or dedicated roof fan
- Disturbance in front of hob
- Only for extract air cooker hoods
- **Gives reasonable odour extraction**

Wery similar to the "Hybrid method" used by RISE

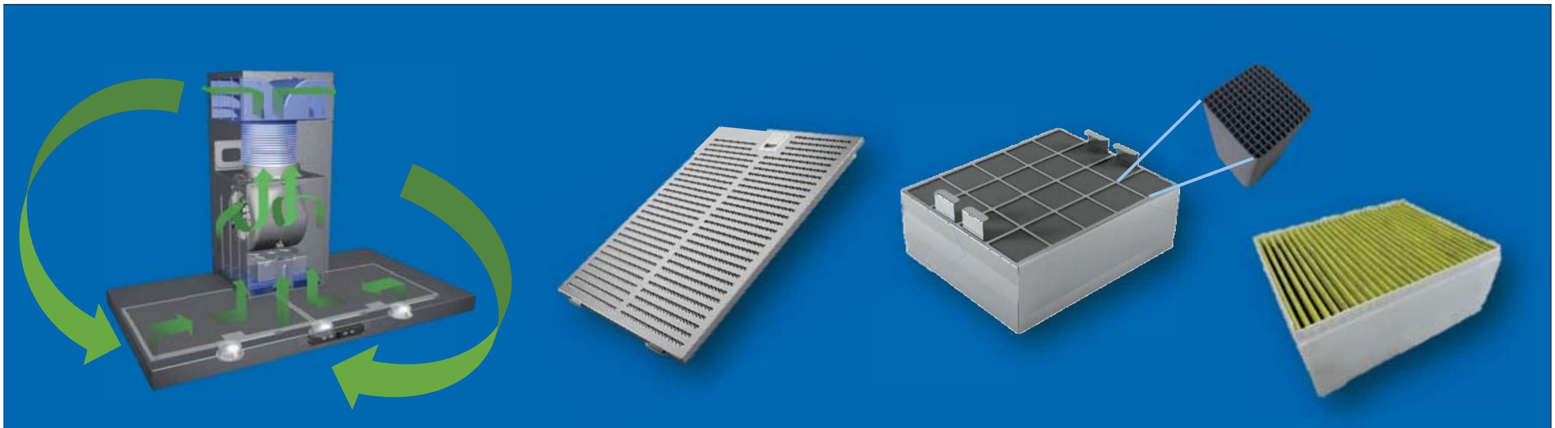


Conclusions

- Cooker hood should be tested in the same way regardless of
  - built in fan or not
  - extract air or recirculating air
- The test procedure for odour reduction used in EN 13141-3:2017 should be used for all types of range

Svein Ruud

Svein.ruud@ri.se
+46 10 516 55 14



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Recirculating cooker hoods – possibilities and challenges

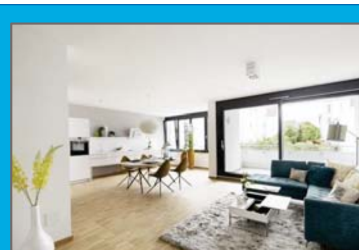
Urban Home Ventilation Workshop Oslo / 6th May 2020

M. Oberhomburg / BSH Home Appliances

Mission for Ventilation

Design

Hoods with a harmonic design, integrated into the kitchen and the living environment.



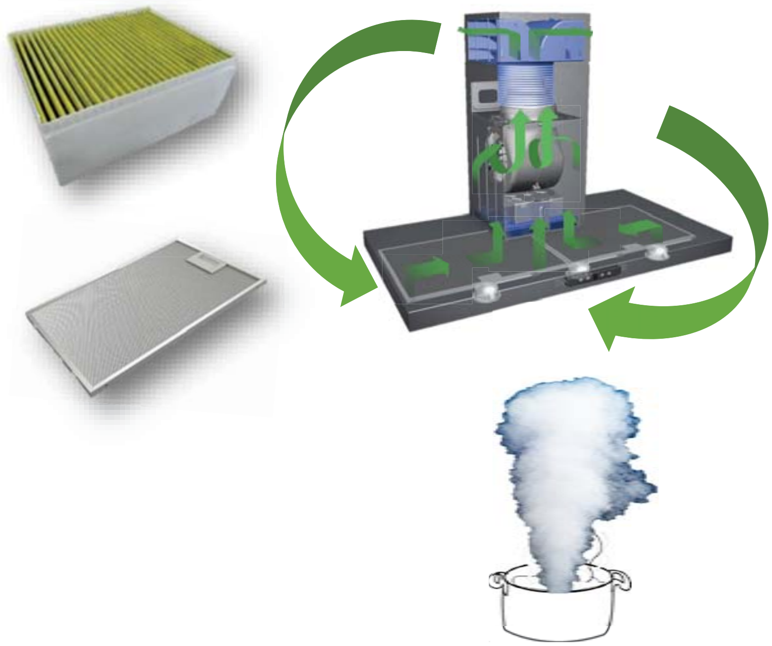
Function

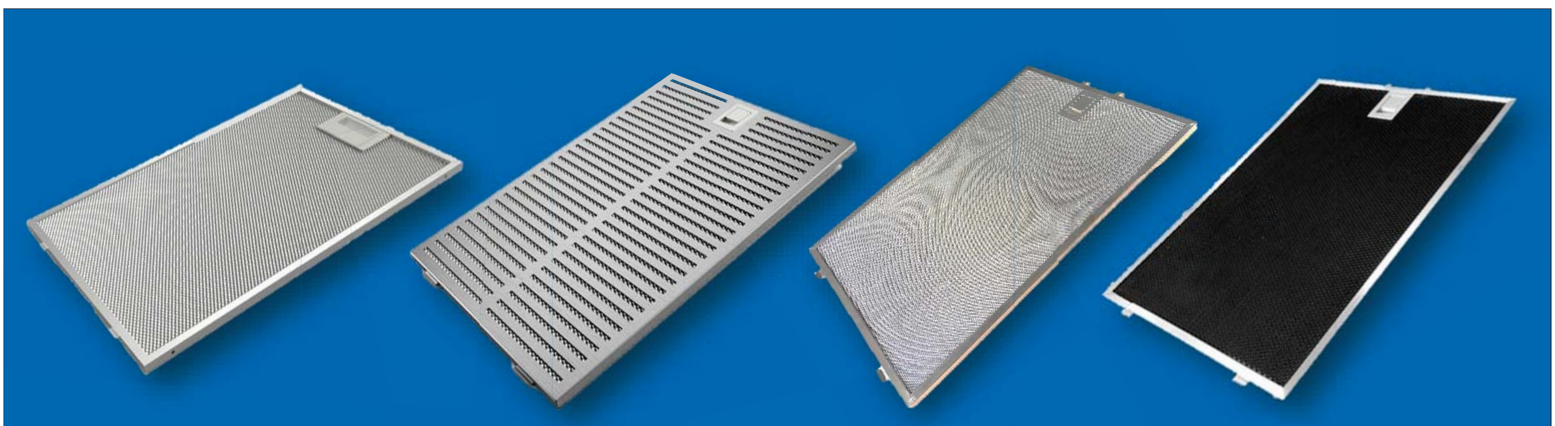
Low noise level for a quiet surrounding and without compromise on performance.

Air Quality

Pure air in kitchen environment for customer. (grease and odour)

Content





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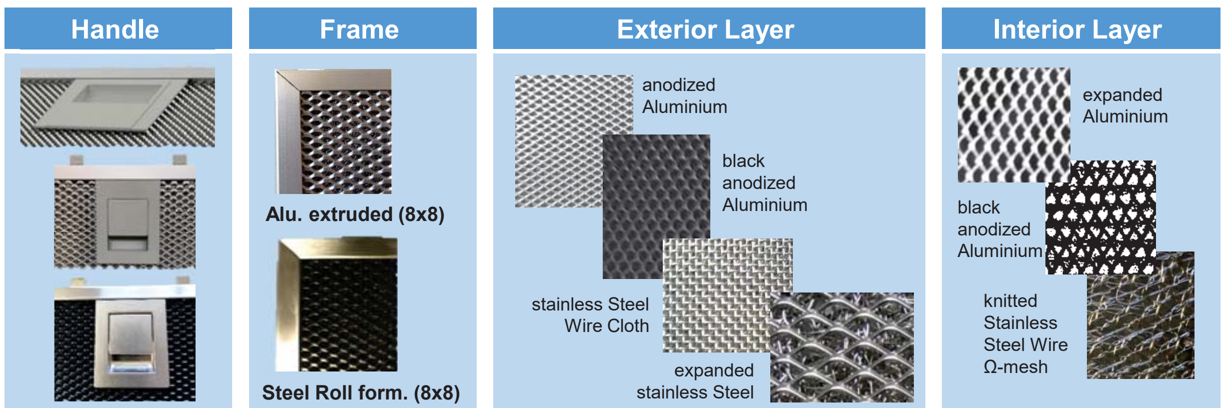
Recirculating cooker hoods – possibilities and challenges

1st step: Grease Filter

Mesh Grease Filter

User Experience | Performance

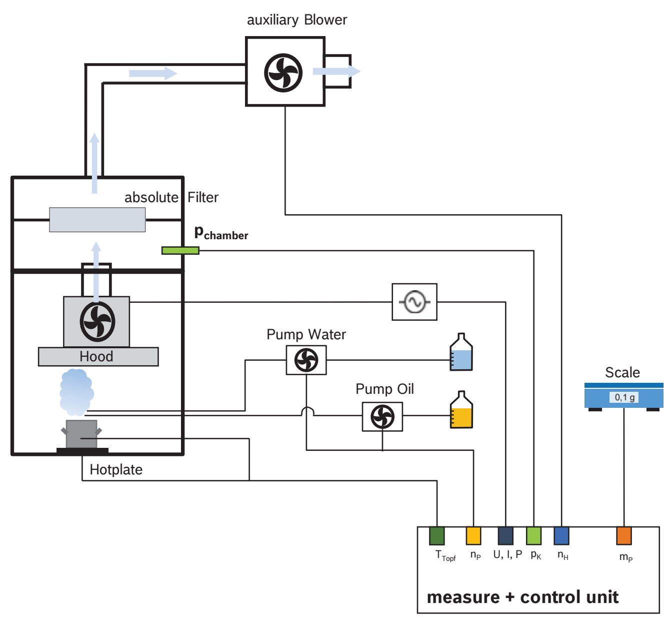


Measurement Method: DIN EN 61591 – Grease Filtering Efficiency / GFE

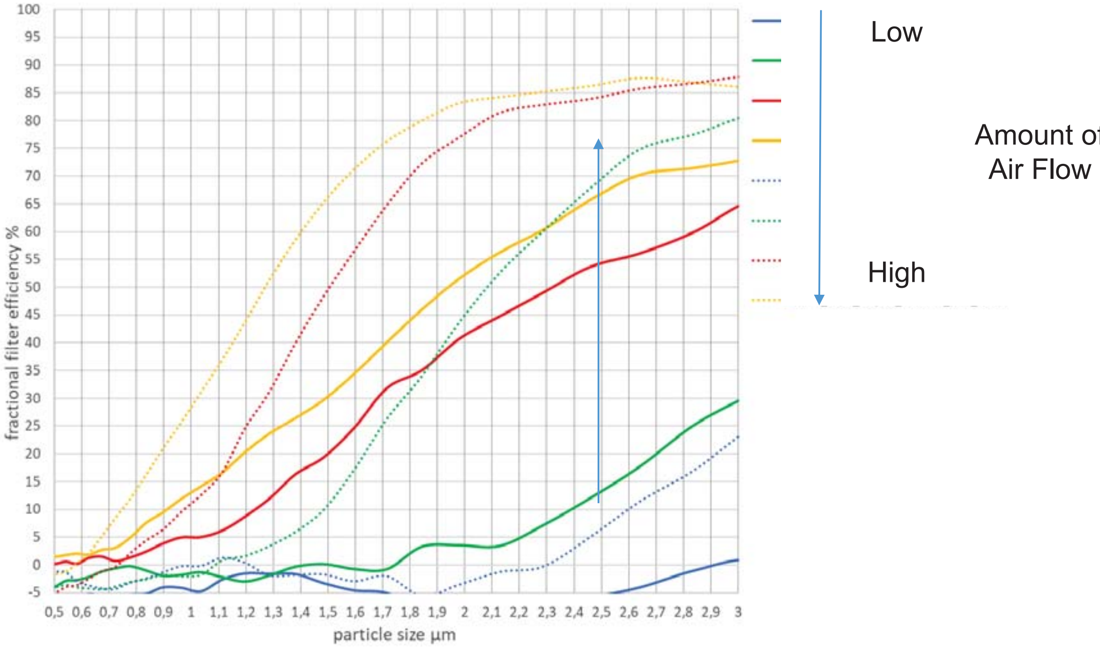
Measurement of weight increase after test
- Filter
- Hood
- 99.99 % absolute filter /Exhaust

$$GFE = \frac{Filter}{Filter + Hood + Exhaust}$$

GFE [%]	GFE class
95 - 100	A
90 - 95	B
85 - 90	
80 - 85	C
75 - 80	
70 - 75	D
65 - 70	
60 - 65	E
55 - 60	
50 - 55	F
45 - 50	
40 - 45	G
35 - 40	
30 - 35	
< 30	



Grease Filter Efficiency with Particle size



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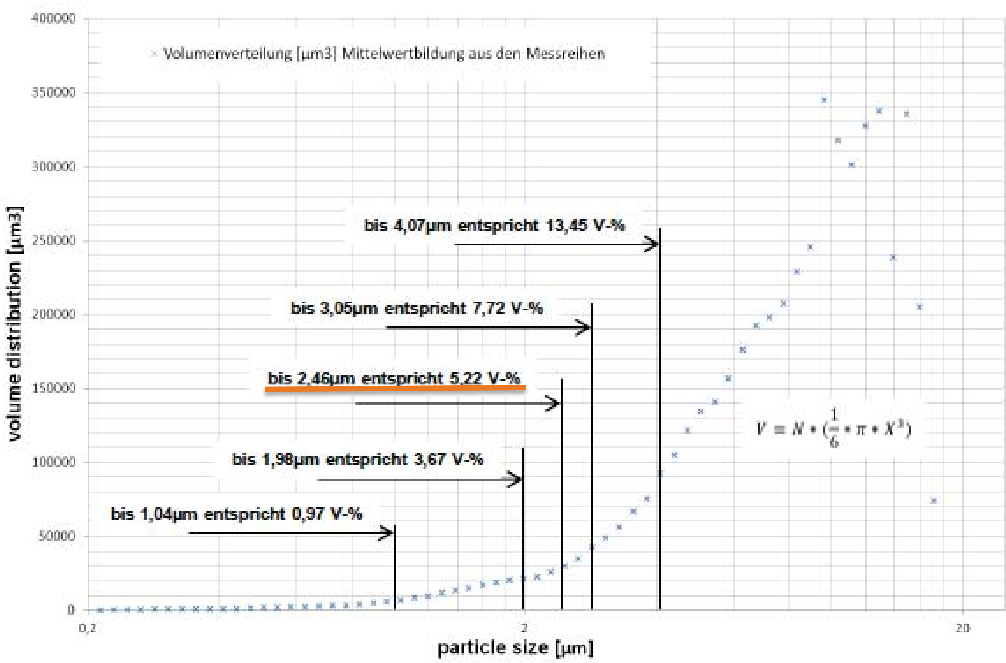
Volume/Mass Particle Distribution measured with Norm Conditions DIN EN 61591



=> Particles smaller 2,5 µm correspond to 5,5% of particle mass

X [µm] (0.2µm bis einschließlich:)	Volumenanteil [%]
1,04	0,97
1,98	3,67
2,46	5,22
3,05	7,72
4,07	13,45
5,05	20,58
5,83	26,45
7,24	37,62
8,36	46,22
9,65	57,88
11,15	70,07
13,83	87,88
15,97	98,54

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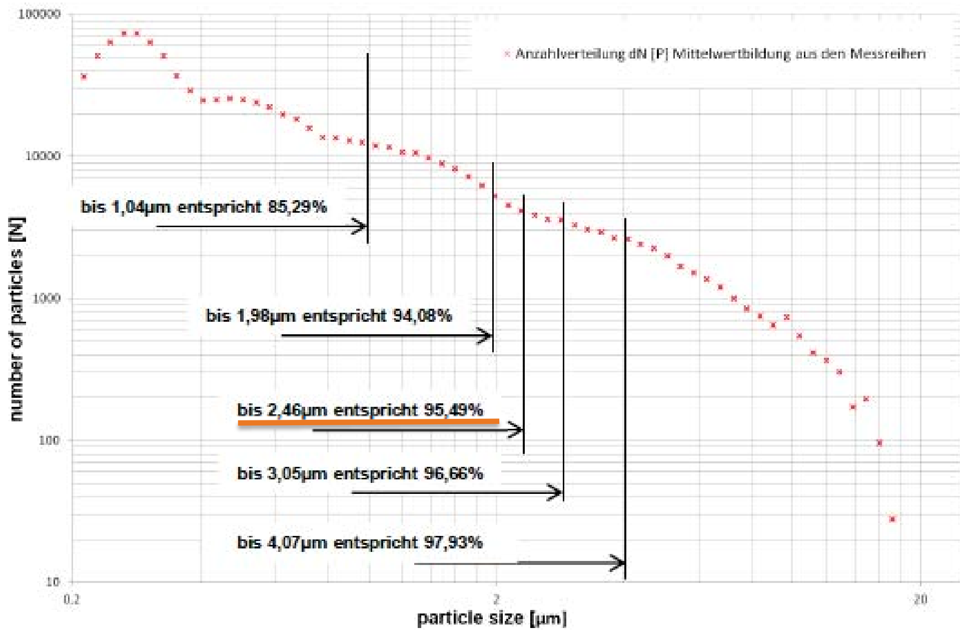
Particle Size Distribution measured with Norm Conditions DIN EN 61591



=> Particles smaller 2,5 µm represent more than 95% of particle amount

X [µm] (0.2µm bis einschließlich:)	Anteil d. Partikelanzahl [%]
1,04	85,29
1,98	94,08
2,46	95,49
3,05	96,66
4,07	97,93
5,05	98,67
5,83	99,03
7,24	99,43
8,36	99,61
9,65	99,76
11,15	99,87
13,83	99,96
15,97	99,997

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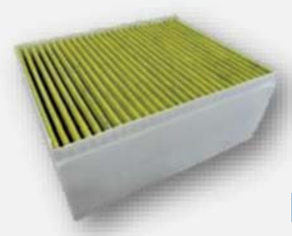
Recirculating cooker hoods – possibilities and challenges

2nd step: Odour Filter

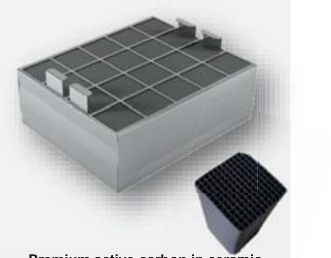
Recirculation Filter Portfolio – Region Europe

Active carbon chemically treated against fish smell



!! New !!

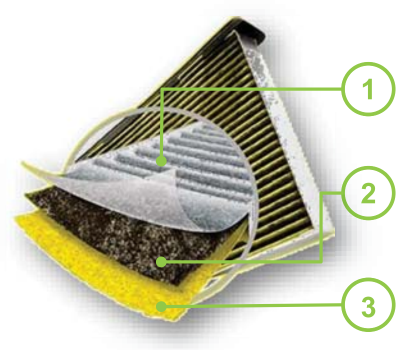
active carbon chemically treated against fish smell incl. a fleece against pollen and a biofunctional layer against allergenes



Premium active carbon in ceramic honey combs structures

"Starter Set" with Foam	Clean Air → Clean Air Plus	Regenerative
Smell Reduction: <<90%	Smell Reduction: >90%	Smell Reduction: 80 - 90%
6 Months Use	12 Months Use	10 Years Use
1st Cost →		

Clean Air Plus



1. **Carrier layer**
Filters Particles and Pollen (>10µm) *>99%*
Filter Class: ePM$_{10}$ 70%

2. **Activated carbon layer**
Eliminates odor *>90%*
Especially treated against fish smell

3. **Bio-functional layer**
Natural polyphenols inactivates allergens *>99%*

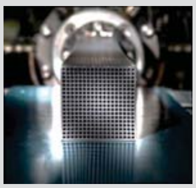
Odour Filter Clean Air Plus
with Bio-functional layer

- Odour Reduction (MEK) > 90 %
- Anti-Fish-Function: special impregnation against fish smell

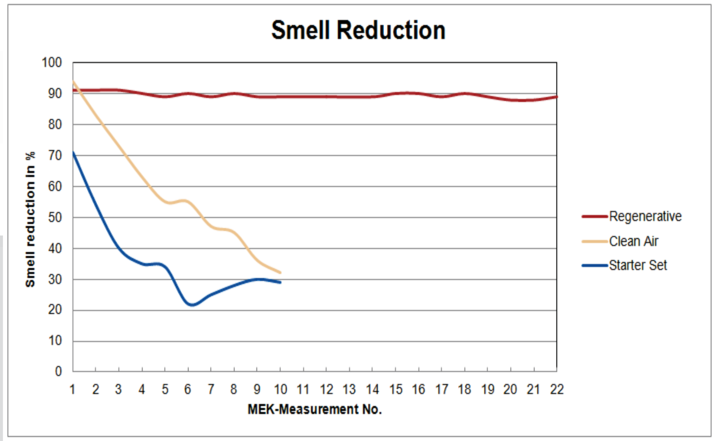
Anti-Pollen-Function:

+ **air floating pollens are withdrawn by the filter**
+ **in filter captured allergens are deactivated**

Honeycombs Technology ⟶ high potential for Recirculation Filter



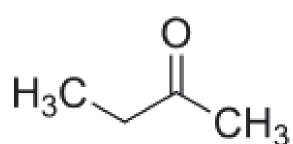
- Charcoal-Ceramic-Honeycombs
- Regeneration in Oven at 200°C
- Same performance after regeneration
- Lifetime of filter 10 years

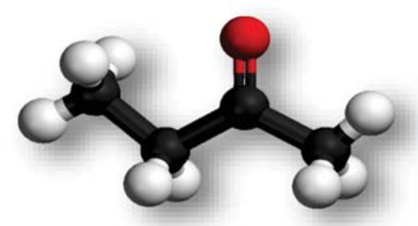


Odor Reduction Efficiency Measurement with “MEK” (DIN EN 61591)

MEK is representing VOC (volatile organic compounds C_xH_y)

MEK / Butanone / C_4H_8O





other names:

- Methylethylketone
- Ethylmethylketone
- 2-Butanone
- Butan-2-on
- Methylpropanon
- Methylacetone

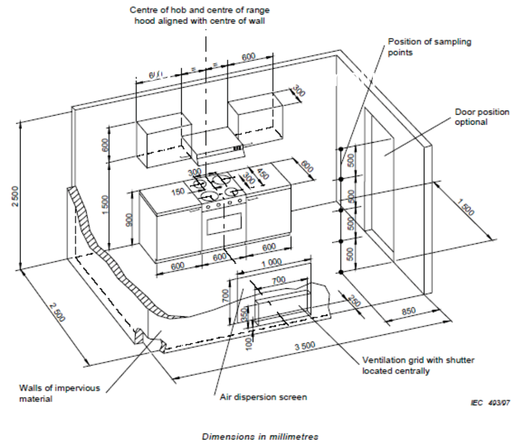
Measurement Methode: DIN EN 61591 – Odour Filter

Odour extraction measurement quantifies the performance in odour extraction of a hood **based on Methylethylketone / MEK**

C1: MEK concentration (ppm) <u>without</u> odour filter

C2: MEK concentration (ppm) <u>with</u> odour filter

$$GR = \frac{C1 - C2}{C1}$$



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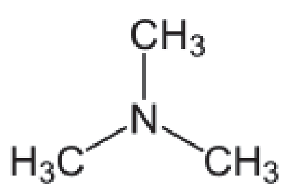
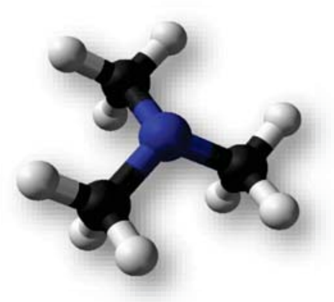
Odor Reduction Efficiency Measurement with “TMA” (not standardized)

=> TMA as representative molecule for “fish smell”

TMA / Trimethylamine / C_3H_9N





other names:

- *N*,*N*-Dimethylmethaneamine
- TMA (ambiguous)
- NMe_3
- Fagin

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Recirculating cooker hoods – possibilities and challenges

3. Catch Rate Evaluation

Visual Catch Rate Evaluation / Example

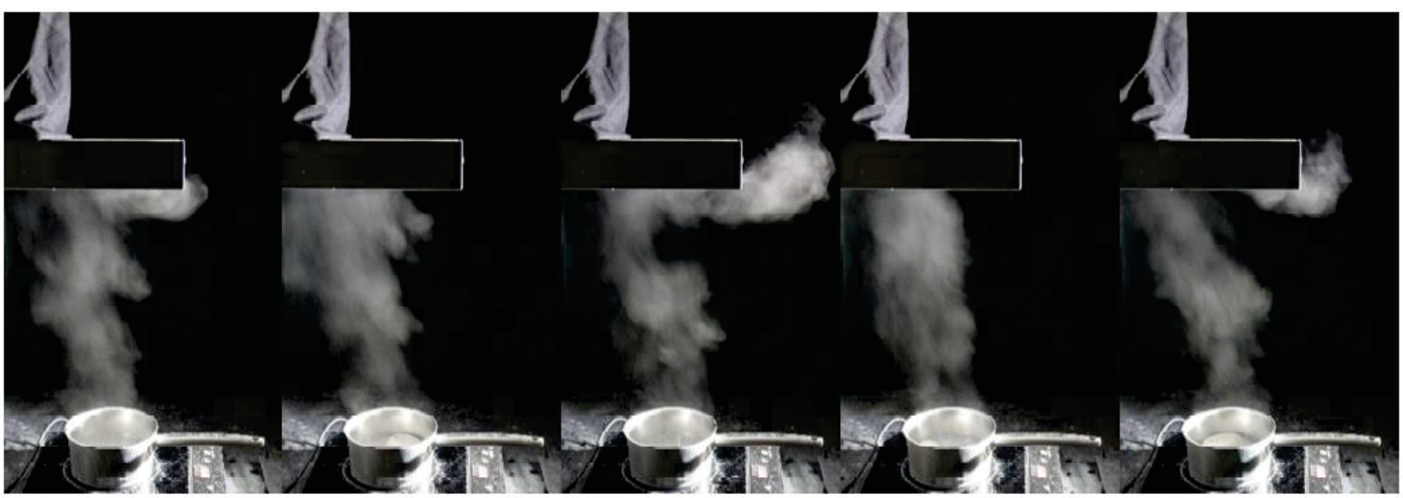
Passivhaus Institut

IHD SCIENCE BY EXPERTS

iTG

Naber ...inspiriert!

5 shots out of time row of 50 / Power Level 2



Visual Catch Rate Evaluation / Example

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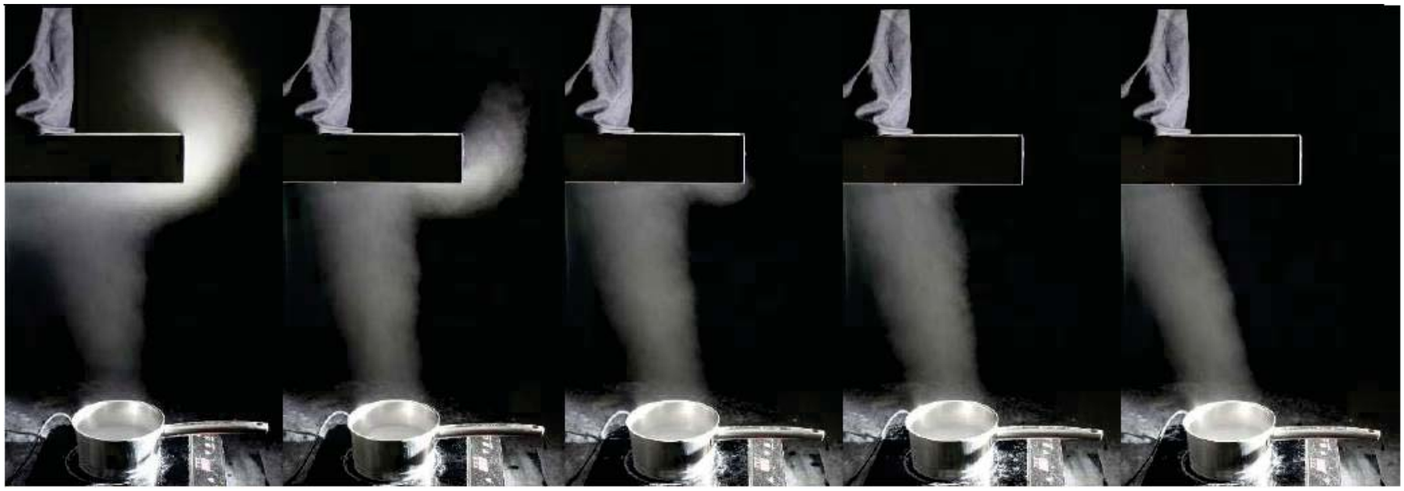
Average Value out of 50 Shots

OFF	Level 1	Level 2	Level 3	Level 4



Visual Catch Rate Evaluation / Example

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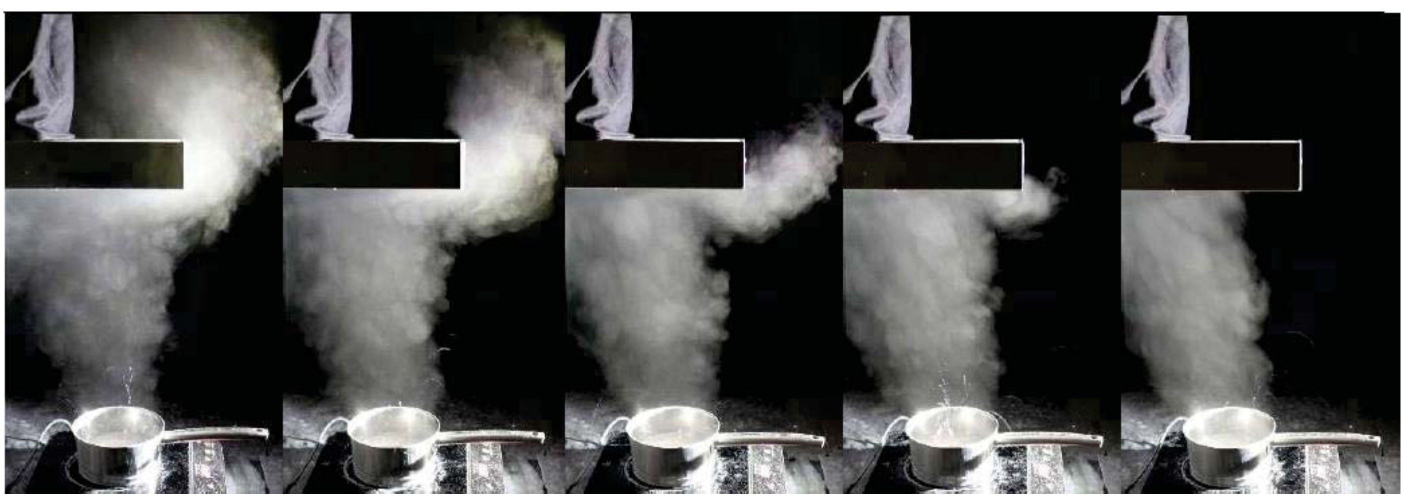
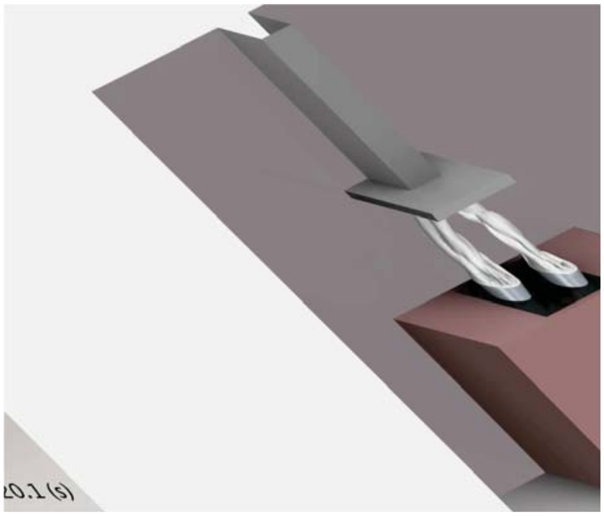
Worst Case out of 50 Shots for different power levels

OFF	Level 1	Level 2	Level 3	Level 4

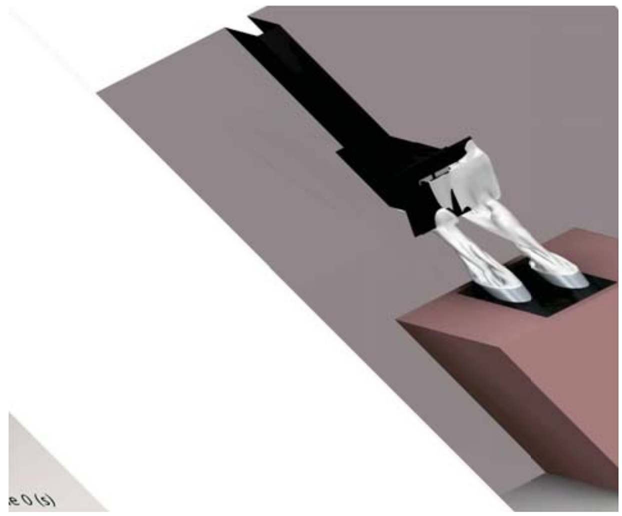


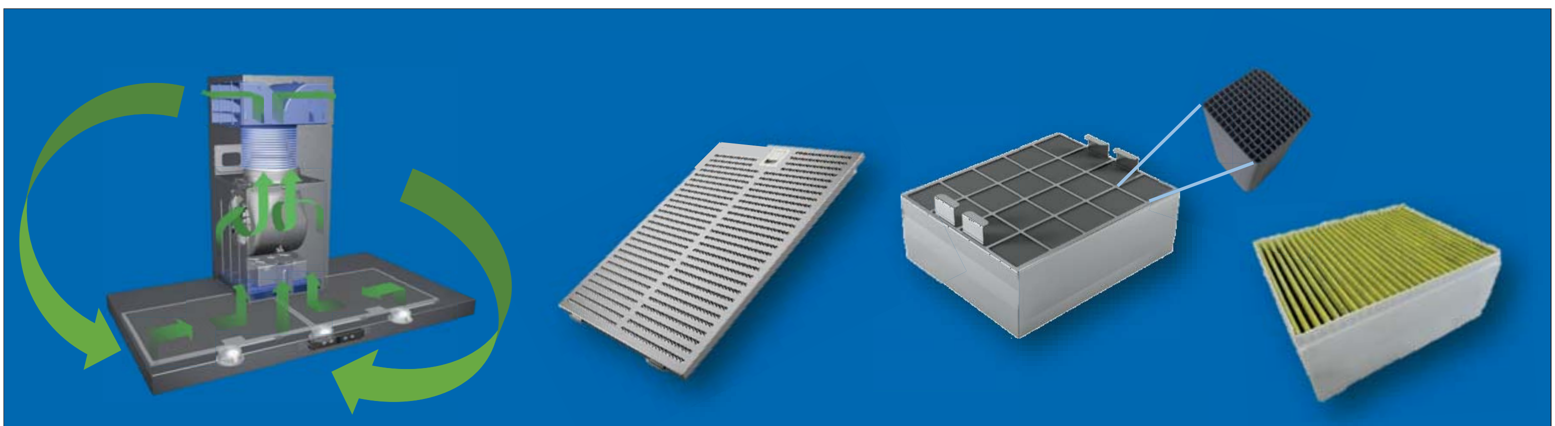
Numerical Catch Rate Simulations with Water Vapour

Box Hood 440 m³/h | 100% / 100%



Inclined Hood 400 m³/h | 100% / 96%





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Recirculating cooker hoods – possibilities and challenges

4. Conclusion

Summary

1. **Grease Filter**
   Expanded aluminum mesh filters can reach good level of grease capturing efficiency, but is not working as “fine dust” filter. **It is Important to “protect” the charcoal filter.**

2. **Odour Filter**
   Big variation of performance can be found in the market (depending on amount and quality of charcoal), but **odour reduction rate bigger 90% is possible**. Regular replacement or regeneration is needed for keeping good performance. Can work as pollen filter.

3. **Catch Rate**
   Very **important** for overall performance, but **difficult to measure**.
   Additionally it **depends** a lot on kitchen design and **ambient air flow**.

4. **Conclusion** =>

The Main Opportunities & Challenges

OPPORTUNITIES

Recirculation = no loss of heated air via the cooker hood

Facilitates kitchen and ventilation planning

A technology revolution in the last decade has raised recirculation to high performance level

CHALLENGES

Requires extra maintenance to change/regenerate carbon filters

Great variety of performance from excellent to almost useless products on the market

Does not remove all emitted particles


Thank You!

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U.S. DEPARTMENT OF ENERGY

In-Situ Effectiveness of Cooker Hoods

Iain Walker

AIVC Webinar
May 6th 2020

1

Three measures of effectiveness

1. Air flow
2. Capture Efficiency
3. Cooker hood use

2

2

Airflow measurement

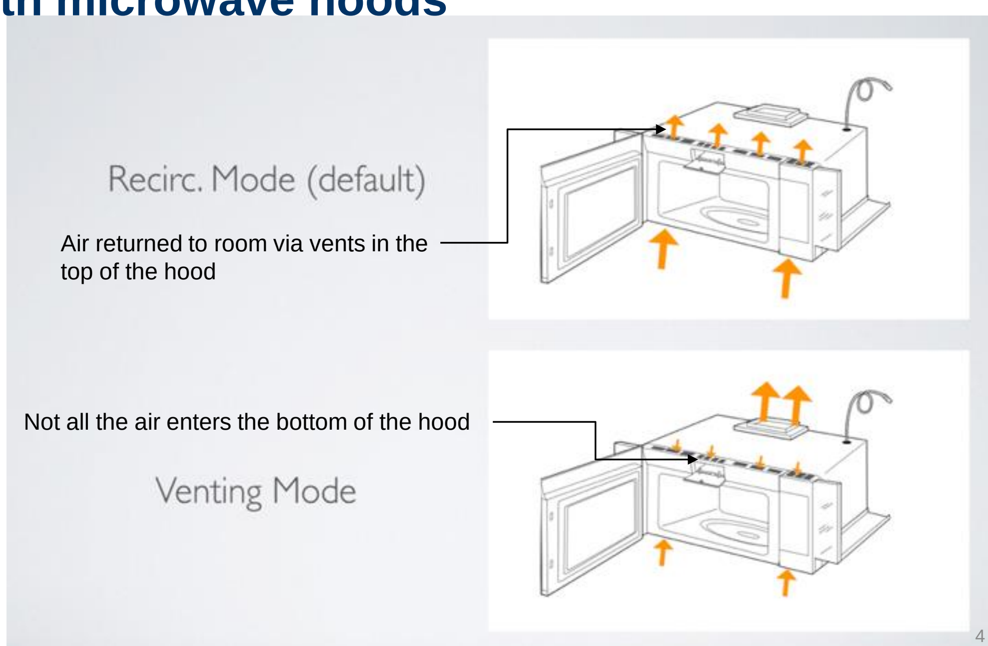
Cardboard flowhood

Use fan/flowmeter to zero pressure different across the cardboard box – or match static pressure in duct system

Fan/flowmeter

3

Issues with microwave hoods



4

Simultaneous inlet & outlet measurements to determine correct microwave hood flows

About 15% of flow missed if measurements are made for the bottom inlet only

Older Home Performance Study

		Measured Flows [L/s] (% of rated flow)		
Home ID	Type	Low	Medium	High
H1	Hood	66	108	148 (59%)
H2	Microwave	66 (78%)		76 (54%)
H5	Hood	135 (98%)		153
H6	Microwave	43		49 (45%)
H8	Hood	20 (40%)	n/a	30 (40%)
H9	Hood	39 (79%)	n/a	19 (64%)

In these older homes – air flows not meeting specifications and not always minimum (in the US ASHRAE 62.2) requirement of 50 L/s

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Air Flow Measurements in NEW California homes

72 New homes in California built since 2008

Higher flows than in older homes

Big range: 16-380 L/s

Microwaves - much lower flow

Fan Speed Setting	Median (5th–95th %tile) (L/s)	
	Range Hood	Microwave
Low	65 (28–138)	36 (16–67)
Medium	106 (38–295)	57 (37–89)
High	121 (65–380)	59 (17–102)

Other recent studies in California:

- 4 homes built in 2012 in California averaged 72 L/s – all met the 50 L/s requirement in California

- 23 apartments in California averaged 43 L/s on low speed and 70 L/s on high. 32% met the 50 L/s requirement in California on low speed and 77% on high speed

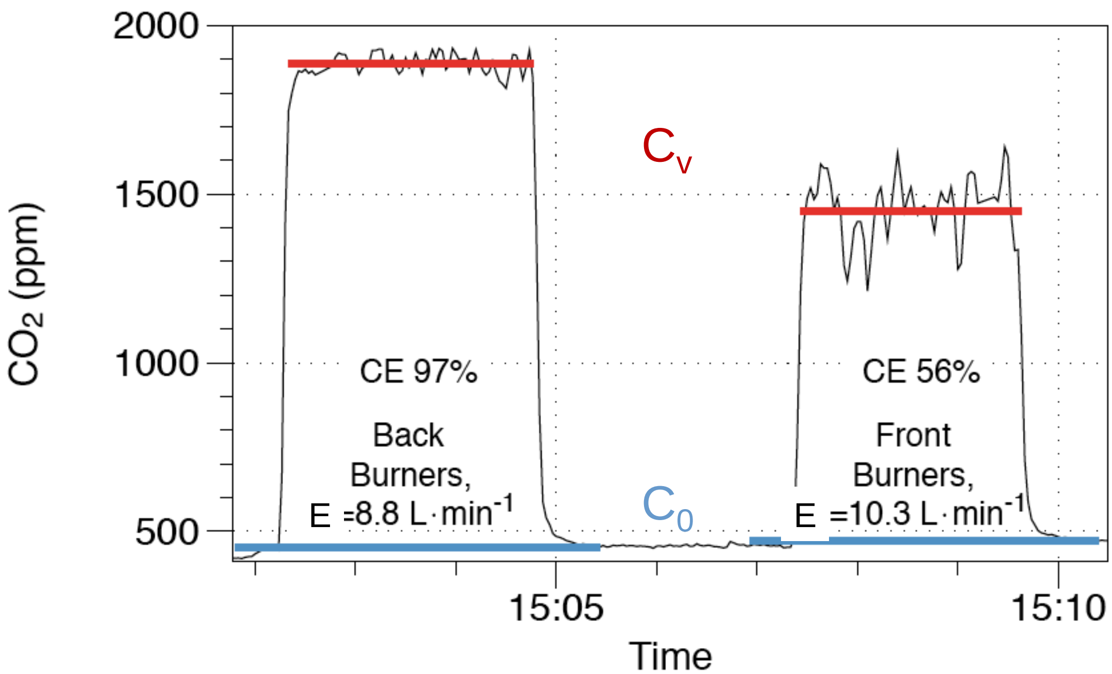
Primary effectiveness metric: Capture Efficiency

The fraction of cooking contaminants are exhausted by the cooker hood

Measuring Capture Efficiency in the field using gas burners

- Turn on burner and use gas meter to determine gas use rate. Convert this to CO_2 emission rate using standard combustion calculations (E [mL/min])
- Measure air flow through cooker hood (Q [m^3/min])
- Measure CO_2 concentration [mL/m^3] in the room (C_0) and the exhaust duct (C_v)

$$CE = Q * (C_v - C_0) * 10^6 / E$$



In-Home Performance Study

15 devices

- 2 downdraft
- 2 microwaves
- 3 flat-bottom hoods
- 2 hybrid
- 6 open hoods

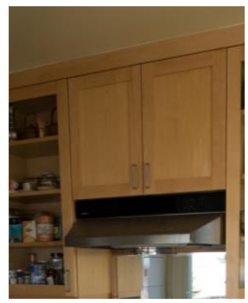
Cooktop tests

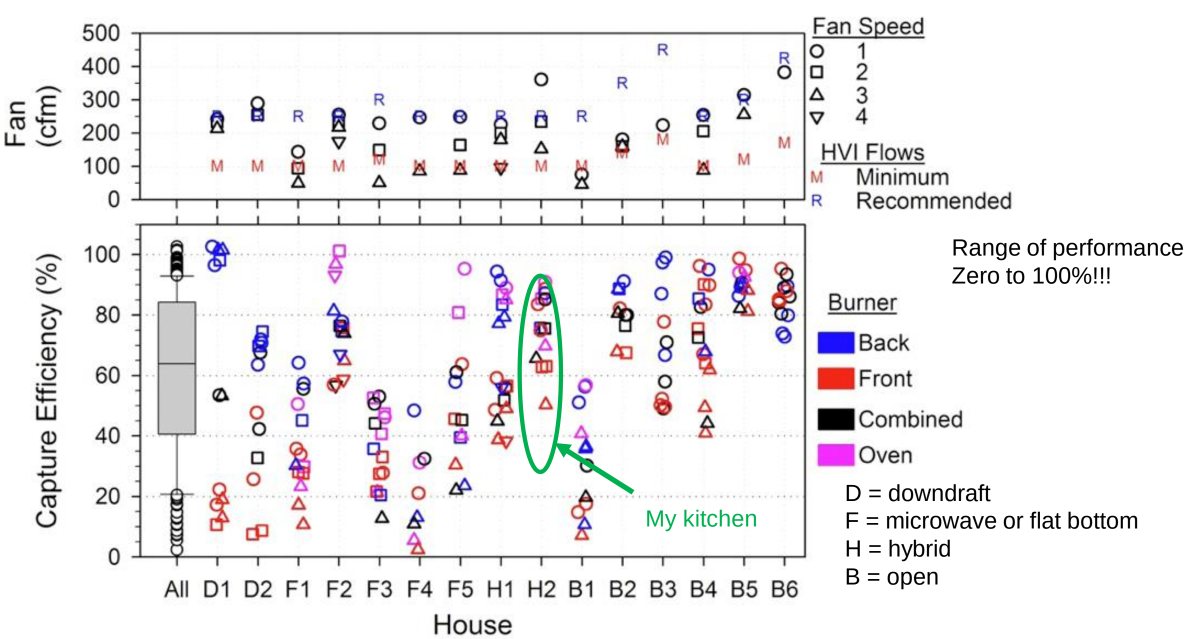
- Pots with water
- Front, back, diagonal

Oven tests

- (245 C) 425 F, door closed
- Cool between tests





Delp, W. W., and B. C. Singer. 2012. “Performance Assessment of US Residential Cooking Exhaust Hoods.” *Environmental Science & Technology* 46 (11): 6167–6173.

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Multifamily field study: gas burners with pots of water in new and renovated dwellings

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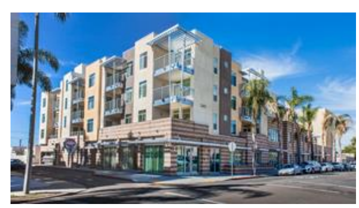
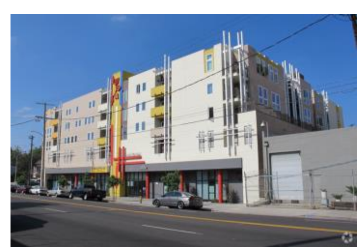
13

Collected field data from 23 apartments in 4 buildings built since 2013

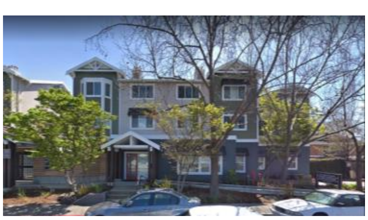
- All low-income residences
- All have gas cooking and self-reported to cook daily
- Six units had Capture Efficiency measurements



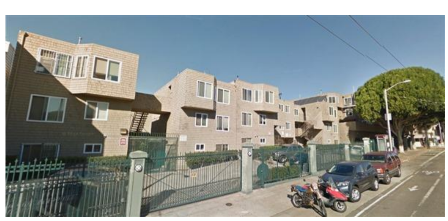
3. Chula Vista (Sep, 2019)



4. Los Angeles (Nov, 2019)



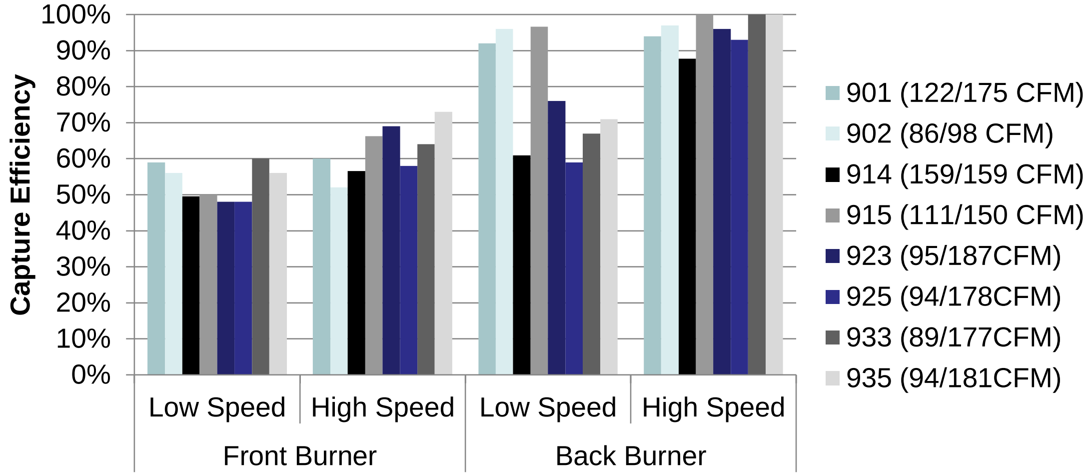
1. Hayward (Feb, 2019)



2. San Francisco (Apr, 2019)

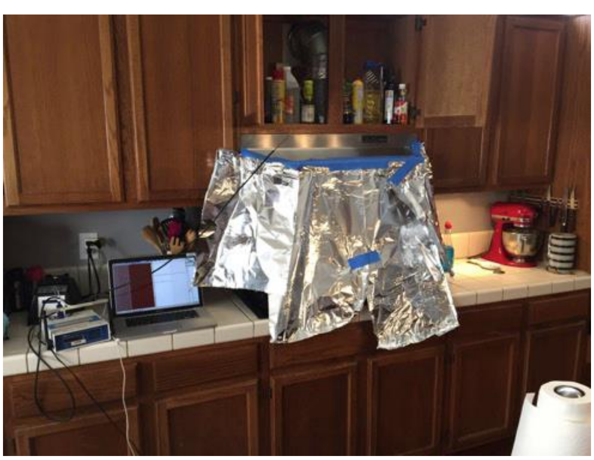
Range Hood Capture Efficiency

Much more consistent and no very low flows or CE compared to older home study



Measuring Capture Efficiency for any burner – gas or electric: the foil curtain

Shroud the cooktop with temporary foil curtain – theoretical 100% capture



Measuring Capture Efficiency for any burner – the foil curtain

- Measure background CO_2 with no burners or CO_2 injection (C_0)
- Use either gas burner* or inject tracer gas into pot above burner as source for CO_2
- Measure CO_2 concentration in the exhaust duct (C_{100}) with shroud in place
- Remove shroud and repeat CO_2 measurement in exhaust duct (C_N)

$$CE = \frac{(C_N - C_0)}{(C_{100} - C_0)}$$

*Note: all data in this presentation for gas burners

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Measured CE using foil curtain approach

		Low speed		High speed	
Home ID	Hood type	Front burners	Back burners	Front burners	Back burners
H1	Hood	NM[1]	NM[1]	NM[1]	NM[1]
H2	Microwave	25%	>95%	35%	>95%
H5	Hood	61%	68%	72%	84%
H6	Microwave	31%	88%	31%	93%
H8[1]	Hood	59%	68%	65%	80%
H9[1]	Hood	25%	74%	36%	75%

[1]Not measured; there was no way to access the range hood exhaust duct without aesthetic damage.

Like other studies/approaches: higher CE on back burner and at higher air flow

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Singer BC, Pass RZ, Delp WW, Lorenzetti DM, Maddalena RL. 2017. Pollutant concentrations and emission rates from natural gas cooking burners without and with range hood use in nine California homes. *Building and Environment* 122: 215-229

18

Cooking and Cooker Hood Monitoring

Monitor cooktop and oven use with iButton temperature sensors

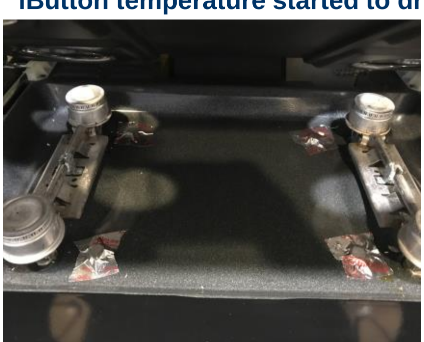
Monitor cooker hood use with anemometer

Identify Cooking Events

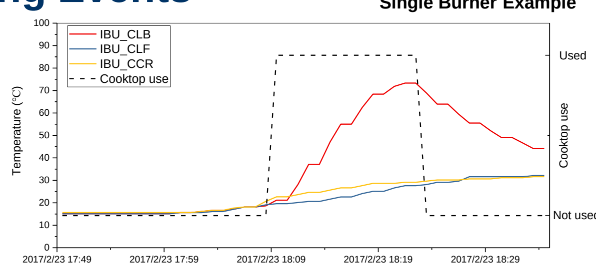
Algorithm to process iButton temperature sensor data

Cooking start identified by a rapid increase in temperature measured by iButton

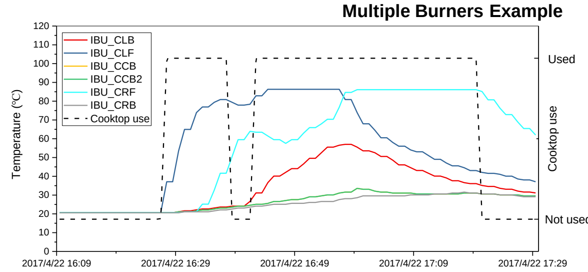
Cooking end when the main burner iButton temperature started to drop



Single Burner Example



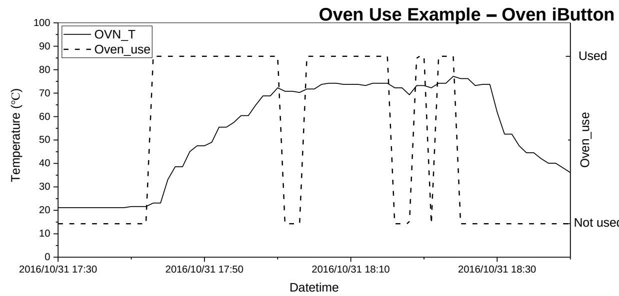
Multiple Burners Example

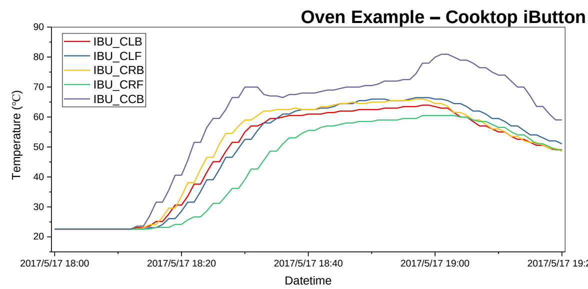


Identify Oven Use

Similar algorithm as cooktop, but more challenging:

- Placement of iButton varied from home to home – near oven vent
- Fluctuations in oven temperature (burner cycling)





Identifying cooktop/oven use

- **The start and ends of cooking events were identified by temperature changes measured by an iButton**
  - Start of event:
    - Cooktops: Threshold temperature rise of 0.6 to 1°C/minute
    - Ovens: Threshold temperature rise of 0.6 to 2°C/minute
  - End of event:
    - Cooktops: temperature drop by a minimum of 0.2 to 0.5°C/minute
    - Ovens: temperature drop of 0.3 to 0.5°C/minute
- **Selection of the threshold value for each home was done by visual inspection with the goal of having all cooking events identified.**
- **No single threshold value was suitable for all homes.**
  - Above limits worked in 86% of homes for cooktop and 78% of homes for oven use

Results of cooktop/oven use monitoring

A cooker hood was used during 29% of events that involved a cooktop burner and 22% of events with oven use.

Longer events with more burners had more cooker hood use.

People are not good predictors of their own cooking behavior:

- **In households that reported no cooker hood use generally, they were actually used during 12% of cooktop events.**
- **In households that said cooker hoods are used 80–100% of the time generally, they were actually used during only 33-38% of cooktop use.**

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Summary of in-field cooker hood effectiveness evaluation methods

Air flow measurement

- Needs temporary flow capture fabrication
- Microwave hoods need to capture all vents (or add about 15%0
- Older homes and installations have generally poor flows, newer homes and remodels are better

Capture Efficiency

- Gas cooktops: use gas consumption rate of burner and measured CO_2
- Gas and electric cooktops: use burner or other CO_2 source and a foil shroud for 100% capture reference
- Vert large performance range zero to 100% capture.
- Better on back burners and at higher flow

Over and Burner operation

- Use small temperature sensors + visual inspection using temperature change metric
- Not perfect, but OK for assessing use patterns

Acknowledgements

Thanks to my colleagues: Brett Singer, Woody Delp, Haoran Zhao, Chris Stratton, Craig Wray, Rengie Chan, Yang-Seon Kim, Hao Tang, Brennan Less

25

1

TEK 17 – Norwegian technical description for building houses.

§ 13-1.*Generelle krav til ventilasjon*
(6) Omluft skal ikke benyttes dersom den forurenser rom hvor mennesker er til stede.
(6) Recirculation shall not be used if it contaminates rooms where humans are present.

§ 13-2.*Ventilasjon i boligbygning*
.
(4) Kjøkken, toalett og våtrom skal ha avtrekk med tilfredsstillende effektivitet.
(4) Kitchen, toilet and bathroom needs extraction with satisfactory efficiency.

§ 13-2 Tabell 1: Avtrekksvolum i bolig.

Rom	**Grunnventilasjon**	**Forsert ventilasjon**
Kjøkken	36 m^3/h	108 m^3/h
Bad	54 m^3/h	108 m^3/h
Toalett	36 m^3/	Som grunnventilasjon
Vaskerom	36 m^3/h	72 m^3/

2

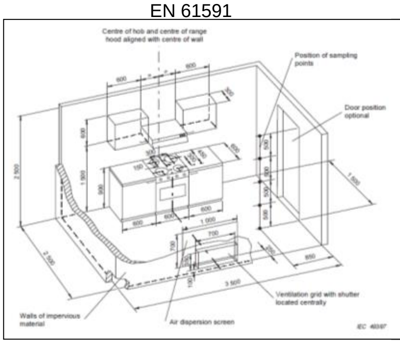
Stk. 3. Køkkener i boliger skal forsynes med emhætte med udsugning over kogepladerne. Emhætten skal have regulerbar, mekanisk udsugning og afkast til det fri og have tilstrækkelig effektivitet til at fjerne fugt og luftformige forureninger fra madlavning. Udsugningen skal kunne forøges til mindst 20 l/s.

Paragraph 3. Kitchens in homes must be equipped with an extractor hood with extraction over the hobs. The hood must have adjustable, mechanical extraction and return to the open air and have sufficient efficiency to remove moisture and gaseous contaminants from cooking. The extraction must be capable of being increased to at least 20 l/s.

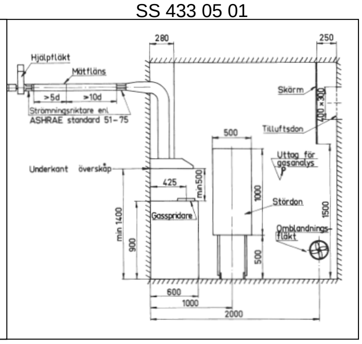
In kitchens there is a requirement that there must be a hood with extraction over the hobs and into the outside air. This requirement will always apply when installing cookoingplates in a home. Recirculation hoods will not normally meet this requirement, including recirculation hoods with carbon filter. The extraction of the hood must be able to be increased to at least 20 l/s. If the hood has an extractive capacity of 75 per cent or higher than the hood, the hood shall be 75 per cent more effective. DS/EN 61591 or DS/EN 13141-3 will normally meet the requirement for sufficient efficiency to remove moisture and gaseous contaminants from cooking. Hotplates may be, for example, electric or gas-heated and built into a stove.

Test room EN 61591

EN 61591



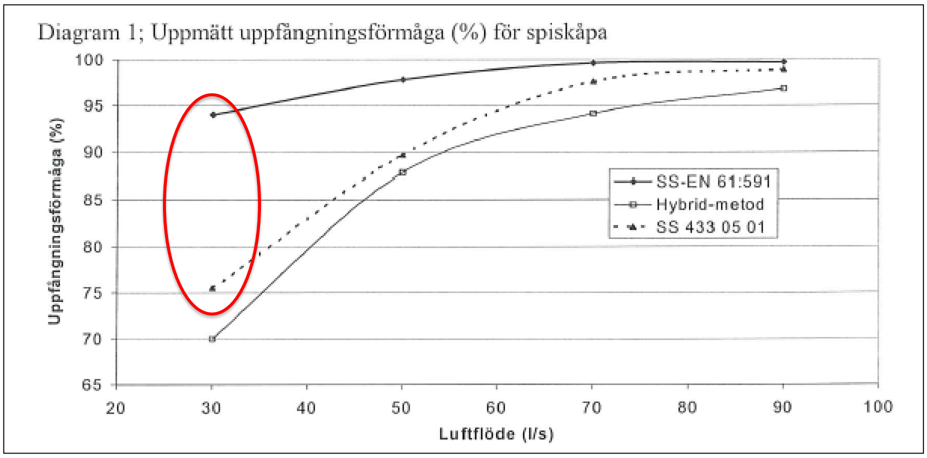
SS 433 05 01



Test WITHOUT ANY air disturbance

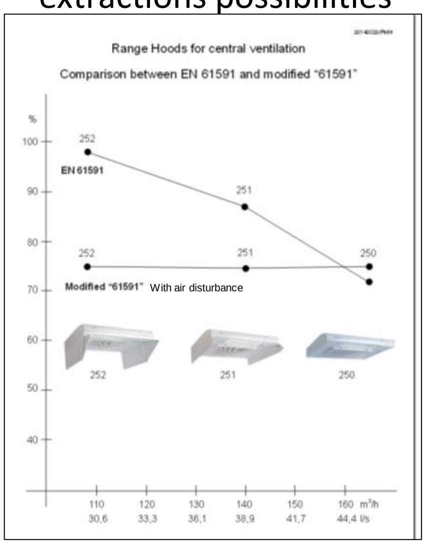
Test WITH air disturbance

Odour reduction factor



Odour reduction factor
For the Nordics we are working with very limited extractions possibilities

108m3/h
140m3/h
165m3/h

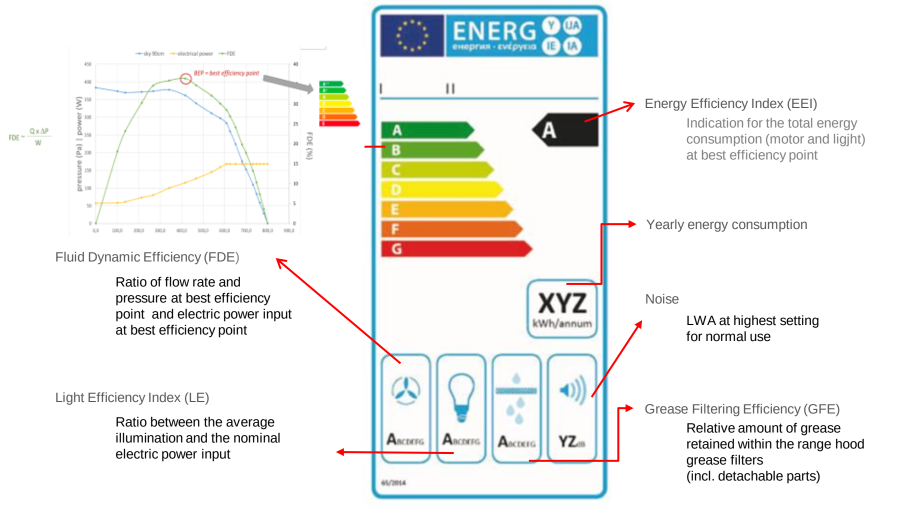


108m3/h
140m3/h
165m3/h

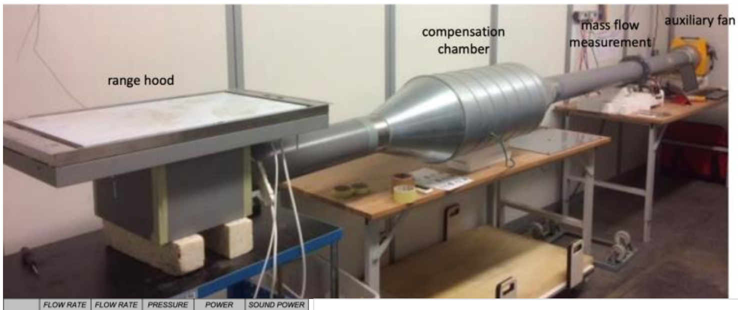
108m3/h
140m3/h
165m3/h

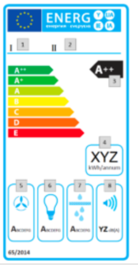
108m3/h
140m3/h
165m3/h

EN lable – does not say anything about odour reduction level/efficiency and and the airflow is significant higher the the inlet-air can handle

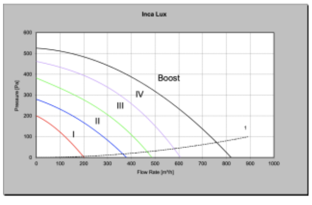


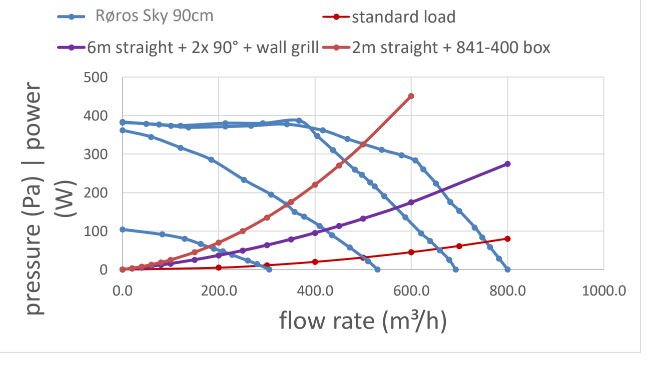
Is the EN Label valid for hood perfomance or just a tool for comparance?



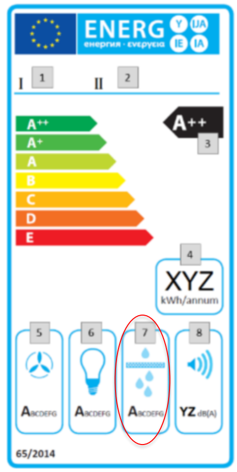


SPEED	FLOW RATE Free delivery [m³/h]	FLOW RATE IEC 61591 (1) [m³/h]	PRESSURE Maximum [Pa]	POWER INPUT [W]	SOUND POWER IEC 60704-2-13 [dB(A)]
I	200	190	200	10	43
II	380	360	280	30	56
III	490	460	390	55	61
IV	610	570	460	95	65
Boost	830	750	530	270	71

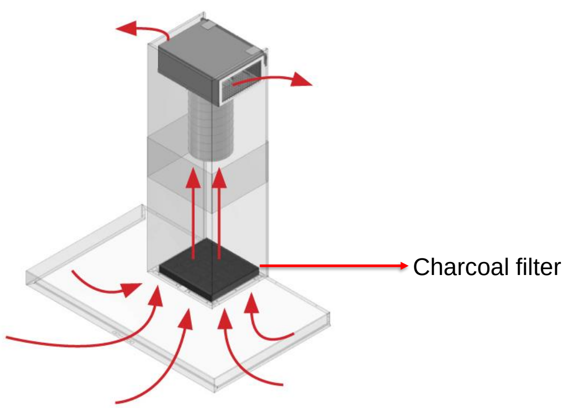




Grease filter

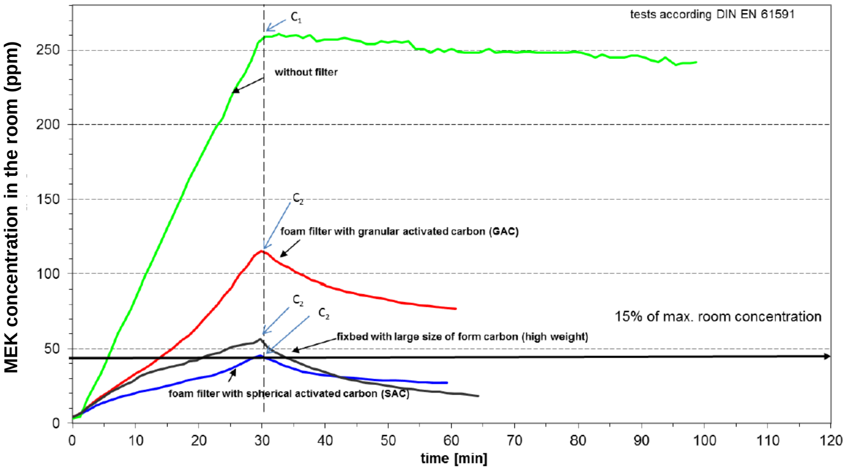


Different charcoal filters



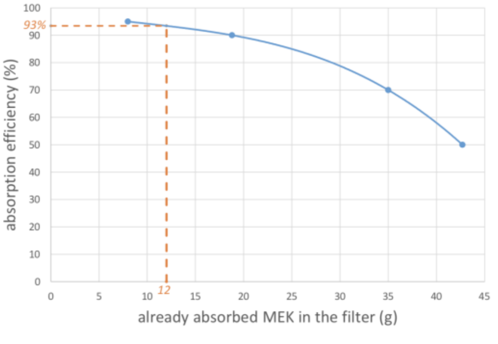
Plasma filter	Active carbon filter	Monoblokk filter
No measurement standard	Measured after EN 61591 MetylEtylKotan. Cooker hood level max normal	Measured after EN 61591 MetylEtylKotan Cooker hood level maw normal

The different carbon filters have different performance of MEK reduction of course



What happens with chacoal filters after some periode of time with »bad handling» of grease filters?

- Active carbon filters ‘capture’ the smells. The filter capacity for smell absorption decreases as more smell is absorbed. The filter thus has a ‘limited’ lifetime.
- Breakthrough measurements show this decrease in absorption efficiency
- Test procedure:
  - Constant concentration of MEK upstream the filter (i.e. 80ppm)
  - Measure the concentration downstream the filter as function of time



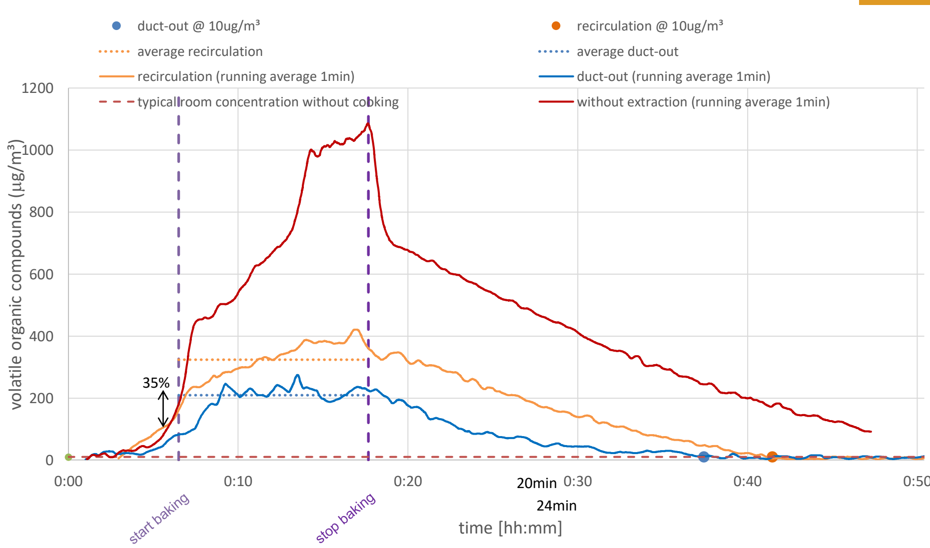
Monoblock filter efficiency measured by SLG

Shall tests also be based on «fish odour» Or real life cooking situations?

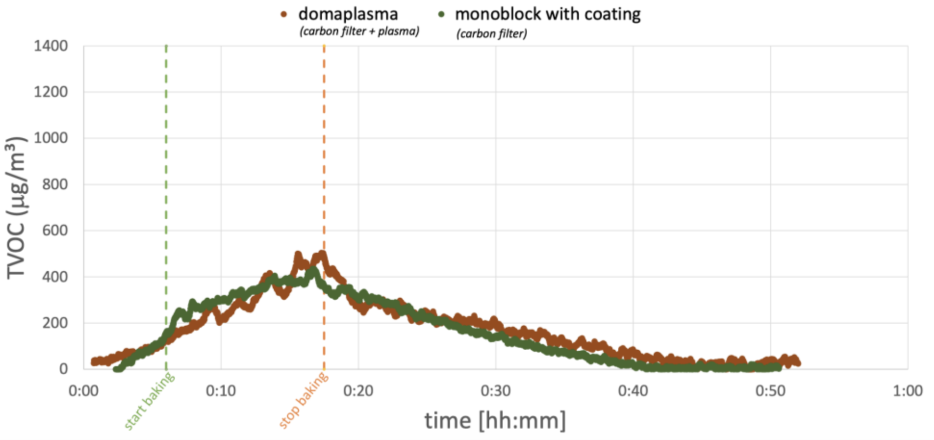
Measuring data of odour extraction in recirculation mode with Trimethylamine	
Weight of odour filter(s) after conditioning	586 g
Setting (max. fan speed in normal use)	**3**
Background value before test of C_1	1,1 ppm
Maximum concentration in the test room	53,2 ppm
Maximum concentration – background value (C_1)	52,1 ppm
Background value before test of C_2	1,0 ppm
Concentration after 30min operating time	2,7 ppm
Concentration after 30min – background value (C_2)	1,7 ppm
Time from C_2 to 15 % of C_1 – Odour dispersion time	0 min
Value after C_2 + 60 min operating time	not applicable
Odour reduction level (O_f)	**96,7 %**

Metyl Etyl Kotan does not represent «real life cooking»

TVOC:	Performed test:
Amino	3 hamburgers
Sulphide	12 min cooking sequence
Aldehydes	Enough inlet air when duction out
Ketones	Identical plates, butter in frying pan, external circumstances
Organic acids	Setting level 3 on cooker hood.



Plasma filter ⟷ Monoblokkfilter



TVOC = Smell/fumes from 3 hamburgers like the previous test
No difference between a Monoblokk filter and Plasmafilters.
Our conclusion – plasma has little effect, the importance is having a good recirculation filter

With the information we have at the present time, duct out is 35% better then recirculation in this performed test.

Thank you for listening