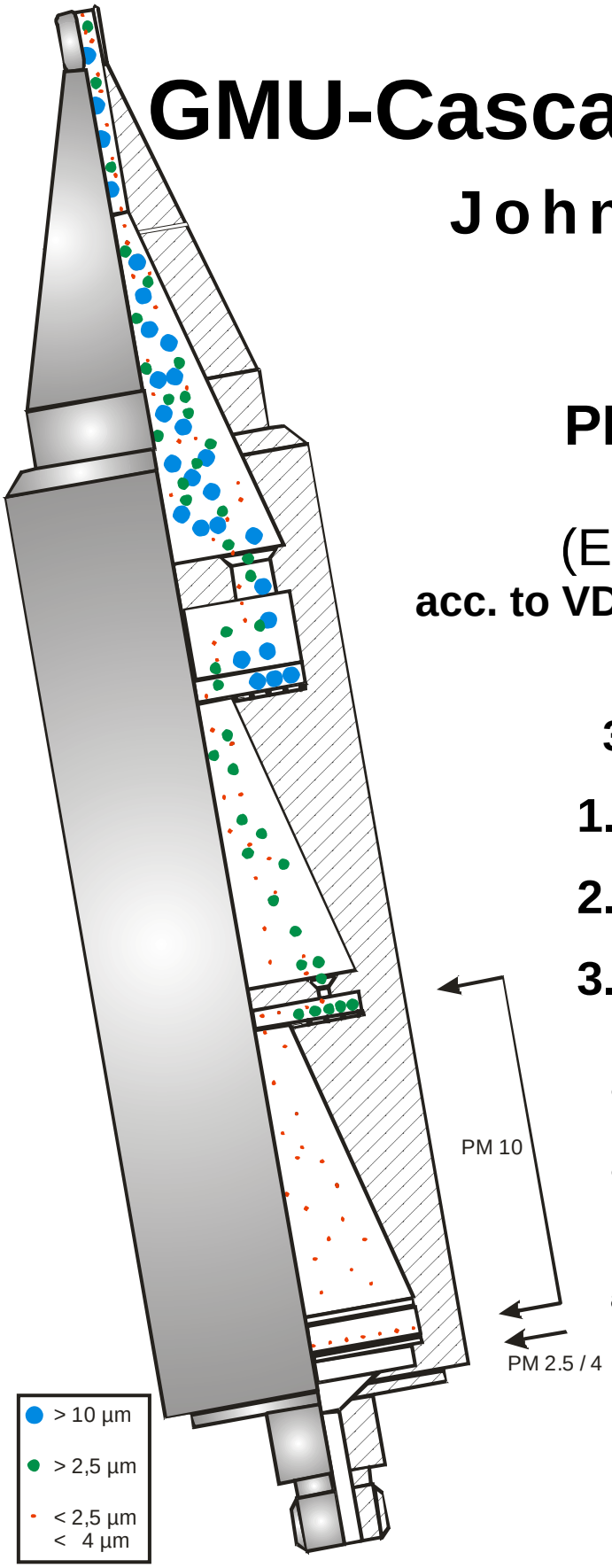
Paul Gothe Bochum

PAUL GOTHE GmbH
Manufacturer of Emissions Control Technology

GMU-Cascade Impactor

Johnas II



for IN-STACK
PM 10 and 4 or 2.5
Measurements
(Emission Monitoring)
acc. to VDI 2066, Part 10 and ISO 23210

3 cut-off-classes:

1. d_{ae} > 10 µm
2. d_{ae} 2,5/4 - 10 µm
3. d_{ae} < 2,5/4 µm

- calibrated with mono- and polysize particle
- checked for their correctness in official control-programs

according to the German and European Guidelines

Developed by Gerhard-Mercator
University Duisburg
and country-environment-office
Nordrhein-Westfalen -Germany-
Manufacturer: Paul Gothe Bochum

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GMU-Cascade Impactor Johnas II

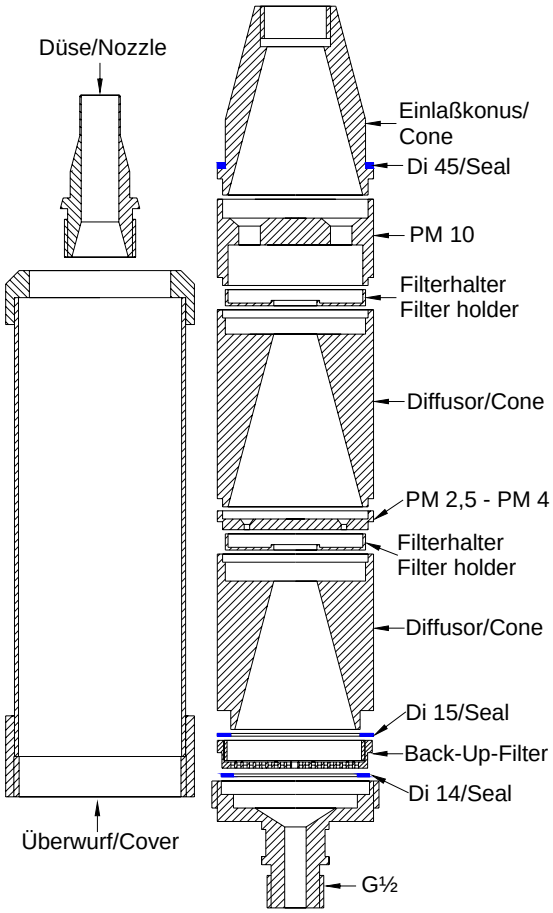
Due to the new standards of ambient air quality PM 10 and PM 2.5, these particle size fractions should also be measured in emissions as combustion and industrial processes are anthropogenic sources of particulate matter in ambient air.

Therefore, a sampling system for PM 10 / PM 2.5 IN-STACK measurements was designed and calibrated.

With the supplement PM 4 stage can be measured the fraction PM 4.

The exhaust gas is isokinetically sucked into the cascade impactor through a smooth cone like the plane-filter-device (VDI 2066 part 7) and the aerosol is fractionated in the particle size classes > 10 µm, 10 - 2.5 (or 4) µm and < 2.5 (or 4) µm.

Due to a relatively high volume flow (~ 3.2 m³/h, depending on exhaust gas conditions), sampling times are kept short (for dust concentrations of 10 mg/Nm³ only 30 min).



° The impactor can be connected to existing *Paul Gothe*-sampling or similar isokinetic sampling system

° Suitable design according to VDI 2066 Part 10 and European Guidelines (EN 13284-1) to minimize "wall losses"

° Modular construction; with future alterations of the guidelines the impactor can become supplement with other impactor stages and follow every new development

° Version:

1. Impact plate with *Munktell*-filter for particle with aerodynamic diameter >10 µm
2. Impact plate with *Munktell*-filter for particle with aerodynamic diameter 2,5 / 4 - 10 µm
3. Back-Up-Filter with *Munktell*-filter for particle with aerodynamic diameter < 2,5 / 4 µm.

° Easy and simple filter-change (like a normal plane-filter-holder)
Filter-modules can be changed without contamination problems

° Standard-Munktell quartz-fibre-filter MK 360 (Ø 50 mm) can be used or any similar plane filter.

° No corrosion or contaminations, because manufactured completely in Titanium

° The officially admitted impactor for the source emission control measurements in Germany

Publications:

° Gefahrstoffe-Reinhaltung der Luft 59 (1999), Nr.11/12, S. 449-453

° Jahresbericht '99 Landesumweltamt NRW
(http://www.lua.nrw.de/veroeffentlichungen/jahresberichte/1999/haupt1a.pdf)

The Johnas II operating conditions:

	Ø	min	max
dust concentration [mg/m³i.N.]	10	1	100
temperature [°C]	135	20	250
pressure [mbar]	1000	850	1100
chemical composition	Air		30 % CO_2
sampling port	Standard 3"		

Calibration-results of the university Duisburg of the effective cut-diameters (d(ae)50):

	$d_{(ae)50}$	deviation	acceptance US-EPA
PM 2,5-stage	2,53 µm	+ 1,2 %	+/- 8 %
PM 10-stage	9,95 µm	- 0,5 %	+/- 5 %
PM 4	4,0 µ m	0 %	+/- 5 %

The impactor has been conceived after the theory of Marple. The particulate matter is lent to a quite certain operating-condition. Unlike the tubular filter device, which is used for measurement the total dust content, the impactor does not permit free selection of the gas flow rate once the probe diameter has been established. On the contrary, the gas flow must be kept constant during the measurement. The evaluation of the gas flow rate and diameter of the nozzle can do easy with an in the delivery capacity enclosed *MS EXCEL*-data file. For special request regarding the particulate matter, can possibly work with adhesive agent on the collecting plates. Normally, this is not necessary. Plane filters are simply put into the filter holder. These filter holder can be conditioned with the plane filter and simply exchanged for the second measurement.

Particles > 15 µm can deposit partially in the cone. Measurement to determined PM 10 and PM 2.5 is very easy. It must only weighting two filter holders, no calculation necessary.

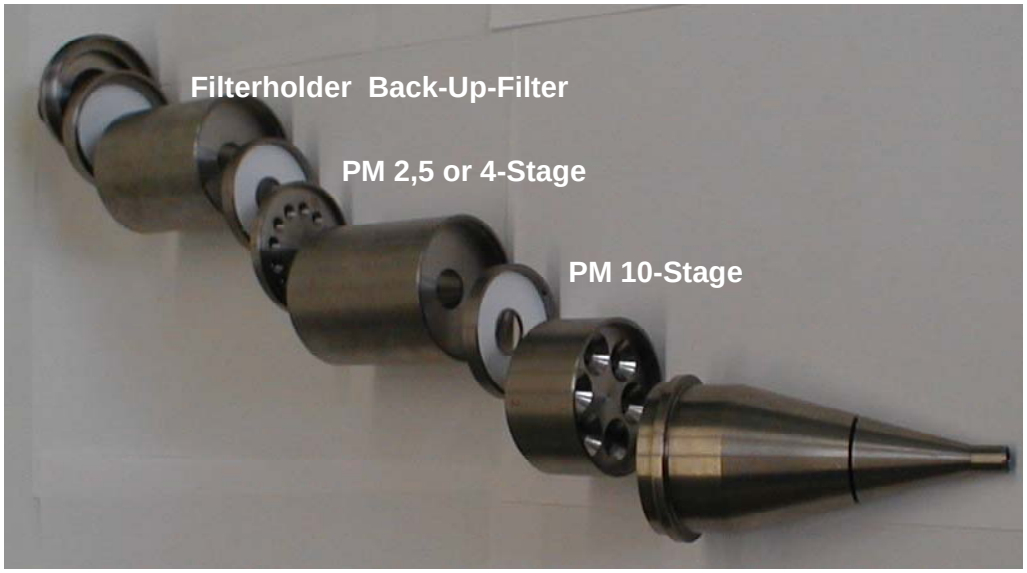
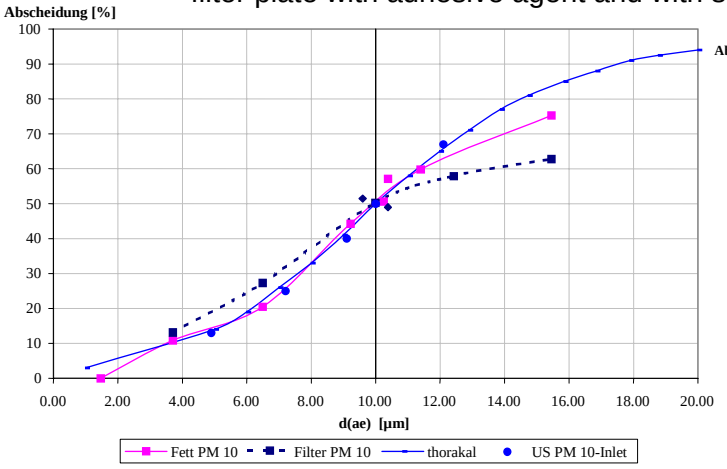
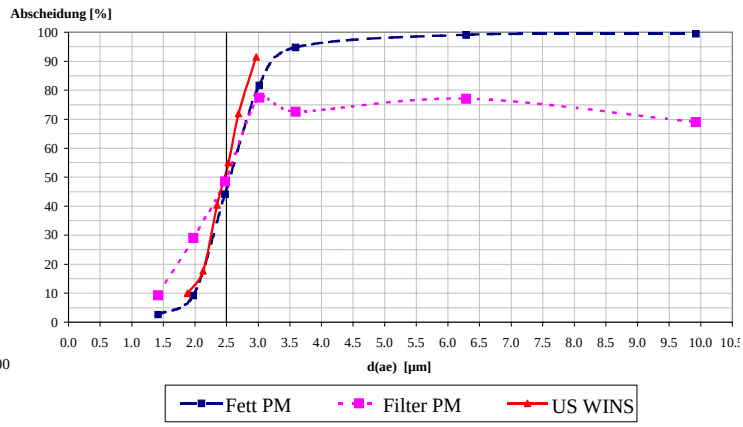


Figure:
Impactor Johnas 2

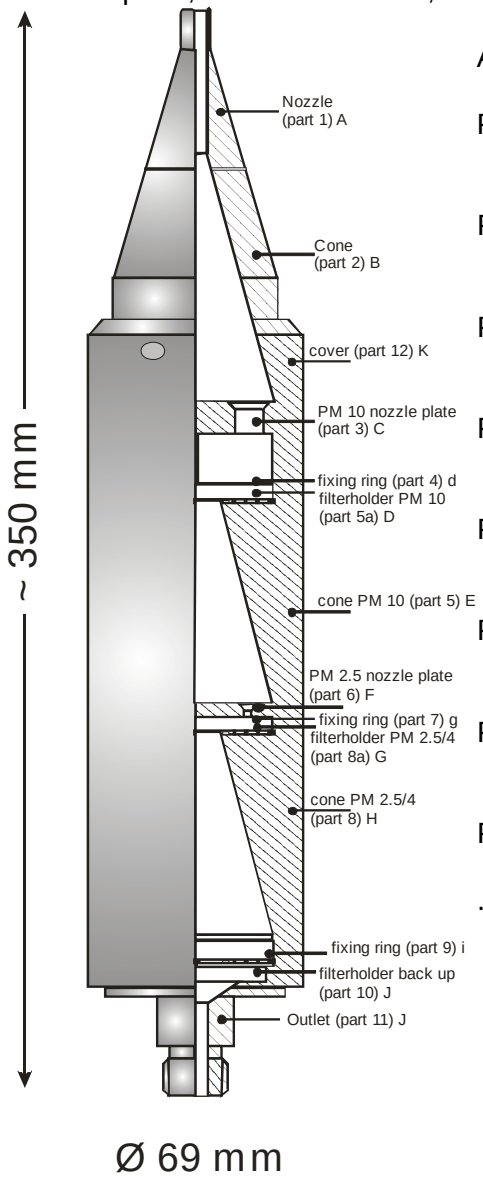
Figure: Effective particulate matter of the stage 2,5 and 10 µm GMU-Impactor. In the comparison, filter plate with adhesive agent and with standard *Munktell* plane filter.





60.0 GMU-**Cascade Impactor Johnas II complete**

14-parts, material: titanium, with one nozzle **Art..-No.: 60.01**



Additional parts for **Cascade-Impactor Johnas II**

Part 1: **Nozzle** (effective diameter can choose free)
Art.-No.: 1.02-T

Part 5a: **Filter holder PM** 10 (same as for PM 2.5)
Art.-No.: 60.06

Part 8a: **Filter holder PM** 2,5 (same as for PM 10)
Art.-No.: 60.06

Part 10: **Filter holder** for Back-Up-Filter (Ø 50 mm)
Art.-No.: 11.03-T

Part 13: **Stamping accessories:** PVC with titanium stamp Ø 18 mm, Art.-No.: 60.2

Part 14: **Glass-vessel** Ø 80 mm
Art.-No.: 27.03

Part 15: **Special bent for impactor**
Art.-No.: 2.01-TI

Part 6: PM 4 Stage
Art.-No.: 60.01-F-4

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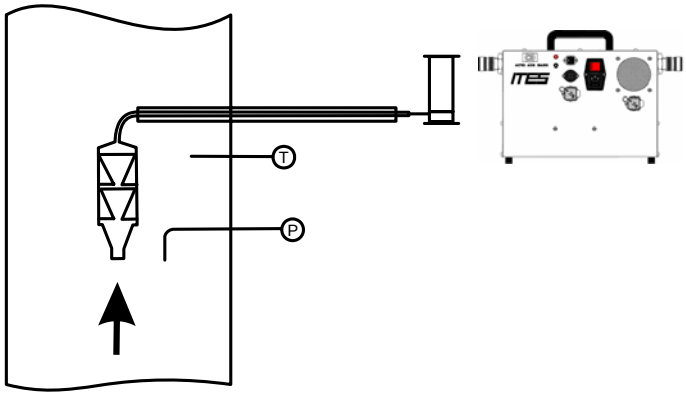
Complete equipment:
- Impactor with tree different nozzles (effective diameter can choose free),
- one additional filter holder for PM 10 and PM 2,5 stage and for Back-Up-Filter,
- 6 glass-vessels for plane filter,
- stamping accessories for plane filter,
- one spezial bent for he impactor
- 25 *Munktell*- quartz-fibre-filter MK 360 (Ø 50 mm),
- matching in a stable suitcase and suitcase for filter holder.

Art.-No.: 60.3

Example of complete samplig equipment:



see: Gefahrstoffe-Reinhaltung der Luft 59 (1999), Nr.11/12, S. 449-453

Jahresbericht '99 Landesumweltamt NRW: (http://www.lua.nrw.de/veroeffentlichungen/jahresberichte/1999/haupt1a.pdf)