New Performance Requirements for Filtration and Air Cleaning in EN 13779/prEN 16798-3

- **Introduction of EVIA**
- **Main changes EN 13779 -> prEN16798-3 and TR 16798-4**
- **Systems and filtration**
  - Outdoor, Indoor, Supply Air
  - Definition by function
- **Requirements Filtration**
  - Outdoor air
  - Filter efficiency EN 779
  - Gas filtration
  - Life cycle cost
- **Clarifications on Fans and SFP values**
  - Ecodesign LOT 6 and EU 327/2011
  - Filtration

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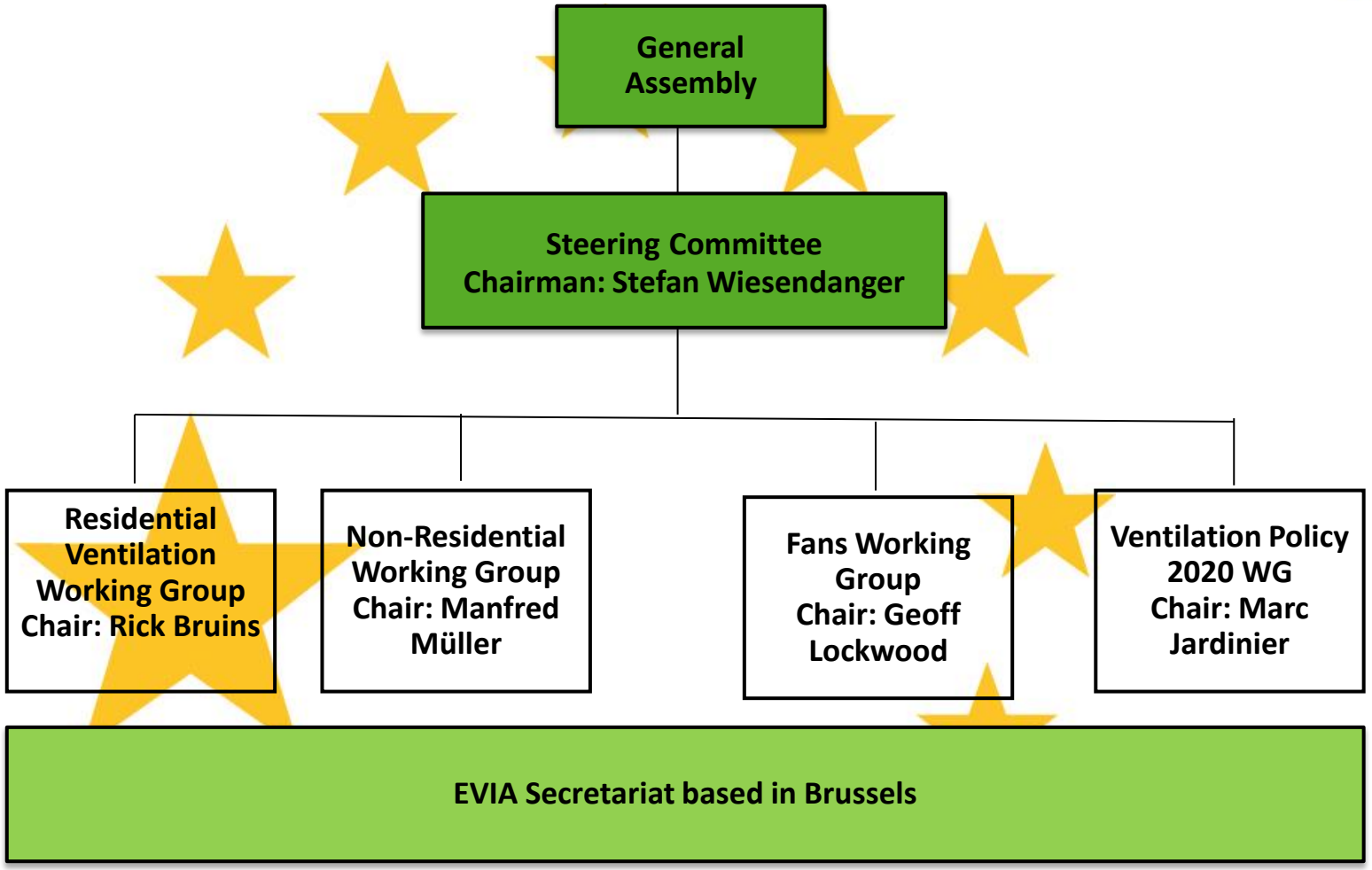
EVIA STRUCTURE



EVIA Mission & Objectives

- Promote energy efficiency at EU and national level
- Provide guidance and interpretation on legislation to its members and the market
- Advocate for its members towards decision makers
- Support standardisation effort at European and international level
- Ensure a level playing field on Market Surveillance
- Seek industry alignment and cooperation

Scope EN 13779 -> EN 16798-3 ans TR 16798-4

- **Design and definition aspects will mainly be kept and updated**
  - Agreement of design criteria
  - Specifications of air
- **All aspects of indoor air quality and indoor environment will be handled in EN 16798-1 and TR 16798-2**
  - Based on the needs of human beeings and buildings
  - Ventilation rate (based on fully mixed airflows)
  - Temperature, humidity, draft risk, etc. CO_2
- **All aspects of the system of non-residential ventilation will be kept in EN 16798-3 and TR 16798-4**
  - Outdoor Air Quality <-> Supply Air Quality
  - System performance
  - System design

EN 13779 – General Classification of IDA

Tabelle A.10 — CO_2-Gehalt in Räumen

Kategorie	CO_2-Gehalt über dem Gehalt in der Außenluft in ppm	
	Üblicher Bereich	Standardwert
IDA 1	≤400	350
IDA 2	400 – 600	500

Table 5 — Basic classification of indoor air quality (IDA)

Category	Description
IDA 1	High indoor air quality
IDA 2	Medium indoor air quality
IDA 3	Moderate indoor air quality
IDA 4	Low indoor air quality

Tabelle A
Auslegung
Möbeln.

Kategorie	Einheit	Nichtraucherbereich		Raucherbereich	
		Üblicher Bereich	Standardwert	Üblicher Bereich	Standardwert
IDA 1	l · s^{-1} · Person^{-1}	>15	20	>30	40
IDA 2	l · s^{-1} · Person^{-1}	10 – 15	12,5	20 – 30	25
IDA 3	l · s^{-1} · Person^{-1}	6 – 10	8	12 – 20	
IDA 4	l · s^{-1} · Person^{-1}	<6	5	<12	10

Types of Ventilation-, Air-conditioning-, and Room Conditioning-Systems based on functions

System	Supply Air Fan	Exhaust Air Fan	Secondary Fan	Heat Recovery	Waste heat pump	Filtration	Heating	Cooling	Humidificat	Dehumidification
Unidirectional supply air ventilation system (Positive pressure ventilation)	x	-	-	-		o	o	-	-	-
Unidirectional exhaust air system	-	x	-		o	-	-	-	-	-
Bidirectional ventilation system	x	x	-	x	o	x	o	-	-	-
Bidirectional ventilation system with humidification	x	x		x	o	x	o	-	x	-
Bidirectional air-conditioning system	x	x		x	o	x	o	(x)	o	(x)
Full air-conditioning system	x	x		x	o	x	x	x	x	x
Room air conditioning system (Fan-Coil, DX-Split- Systems, VRF, local water loop heat pumps, etc.)	-	-	x	-	-	o	o	x	-	(x)
Room air heating systems	-	-	x	-	-	o	x	-	-	-
Room conditioning system	-	-	-	-	-	-	o	x	-	-

Definition of Outdoor Air

- **As a starting point, the following approach shall be followed.**
  - ODA 1 applies where the WHO (2005) guidelines and any National air quality standards or regulations for outdoor air are fulfilled.
  - ODA 2 applies where pollutant concentrations exceed the WHO guidelines or any National air quality standards or regulations for outdoor air by a factor of up to 1,5.
  - ODA 3 applies where pollutant concentrations exceed they WHO guidelines or any National air quality standards or regulations for outdoor air by a factor greater than 1,5.
  - Typical gaseous pollutants to be considered in the evaluation of the outdoor air for the design of ventilation and room-conditioning systems are carbon monoxide, sulphur dioxide, oxides of nitrogen and volatile organic compounds (VOCs).

Aspects of Filtration

- **Clarifications particle filters and gas filters vs. ODA**
- **Definition of Supply air quality**
- **No Link to Indoor Air quality -> EN 15251**

Category	Description	Recommendation
SUP 1	Supply air with very low concentration of particulate matter and/or gases	< 0,25 * WHO
SUP 2	Supply air with low concentrations of particulate matter and/or gases	< 0,50 * WHO
SUP 3	Supply air with medium concentrations of particulate matter and/or gases matter	< 0,75 * WHO
SUP 4	Supply air with high concentrations of particulate matter and/or gases matter	< 1.00 * WHO

Clarification o outdoor air

- **Classification will be split**
  - Particle concentration PM 10 and PM 2,5 — Particle filter
  - Gaseouse pollutants — Gas filter

Category	Description
ODA P1	Outdoor air which may be only temporarily dusty (e.g. pollen)
ODA P2	Outdoor air with high concentrations of particulate matter
ODA P3	Outdoor air with very high concentrations particulate matter

Category	Description
ODA G1	Outdoor air which may be only temporarily polluted
ODA G2	Outdoor air with high concentrations of gaseous pollutants
ODA G3	Outdoor air with very high concentrations of gaseous pollutants

Key pollutants for the classification of the outdoor air quality. TR 16798-4 (current working document)

- **The maximum exceeding in particle matter ODA (P) and gaseous components ODA (G).**

	Guideline value	***Stuttgart***	***London Traffic road***	***Madrid***
O_3	annual mean	63	31,2	31,5
	maximum 8 h (EC) ***120 µg/m³ (WHO)100 (WHO)100µg/m³***	178	85,50	105,7
	days over 120 *µg/m³*	31	YES	1
	Factor over guideline	**< 1,5**	**<1**	**<1**
PM_{10}	annual mean EC 40 *µg/m³ WHO 20 WHO 20µg/m3*	34	28	30,30
	maximum 24 h 50 *µg/m³*	109		109
	day over 50 µg/m³ *35 days*	**42**	**43**	**44**
	Factor over guideline	**< 1,5**	<1,5	<1,5
	ODA (G)	**2**	**1**	**1**
	ODA (P)	**2**	**2**	**2**

Minimum Filtration Efficiency Based on Particle Outdoor Air Quality

Outdoor Air Quality	Supply Air Class			
	SUP 1	SUP 2	SUP 3	SUP 4
ODA (P) 1	88%*	80%*	80%*	80%*
ODA (P) 2	96%*	88%*	80%*	80%*
ODA (P) 3	99%*	96%*	92%*	80%*

*Combined average filtration efficiency over a single or multiple stage filtration in accordance to average filtration efficiency specified in EN 779.

The combined filtration efficiency shall be calculated according (20):

$$E_t = 100 * \left(1 - \left(\left(1 - \frac{E_{s1}}{100} \right) * \left(1 - \frac{E_{s2}}{100} \right) * \ldots * \left(1 - \frac{E_{sn+1}}{100} \right) \right) \right)$$

Where:

E_t is the total filter efficiency

E_{sn+1} is the efficiency of each filter step

Recommended filter classed are given in Annex A

Aspects of filtration
Default Data if Calculation is not applied

Recommended minimum filter classes per filter section (definition of filter classes according to EN 779)

	SUP 1	SUP 2	SUP 3	SUP 4
ODA 1	M5+F7	F7	F7	F7
ODA 2	F7 + F7	M5 + F7	F7	F7
ODA 3	F7 + F9	F7 + F7	M6 + F7	F7

Aspects of filtration – Recommendations for Gas Filter

- **In case where optional gas filtration is designed the following table shall be applied.**
- **Required application of Gas Filter as compliment to particle filtration based on gaseous outdoor air quality**

Outdoor air quality				
	SUP 1	SUP 2	SUP 3	SUP 4
ODA (G) 1	recommended			
ODA (G) 2	Required	recommended		
ODA (G) 3	Required	Required	recommended	
• GF= Gas Filtration, should be considered when going from above ODA / SUP levels. Dimensioning should be done in accordance with EN ISO 10121 – 1&2: 2014.				

Aspects of Filtration

- Special attention to airtightness of both the building envelope and air handling units
- In situations with one filter step, the filter shall be placed after the fan (to be discussed for direct driven fans).
- With two or more filter steps, the first filter section shall be placed before, the second filter section after the air treatment.
- A prefilter shall be used to reduce the dust in the outdoor air at the inlet of the ventilation unit and keep the ventilation equipment clean.
- Special attention should be paid to the influence of pressure conditions to the air flows, influencing the electrical energy consumption.
- To avoid increasing the installation running costs, designers shall select air filters upon the assessment of total energy consumption during the operation time, using life cycle costing methodology.

Life Cycle Cost TR 16798-4 (current working document)

- A life cycle cost analysis (LCC) for air filters is a valuable and useful tool for users to minimize the running costs for an installation.
- Example of an LCC calculation for an F7-filter

LCC calculation	Cost (€)	%
Investment	80	**4.5**
Energy	1 364	**78**
Replacement	272	**15.5**
Disposal	34	**2**
Total LCC	**1 750**	**100**

Aspects of Filtration

- **The relative humidity over a long period should be higher than 80 %.**
- **In category ODA 3 (highly industrialised regions, near airports etc.) electrostatic filtering can be needed in some applications.**
- **Filter maintenance**
  - A plan for regular filter changing is needed, see EN 15780.
  - The relative humidity in the air of filters has to be limited to 90%, see EN 13053.
  - The outdoor intake should be constructed so that the rain or snow cannot enter to the system

SFP values – Specific Fan Power

- **Clarifications**
  - Filters
  - Unit, fan or building based
  - Default is clean filters and dry conditions

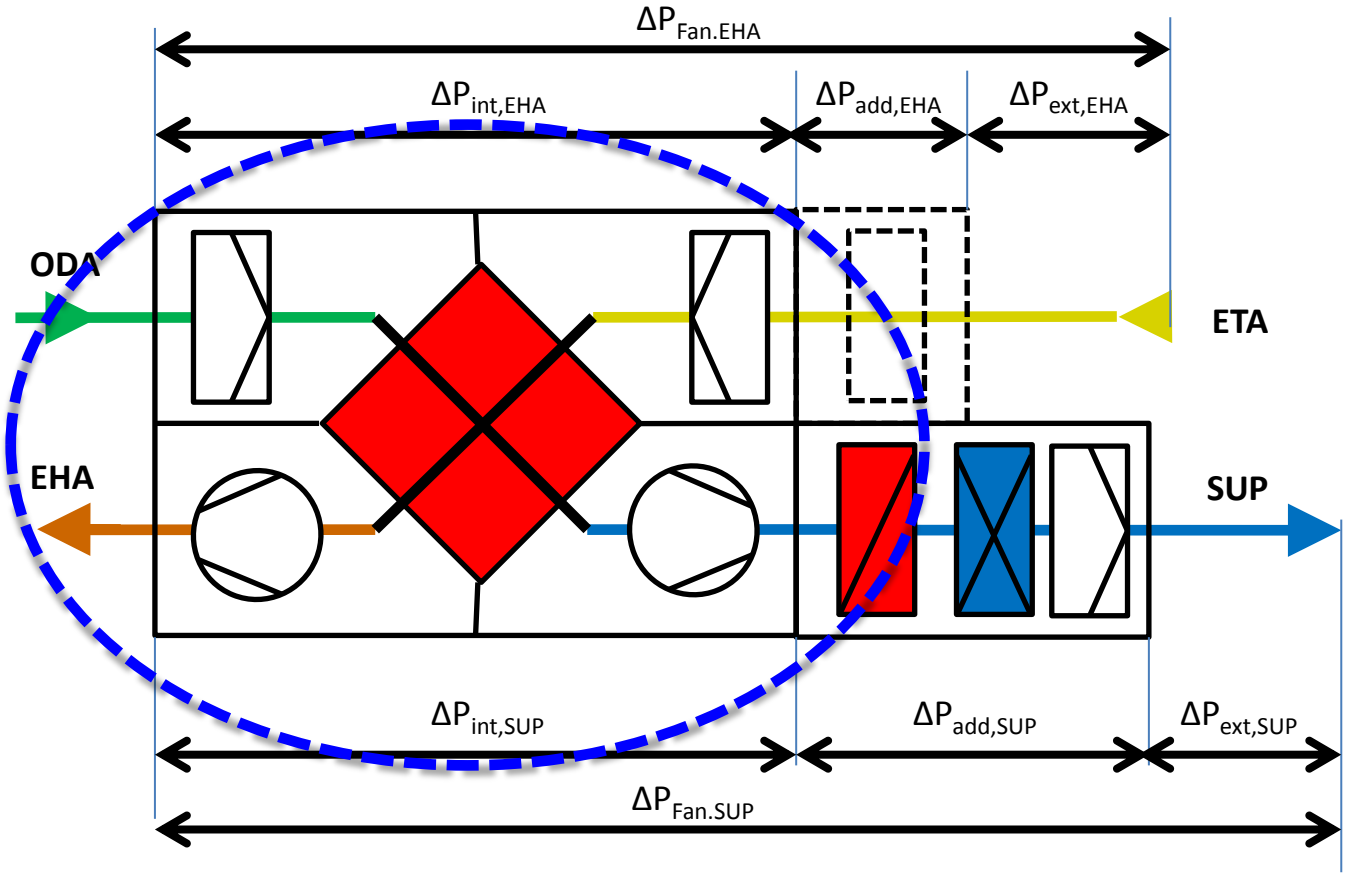
$$P_{SFP} = \frac{P}{q_v} = \frac{\Delta p_{tot}}{\eta_{tot}} = \frac{\Delta p_{stat}}{\eta_{stat}}$$

- **Ecodesign EU1253/2014 Aspects of SFP**
  - Reference Ventilation Unit includes Heat Recovery, Casing and
  - F7 SUP and M5 EXT Filters
  - SFP_{int} is the sum of SUP+EXT air stream

- **Upgrade based on Fan Regulation EU 327/2011**

Definition of SFP internal – EU 1253/2014
Heat Recovery + Filter + Box

$$SFP = SFP_{int} + SFP_{add} + SFP_{ext}$$



$$P_{SFP} = \frac{\Delta p_{int\,tot}}{\eta_{tot}} + \frac{\Delta p_{add\,tot}}{\eta_{tot}} + \frac{\Delta p_{ext\ tot}}{\eta_{tot}} = \frac{\Delta p_{int\,stat}}{\eta_{stat}} + \frac{\Delta p_{add\,stat}}{\eta_{stat}} + \frac{\Delta p_{ext\,stat}}{\eta_{stat}}$$

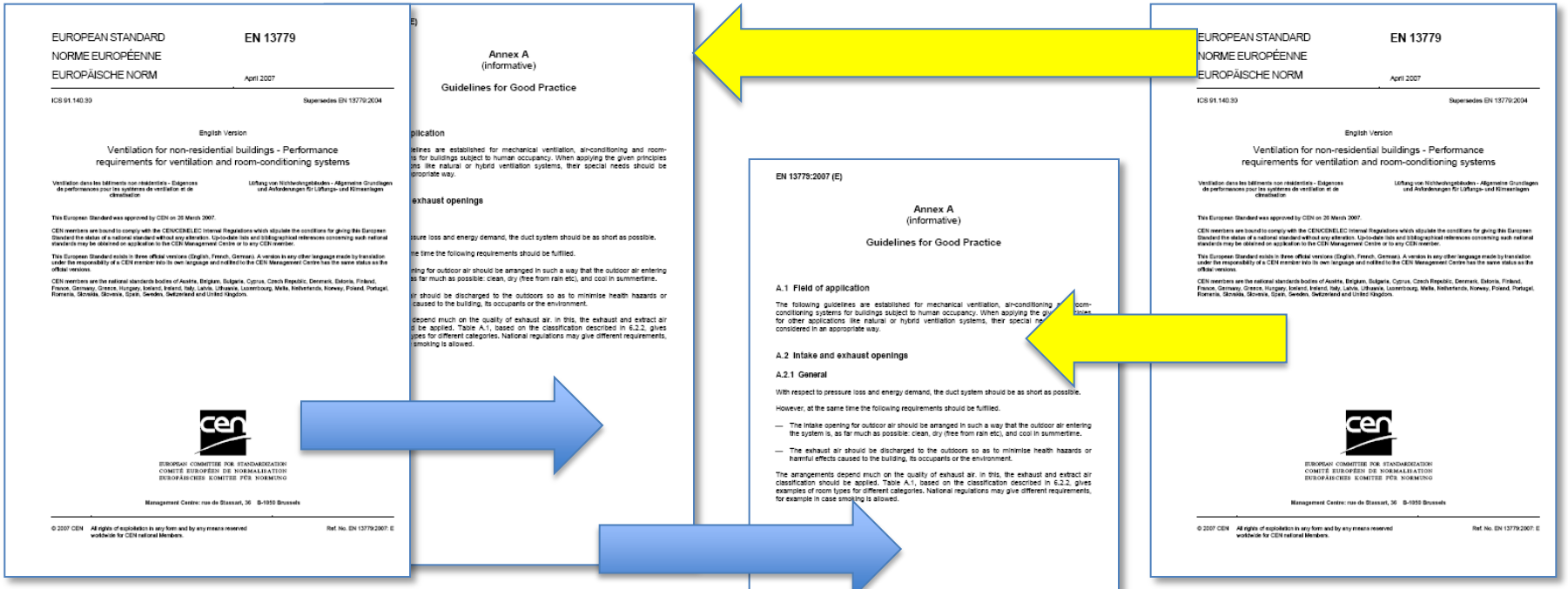
Filter Maintenance
TR 16798-4 (current working document)

- **The filter should be replaced after the main pollen and spore season in the autumn.**
- **Proximity to heavy traffic roads or industrial areas may require earlier air filters change.**
- **Agricultural activity such as plowing and harvesting nearby building has to be considered as well as it releases dust.**

Filter stage/ class	Recommended final pressure loss	Hygiene interval	Factors affecting change
	First occurring between		
Only 1 filtration stage		1 year	Spring and autumn – after pollen and spore seasons
1st filter stage		1 year	
2nd Filter stage		2 years	
G1 — G4	150 Pa		
M5 — F7	200 Pa		Highly polluted or dusty areas
F8 — F9	300 Pa		

New Structure of EPBD standards prEN 16798 – 3 and TR 16798 – 4 former EN 13779

Supporting



EN 16798-3
normativ

EN 16798-3
default
Annex

EN 16798-3
national
Annex

EN 16798-4
Technical Report

Guiding

Thank you very much for your attention