PORTABLE ATOMIZER AEROSOL GENERATOR MODEL 3079A

OPERATION AND SERVICE MANUAL

P/N 6007492, REVISION A
JANUARY 2014

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OPERATION AND SERVICE MANUAL

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Contents

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Safety

The atomizer aerosol generator Model 3079A is an instrument for producing test aerosols with known properties (according to guideline VDI 3491) e. g., for filter testing and for validation of cleanrooms.

Appropriate aerosol substances are fluids, preferably DEHS and Emery 3004 (PAO) (size of the generated particles mainly in the range of 0.1 to 0.3 µm). Furthermore the device is applicable for generating latex or salt aerosols.

The Model 3079A is only applicable for generating droplet aerosols, not for dusts.

All responsibility regarding the handling of the aerosol substance and the application of the generated aerosols must be assumed by the user.

The implementation of appropriate safety precautions as well as the assessment of risk of biological substances is in the accountability of the user.

The user assumes full responsibility in case of the use of radioactive substances. (Applicable regulations for workplace risks according to Radiation Protection Ordinance and other appropriate regulations have to be followed.) The implementation of appropriate safety precautions as well as the assessment of risk of radioactive substances is in the accountability of the user.

Caution
Fire and explosion hazard! The apparatus must **NOT** be used in explosive environments and **NOT** with highly inflammable aerosol substances (pay attention to the data in the corresponding safety data sheet).

Caution
Please read this instruction manual carefully before using the device. TSI Inc. does not assume any liability for damages caused by improper operation, application, cleaning or use of unsuitable materials.

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1 Introduction

The Model 3079A Atomizer Aerosol Generator is an instrument for producing test aerosols with known properties according to German guideline VDI 3491. When DEHS is used as aerosol substance the instrument is suitable for use as verifying instrument in cleanrooms according to standards VDI 2083 and EN 14644. The generated particles are in the range of the Most Penetrating Particle Size (MPPS) between 0.1 and 0.3 µm and thereby guarantee a safe evaluation of high performance filters.

The design and implemented technological features guarantee the production of aerosols with constant particle size distribution and concentration with a high reproducibility.

The Model 3079A can also produce Latex or salt aerosols. In this case, a diffusion dryer Model 3062 is recommended to be used downstream of the aerosol generator in order to remove remaining water droplets or prevent their formation.

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2 Product Description

The Model 3079A Portable Atomizer Aerosol Generator is built for mobile use and has a very compact and rugged design. It can be operated with a minimum of other utilities, i.e., no compressed air supply is required.

Its design is focused on long life, high availability and robustness of the device.

The device is very suitable for cleanroom applications because it can easily be cleaned and disinfected.

All pressure tubes of the atomizer are protected by the sheet steel casing against any exposure from the outside. A pressure relieve valve protects the glass vessel.

Figure 1: Portable Atomizer Aerosol Generator Model 3079A with Adjustable Aerosol Flow Rate

The socket for the power supply, the On / Off Switch, and the flowmeter with needle valve for adjusting the aerosol flow rate are located at the front-side of the aerosol generator. To fill up the aerosol glass vessel, unscrew the lid and remove the vessel. The instrument will be ready for operation within a very short period of time.

A low-noise compressor produces the compressed air required for generating the aerosol. The air is cleaned by a HEPA-filter before it is introduced to the atomizer.

The aerosol flow rate can be adjusted in the range of 60…300 L/h. This way the particle production can be adapted to the corresponding application.

To adjust the aerosol flow rate of this model, use the needle valve on top of the flowmeter.

A pressure relief valve is integrated in the head of the atomizer to protect the glass vessel against excess pressure if the outlet is blocked.

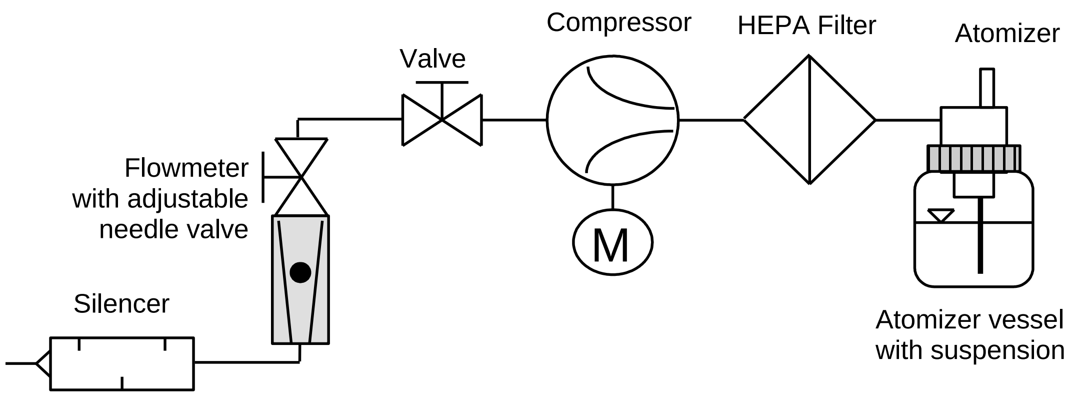

Figure 2: Schematic of the Model 3079A, Aerosol Flow Rate Adjustable

The newly developed atomizer is the key part of the Model 3079A (registered design GS 9408604.4). It is made of high-quality stainless steel and works as a two-stream nozzle, based on the injection principle. The unique feature is that the outlet points towards the wall of the glass vessel which works as the baffle plate. This particle impaction section removes coarse spray droplets and results in a particle size distribution mainly below 1 µm.

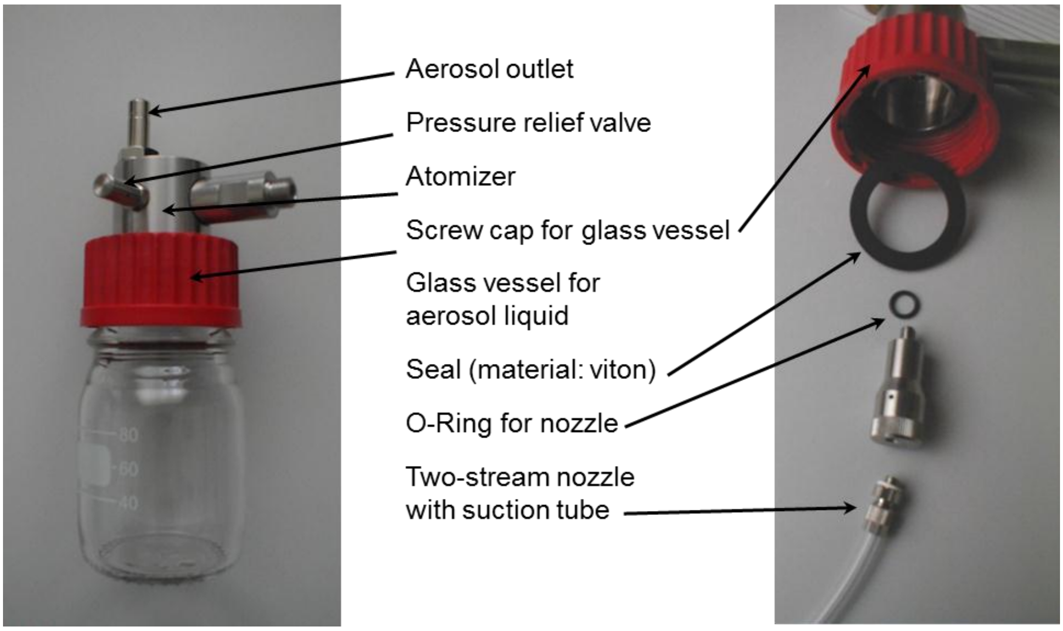

Figure 3: Components of the Atomizer

Adjusting the Particle Production Rate by Regulation of the Volumetric Flow Rate

The particle production rate of the Model 3079A is adjustable. This adjustment can be done with the integrated needle valve and will be shown on the flow meter.

Closing the needle valve will throttle the volumetric flow rate and the operating point of the Model 3079A will be altered. Lower volumetric flow rates will lead to a reduced particle production rate.

The following figure shows the correlation between the volumetric flow rate and the particle production rate.

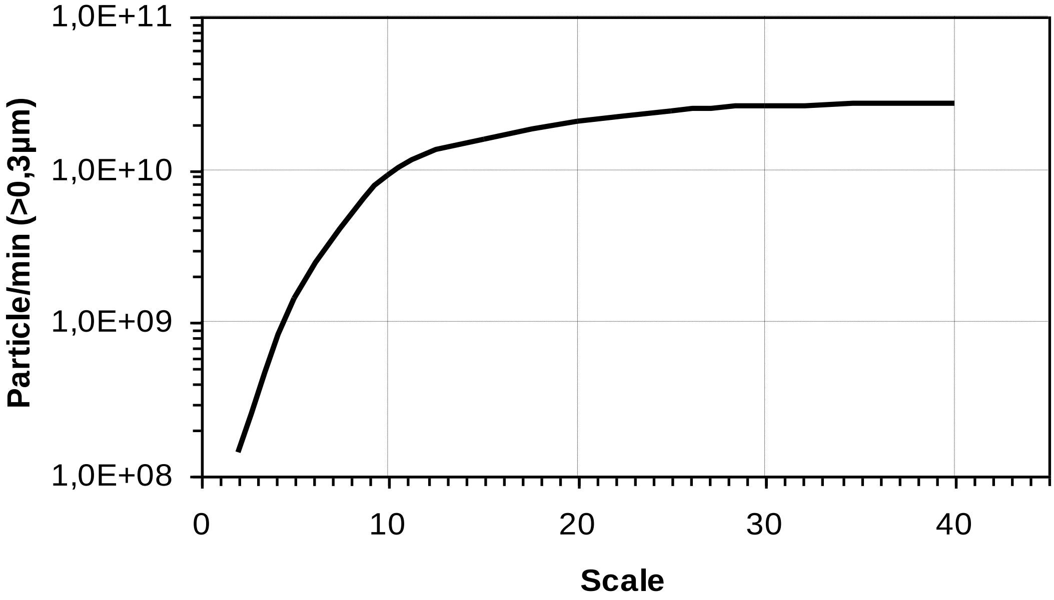

Figure 4: Correlation between Volumetric Flow Rate and Particle Production Rate

The particle production rate can be adjusted over a wide range of up to 300 times the minimum concentration. Over the whole concentration range a high accuracy and reproducibility is given.

3 Operation and Maintenance

Packing/Unpacking

Use the information in this chapter to unpack and set up the Model 3079A Portable Atomizer Aerosol Generator.

The packing list below shows the components shipped with the Model 3079A.

Qty	Description	Model/Part Number
1	Atomizer Aerosol Generator	3079A
1	Power cord	
1	Operation and Service Manual	6007492

If anything is missing or appears to be damaged, please contact TSI immediately.

C a u t i o n

Before using the instrument, remove the yellow protection cap from the aerosol outlet.

Operation

C a u t i o n

Before start-up make sure the aerosol outlet is open. During operation ensure that the produced aerosol can freely escape through tubes connected to the atomizer outlet and that there are no bends in the outlet tubes.

The needle valve at the flowmeter must not be closed completely.

The aerosol generator should be placed on a rigid and even surface.

The atomizer glass vessel can be unscrewed and removed in order to be filled with aerosol substance. For normal operation the volume of aerosol substance should be between 10 ml and 80 ml. A constant aerosol production is ensured up to a minimum filling level of 10 ml.

For power supply, connect the power cord to the standard socket. The generator has a standardized low-temperature device socket (IEC/EN 60320-1) as well as an integrated large range power supply unit.

To stop and start operation, press the power switch.

Transport

The Model 3079A can be transported using the attached handle. The design of the casing ensures safe carrying of the device.

Caution
Be careful when transporting the Model 3079A with filled liquid vessel. Liquid may run out via the aerosol outlet if the instrument is tilted too much.

Maintenance

The operation of the Model 3079A is maintenance free. Regular cleaning of the atomizer nozzle is recommended. To clean the atomizer nozzle, unscrew the atomizer nozzle and clean it in an ultrasonic bath or with compressed air. Avoid using sharp tools.

***Note**: After reassembling the nozzle, check the proper position of the O-rings.*

Changing the internal HEPA filter can be done by the user (see “Changing the Internal HEPA Filter” below).

Please contact TSI for all other service and maintenance.

Changing the Internal HEPA Filter

To change the internal filter cartridge, first open the Model 3079A. Follow these steps:

1. Unscrew the eight (8) screws at the sides of the casing with a Phillips screwdriver
2. Pull the aerosol generator casing from the chassis.
3. Remove the filter cartridge from the tubes and replace with a new one.

WARNING
Risk of electric shock. Disconnect power cord before opening.

***Note**: Contact TSI to get new filter cartridge. Do **NOT** use any other filter product.*

Reassembly of the casing is done in reverse order.

4 Troubleshooting

Error Message/Symptom	Problem	Recommendation
No aerosol	No aerosol substance	Check level of aerosol substance in atomizer vessel
Pump does not work	No power supply	Exchange of fine fuses
	Defect in the pump or power supply unit	Service
Flow rate by far lower than 300 L/h	Incorrect position of the atomizer glass vessel	Check correct position of glass vessel
	Flat gasket missing	Replace flat gasket
	Atomizer nozzle is blocked	Clean atomizer nozzle
	Pressure drop of the HEPA filter is too high	Change HEPA filter cartridge
Flow rate much higher than 300 L/h	Nozzle assembly may be leaking	Test for leaks

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5 Applications

Testing HEPA/ULPA Filters

A very important application for the Model 3079A is the testing of high efficiency filters, and the verification of cleanrooms and laminar flow boxes.

The produced aerosol was analyzed by extensive measurements by means of a Scanning Mobility Particle Sizer™ System; TSI Inc.). The resulting particle size distribution is shown in the following diagram.

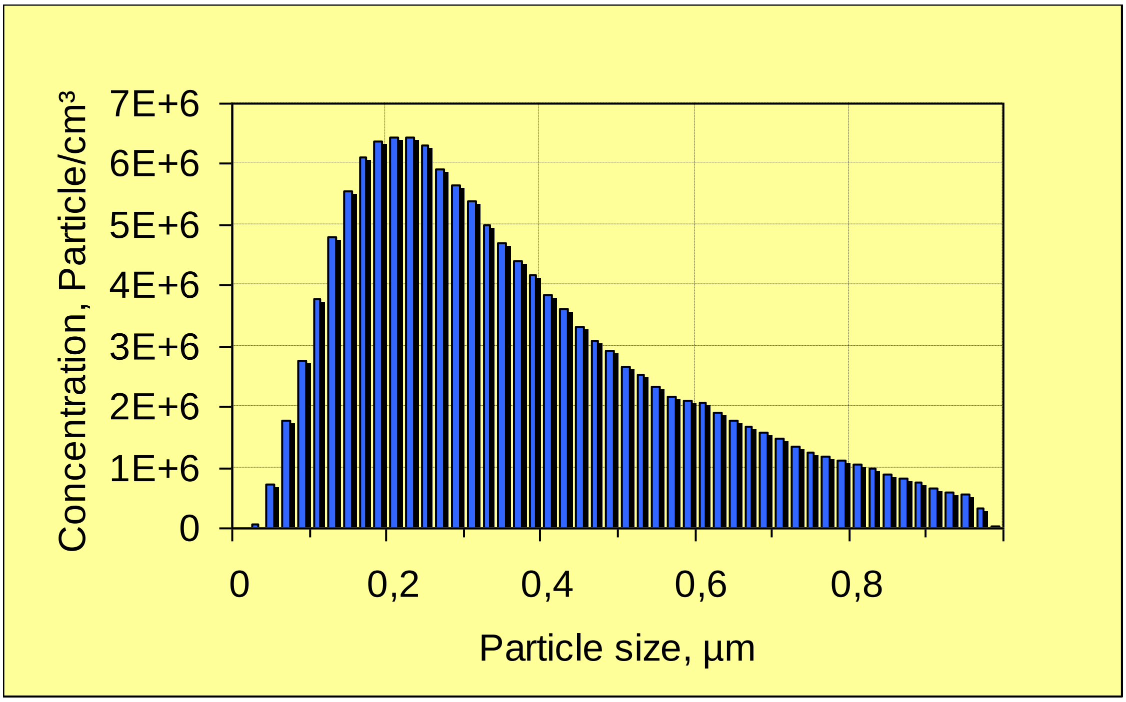

Figure 5: Particle Size Distribution of a DEHS Aerosol Measured by the Scanning Mobility Particle Sizer

The produced DEHS aerosols features very high particle concentration (>10^7 particles/cm^3) for particle sizes close to the so-called most penetrating particle size MPPS (0.1...0.3µm). The particle concentration is also sufficiently high ($1.5 \bullet 10^7$particles/cm^3) in the measuring range of most optical particle counters (0.3...0.5µm).

The following table shows the Model 3079A flow rates to adjust for various volumetric flow rates through systems at three different particle concentrations. The particle concentrations assumed here are well above the required concentrations as specified in the VDI 2083-3 and EN 14644-3 standards and thereby enable the determination of the optimum scanning velocity with a sampling probe from appropriate diagrams.

	Requested Particle Concentration in Test Aerosol, Particles/m³		
Particle Concentration in Total Flow	300 x 10^6 Particles/m^3	400 x 10^6 Particles/m^3	1000 x 10^6 Particles/m^3
Flow Rate Equipment, m^3/h	**Flow Rate Generator L/h**	**Flow Rate Generator L/h**	**Flow Rate Generator L/h**
50	**91**	**92**	**98**
100	**94**	**96**	**107**
200	**100**	**104**	**128**
300	**105**	**111**	**150**
600	**123**	**136**	**226**
700	**130**	**145**	**259**
800	**136**	**154**	**296**
900	**143**	**164**	
1000	**150**	**173**	
1200	**164**	**193**	
1500	**186**	**226**	
1600	**193**	**237**	
1800	**209**	**267**	
1900	**217**	**281**	
2000	**226**	**296**	
2200	**243**		
2500	**278**		
2800	**311**		

Calculation of the Particle Concentration in the Produced Test Aerosol

If other settings are requested, the formula shown below can be used to calculate the total concentration in the test aerosol.

By entering the flow rate of the Model 3079A Aerosol Generator and the total flow rate, the generated concentration in the test aerosol can be easily calculated as follows:

C_{total}	=	$\dot{V}_{AG}$	x	C_{AG}	/	$\dot{V}_{Unit}$
Particles/m^3		L/h		Particles/m^3		m^3/h

C_{total}	=		x	2.7 x 10^9	/	
C_{total}	=			Particles/m^3		

The conversion of the units has been considered in the formula.

Calculation for the Adjustment of Model 3079A Aerosol Volume Flow Rate

The following formula allows the calculation of the Model 3079A flow rate that needs to be adjusted in order to achieve a certain particle concentration in the test aerosol.

Entering the requested particle concentration and flow rate through the system will yield the flow rate that needs to be adjusted on the needle valve.

$\dot{V}_{AG}$	=	$\dot{V}_{Unit}$	**x**	C_{ges}	**/**	C_{AG}
L/h		m^3/h		Particles/m^3		Particles/m^3

$\dot{V}_{AG}$	=		**x**		**/**	2.7 x 10^9
$\dot{V}_{AG}$	=			L/h		

The conversion of the units has been considered in the formula.

PSL Aerosols

The Model 3079A Aerosol Generator makes it possible to produce PSL aerosols according to certain particle size standards.

For this purpose put a suitable latex suspension in the cleaned atomizer bottle. The concentration of the PSL suspension is determining the number concentration of the produced aerosol.

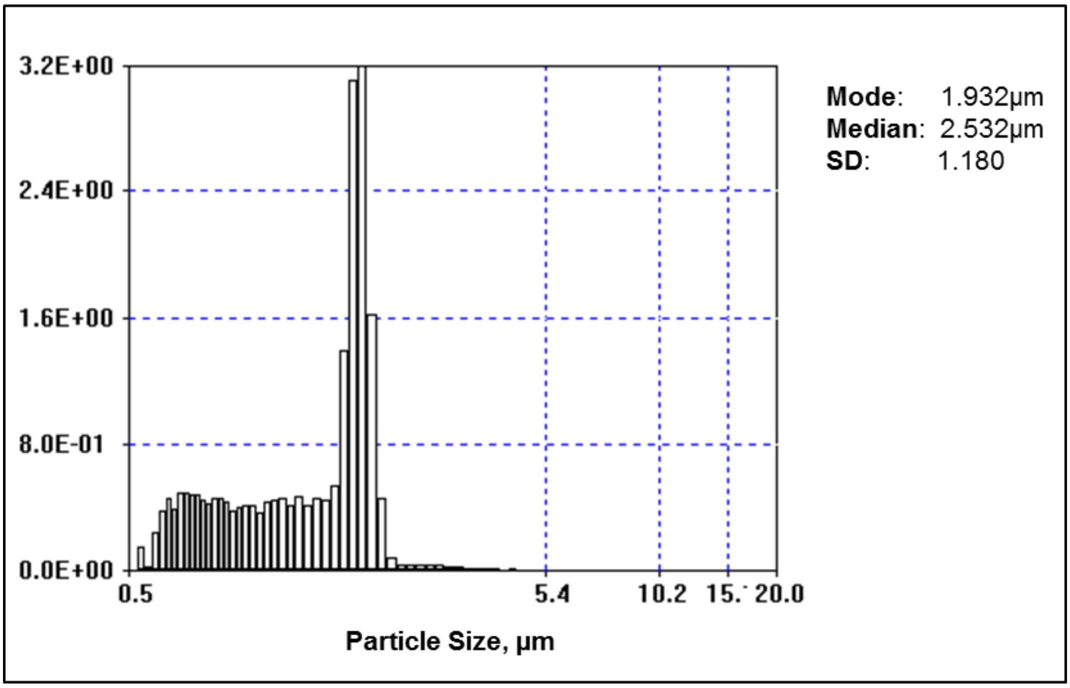

Figure 6: Measurement Results of a 2,02 µm PSL Aerosol

Production of PSL aerosols with the Model 3079A is possible up to particle sizes of 3 µm. Due to the excellent separation characteristics of the integrated baffle it is possible to prevent the formation of agglomerates.

Generation of Tracer Particles

The continuous and stable generation of particles is important when using optical methods for measuring flow velocities and distributions. The Model 3079A meets these requirements and makes it also suitable for tracer particle generation.

Generation of Salt Aerosols

The Model 3079A Atomizer Aerosol Generator is also suitable for salt aerosol production. The resulting particle size d_p depends on the droplet size generated by the atomizer d_d and can be varied by altering the salt solution concentration c according to the following equation:

$$d_p = d_d \sqrt[3]{c}$$

In the diagram below, a calculated particle size distribution for a salt solution with a concentration of 200 ppm (e.g. 200 mg NaCl/1l H_2O) is shown and compared with the droplet particle size distribution of water which has been characterized by means of the "residual technique."

The residual technique is very useful for characterizing droplet distributions of water, for instance, which evaporates very quickly under normal conditions. In this method the produced droplet aerosol is completely dried and the residual distribution is measured afterwards. From this residual distribution the droplet distribution can be recalculated using the given equation.

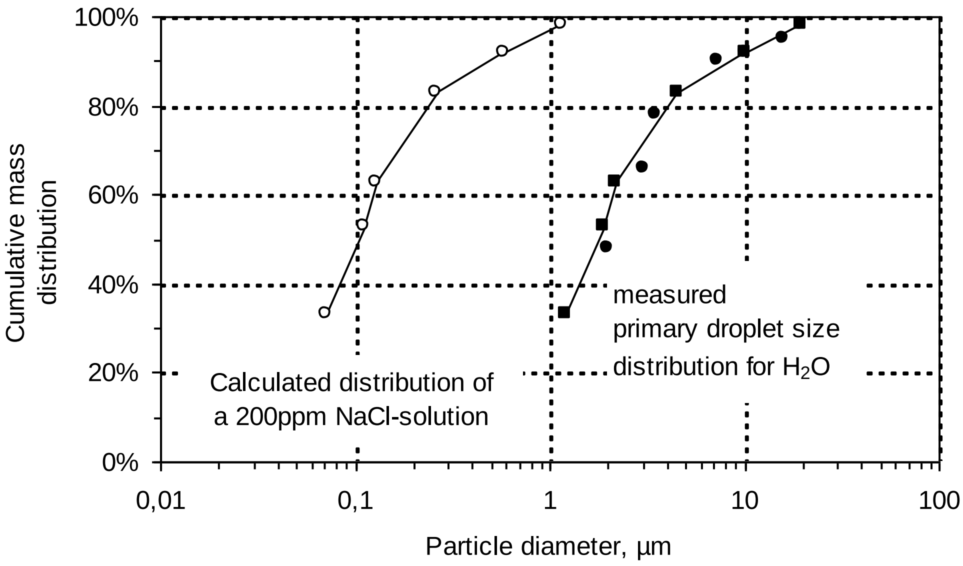

Figure 7: Recalculated Size Distribution

Note: *If liquids like water are atomized over longer periods (>1hour), the equipment connected to the Model 3079A cools down below the saturation temperature. In this case, droplets will inevitably condense again. It is recommended to use a diffusion dryer and heat the connected aerosol tubes for such applications.*

The following table gives an overview of the expected particle size depending on salt solution concentration and primary droplet size.

Concentration of Salt Solution		Residual Size for 1 µm Droplet	Residual Size for 5 µm Droplet
5.000%	50000 ppm	0.368 µm	1.842 µm
1.000%	10000 ppm	0.215 µm	1.077 µm
0.500%	5000 ppm	0.171 µm	0.855 µm
0.100%	1000 ppm	0.100 µm	0.500 µm
0.020%	200 ppm	0.058 µm	0.292 µm
0.010%	100 ppm	0.046 µm	0.232 µm
0.005%	50 ppm	0.037 µm	0.184 µm
0.001%	10 ppm	0.022 µm	0.108 µm

Applications

- Generation of very fine aerosols with particle diameters <100 nm
- Filter testing

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6 Specifications

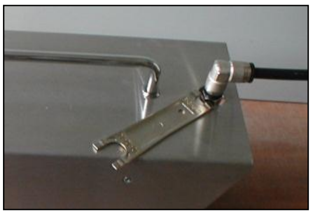
Instrument Specifications

Flow rate	max. 300 L/h
Temperature range	10°C ... 30°C
Max. counter pressure	20kPa (0.2bar)
Opening pressure of the relief valve	max. 90 kPa (0.9 bar) (see certificate of instrument testing)
Aerosol substances	DEHS, Emery 3004 (PAO), Paraffin, PSL, Salt solutions
Filling amount	min. 10 ml, max. 80 ml
Aerosol outlet	Quick connector, ∅ 8 mm
Device fuse	fuse ∅5x20 - 2A fast-acting
Power supply	100 ... 240 V AC
Dimensions	300 x 120 x 195 mm
Weight	4.8 kg

Specification of Generated DEHS Aerosol at Flow Rate of 250 L/h

Number concentration	$>10^{8}$ particles/cm^3
Number concentration (0.2 µm)	2×10^{7} particles/cm^3
Number concentration (0.5 µm)	5×10^{5} particles/cm^3
Number concentration (1 µm)	1×10^{5} particles/cm^3
Number concentration (class 0.3 … 0.5 µm)	1.5×10^{7} particles/cm^3
Number concentration (class 0.5 … 1.0 µm)	8×10^{6} particles/cm^3
Peak diameter (mode)	0.1 ... 0.5 µm
Mass flow rate	2.5 g/h
Max. continuous operation time	≈ 25 h (with 80 ml aerosol substance in vessel)

Accessories

Atomizer glass vessel	
Model 3062 Diffusion Dryer, direct connection to Model 3079A Aerosol Generator possible for generation of salt or PSL-aerosols	
Quick-release tube connectors, straight or 90° (with mounting tool)	
Model 3332 Dilution System for a defined aerosol dilution, suitable to verify test aerosols using particle counters (test of cleanrooms, laminar flow boxes, safety benches according to EN 14644 and VDI 2083-3)	

7 Appendix

Periodic Testing of Particulate Matter Air Filters in Cleanroom Equipment

In this chapter recommendations are given on how to efficiently combine various TSI instruments to one test unit. Especially the aerosol generators Model 3079 and Model 3079A, the Model 3332 dilution system the isokinetic sampling probe SYS 529 and the particle counter have been successfully combined in the past for testing laminar flow boxes, safety work benches, and smaller cleanrooms. All recommendations are based on the Standards EN 14644-3 and VDI 2083, sheet 3 for testing particulate matter air filters.

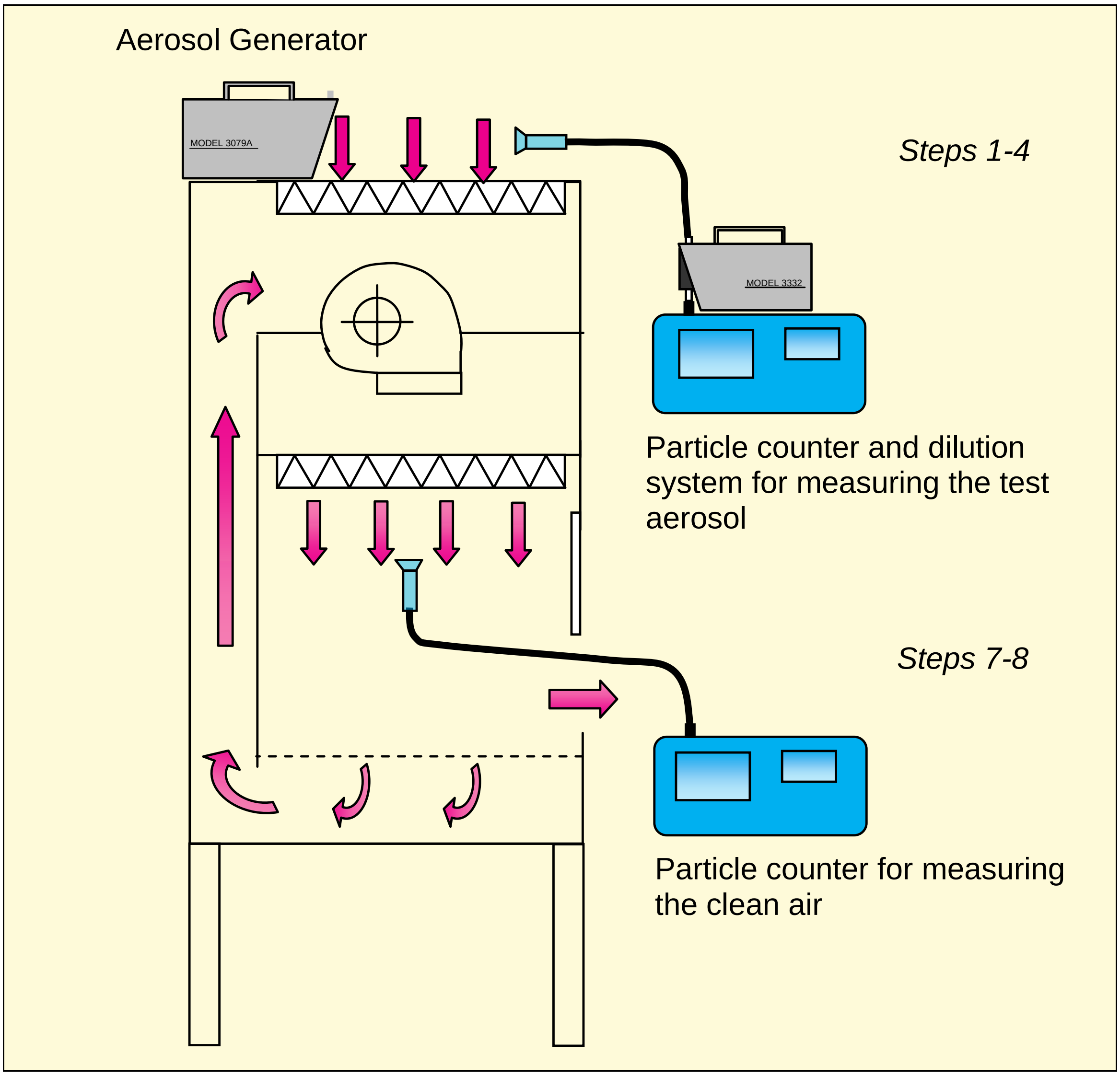


Figure 8: Applications for TSI Instruments

Using a test aerosol with a defined number of particles is the basis for checking the quality of the filter. In Germany this test procedure defines a minimum particle concentration of 10^6#/cf according to VDI standard 2083. This particle number concentration enables a leak detection on an acoustical basis because commonly used cleanroom particle counters feature a beep tone when a particle is detected. Particle concentrations exceeding a critical value will cause a continuous beep signal. This way filters with separation efficiencies according H13 and H14 can be tested. Leaks can easily be located by scanning the downstream filter.

In order to measure the particle concentration of the test aerosol commonly used, cleanroom particle counters require a dilution with a defined factor. The Model 3332 dilution systems have been developed especially for this application.

The possibility of aerosol flow rate and concentration adjustment with the Model 3079A in combination with the Model 3332 dilution system enable measurements of the particle number concentration of the test aerosol with a high degree of accuracy.

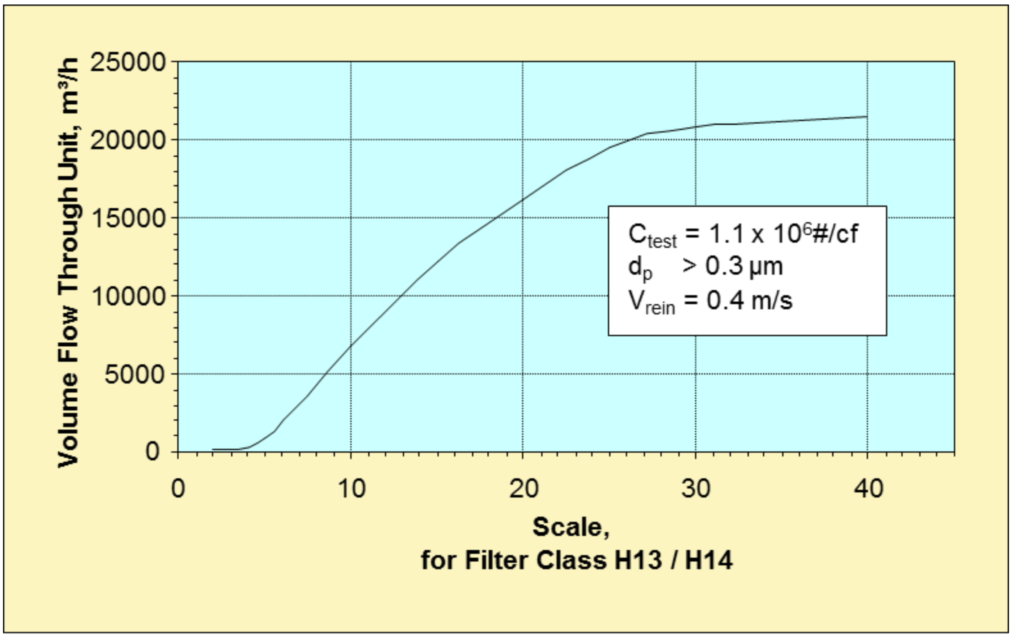


Figure 9: Range of Volume Flow of the Model 3079A Aerosol Generator

Assuming this raw air particle concentration C_{test} the Model 3079A can be used:

- with volumetric flow rates of safety work benches from 75 to 21,000m³/h
- for a filter area from 0.05 to 14.5m² (based on an downstream aerosol velocity of 0.4m/s).

Recommendations for Carrying out the Leak Test with only one Particle Counter (Figure 8)

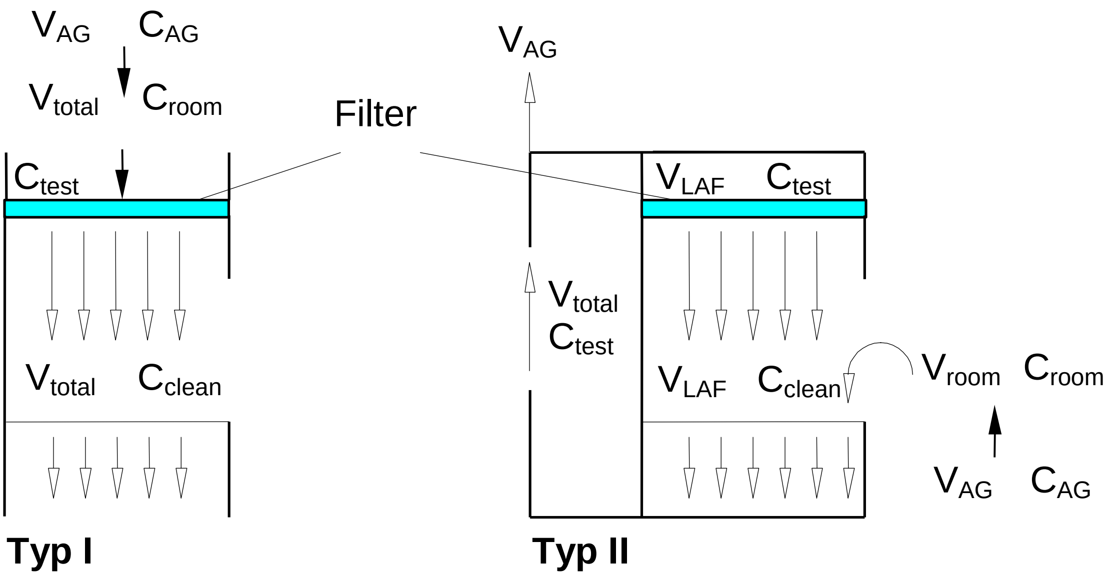
1. Connect the Model 3079A Atomizer Aerosol Generator to the test aerosol inlet or put the outlet of the aerosol generator at the inlet of the to be tested unit, set up the particle counter to the dilution system DIL, connect the point of aerosol sampling with the dilution system inlet, adjust the dilution system while the particle counter is operating.
2. Start up the aerosol generator and set the requested aerosol flow rate by using the above diagram (Figure 9).
3. Adjust the particle number concentration of the test aerosol to >10^6#/cf by setting the aerosol flow rate of the aerosol generator (a 1cfm particle counter will count >10,000#/min).
4. Measure the particle number concentration of the test aerosol 3 times per minute (using a dilution system Model 3332).
5. Switch off the particle counter, remove tube from the aerosol sampling point and blank off, continue to operate the aerosol generator.
6. Connect isokinetic sampling probe SYS 529 with absolute filter to particle counter, switch on particle counter and operate until no more particles are detected, switch off pump.

7. Remove absolute filter from isokinetic sampling probe SYS 529, put probe underneath the filter to be tested, switch on the pump, carry out leak test and clean air measurement.
8. Switch off the aerosol generator; blank off aerosol inlet of the tested unit.
9. Summarize the results in a report.

The scanning velocity for the leak test depends on the filter outlet velocity, the cross-section dimensions of the sampling probe, and the particle concentration of the test aerosol.
It is shown in the diagram in Figure 10 for one of the rectangular TSI sampling probes (according to DIN EN ISO 14644).

Estimating the Particle Concentration of the Test Aerosol

Calculation Formula for Two Types of Laminar Flow Boxes



For both types of laminar flow boxes the particle number concentration in the air can be calculated with formula (1). The particle number concentration of the surrounding air is neglected in this formula.

$$C_{test} = \frac{\dot{N}_{AG}}{\dot{V}_{total}} = \frac{C_{AG}\,\dot{V}_{AG}}{\dot{V}_{total}} \qquad (1)$$

If the particle number concentration of the surrounding air is to be considered, other formulas for the two types of laminar flow boxes must be used [formula (2) and (3)].

Model I:

$$C_{test} = \frac{\dot{N}_{AG} + \dot{N}_{room}}{\dot{V}_{total}} = \frac{C_{AG}\,\dot{V}_{AG} + C_{room}(\dot{V}_{total} - \dot{V}_{AG})}{\dot{V}_{total}} \qquad (2)$$

Model II:

$$C_{test} = \frac{\dot{N}_{AG} + \dot{N}_{room}}{\dot{V}_{LAF}} = \frac{C_{ATM}\dot{V}_{AG} + C_{room}(\dot{V}_{room} - \dot{V}_{AG})}{\dot{V}_{LAF}} \qquad (3)$$

Aerosols Produced by the Aerosol Generator (no dilution)

	Particle/cm^3	Particle/cf
Number concentration (total)	>10^8	$2.8 \cdot 10^{12}$
Number concentration (fractions 0.3 … 0.5µm):	$5 \cdot 10^5$	$1.4 \cdot 10^{10}$
Number concentration (fractions 0.5 … 1.0µm):	$3 \cdot 10^5$	$8.5 \cdot 10^9$

Example

Laminar flow box type II
V_{LAF} = 600 m^3/h
V_{LAF} = 70% V_{total} = 0.7 V_{total}
V_{room} = 30% V_{total} = 0.3 V_{total}
C_{room} (0.5 µm)= 3.5 Particle/cm^3 (cleanroom standard 100000
→ US-Fed.Std. 209D or in Germany: VDI2083)
C_{AG} (0.5 … 1.0µm) = $3 \cdot 10^5$ Particle/cm^3
V_{AG} = 250 L/h = $250 \cdot 10^3$ cm^3/h

Considering the allowed particle number concentration in the surrounding air, the particle concentration in the produced aerosol will be calculated as follows:

$$c_{test} = \frac{\dot{N}_{AG} + \dot{N}_{room}}{\dot{V}_{LAF}} = \frac{C_{AG}\dot{V}_{AG} + C_{room}(0.3\dot{V}_{total} - \dot{V}_{AG})}{\dot{V}_{LAF}}$$

$$C_{test} = \frac{8 \cdot 10^6 \frac{\text{Particle}}{\text{cm}^3} 250 \cdot 10^3 \frac{\text{cm}^3}{\text{h}} + 3.5 \frac{\text{Particle}}{\text{cm}^3}(0.3 \cdot 600 \cdot 10^6 - 250 \cdot 10^3)\frac{\text{cm}^3}{\text{h}}}{600 \cdot 10^6 \frac{\text{cm}^3}{\text{h}}}$$

$$C_{test} = 3334 \frac{\text{Particle}}{\text{cm}^3} = 9.4 \cdot 10^7 \frac{\text{Particle}}{\text{cf}}$$

If the surrounding air is considered, the produced test aerosol concentration is calculated as 126 Particles/cm^3 ($3.6 \cdot 10^6$ Particles/cf); whereas, without it, the concentration is 125 Particles/cm^3. This example shows that it is acceptable to neglect the particle number concentration in the surrounding air and apply formula (1).

Used Symbols and Indices

Symbol	Description
C	Particle number concentration
V	Dilution factor
$\dot{V}$	Volumetric flow rate
$\dot{N}$	Aerosol flow rate (aerosol generator)
AG	Aerosol generator
LAF	Laminar flow box
room	Surrounding air
test	Test aerosol
total	Total volumetric flow rate
clean	Clean air

Diagram for Determining the Scanning Velocity when using a Rectangular Probe
(Dimensions WP/DP=max. 6:1 according to
EN ISO 14 644, Probe WP=80 mm; DP=15 mm; air velocity 0,45 m/s)

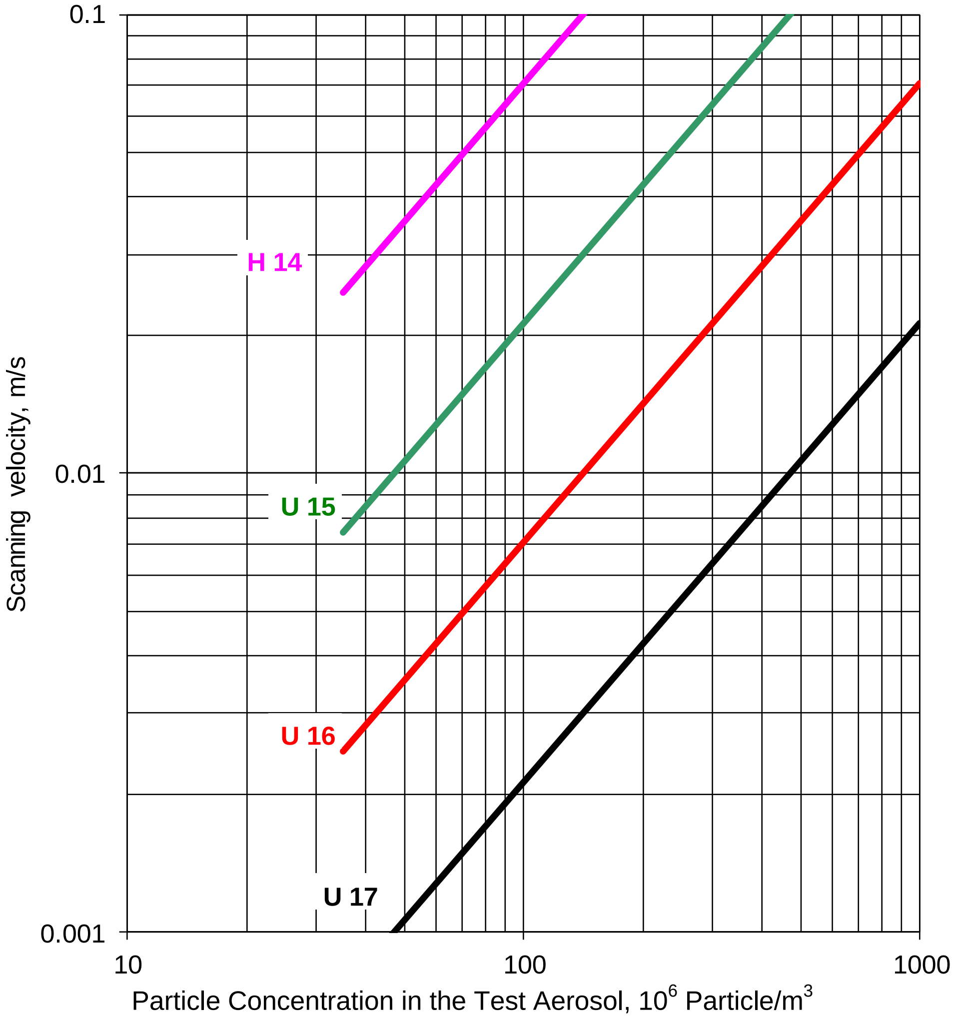
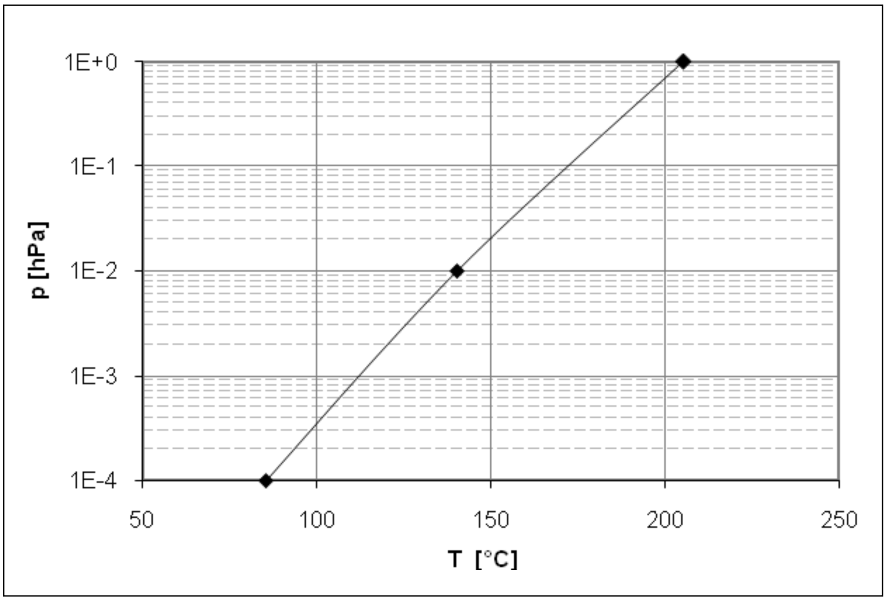


Figure 10: Scanning Velocity for Rectangular Sampling Probe

Physical Data of DEHS

Name	Di ethyl hexyl sebacate
CAS-No.	[122-62-3]
Formula	$C_{26}H_{50}O_4$
Molar mass	426.69 g/mol
Dynamic viscosity	0.023 Pa s
Kinematic viscosity	25.16 mm^2/s
Density	0.912 kg/cm^3 (DIN 51757)
Melting point	225 K (-48 °C) (ISO 3016)
Boiling point	525 K (252 °C) (DIN 51751)
Vapor pressure (293 K)	<1 Pa
Flash point	>473 K (>200 °C) (ISO 2592)

Refractive index	Wavelength, nm
1.450	650
1.452	600
1.4535	550
1.4545	500
1.4585	450



Vapor Pressure of DEHS vs. Temperature

Physical Data of Emery 3004

Name	Polyalphaolefin (Poly(1-decene), hydrogenated)
CAS-No.	[68649-12-7]
Formula	$[-CH_2CH[(CH_2)_7CH_3]-]_n$
Density	0.819 kg/cm^3
Dynamic viscosity	0.014 Pa s
Boiling point	474 K (201°C)
Refractive index	1.455

Life Time of Aerosol

Droplet diameter, µm	Life Time of	
	Water	DEHS
0.1	2 µs	84 min
0.3	73 µs	4 h
1.0	1 ms	57 h
3.0	7 ms	16 d
10.0	80 ms	160 d

Values for 20°C.

Characteristics of the Model 3079A

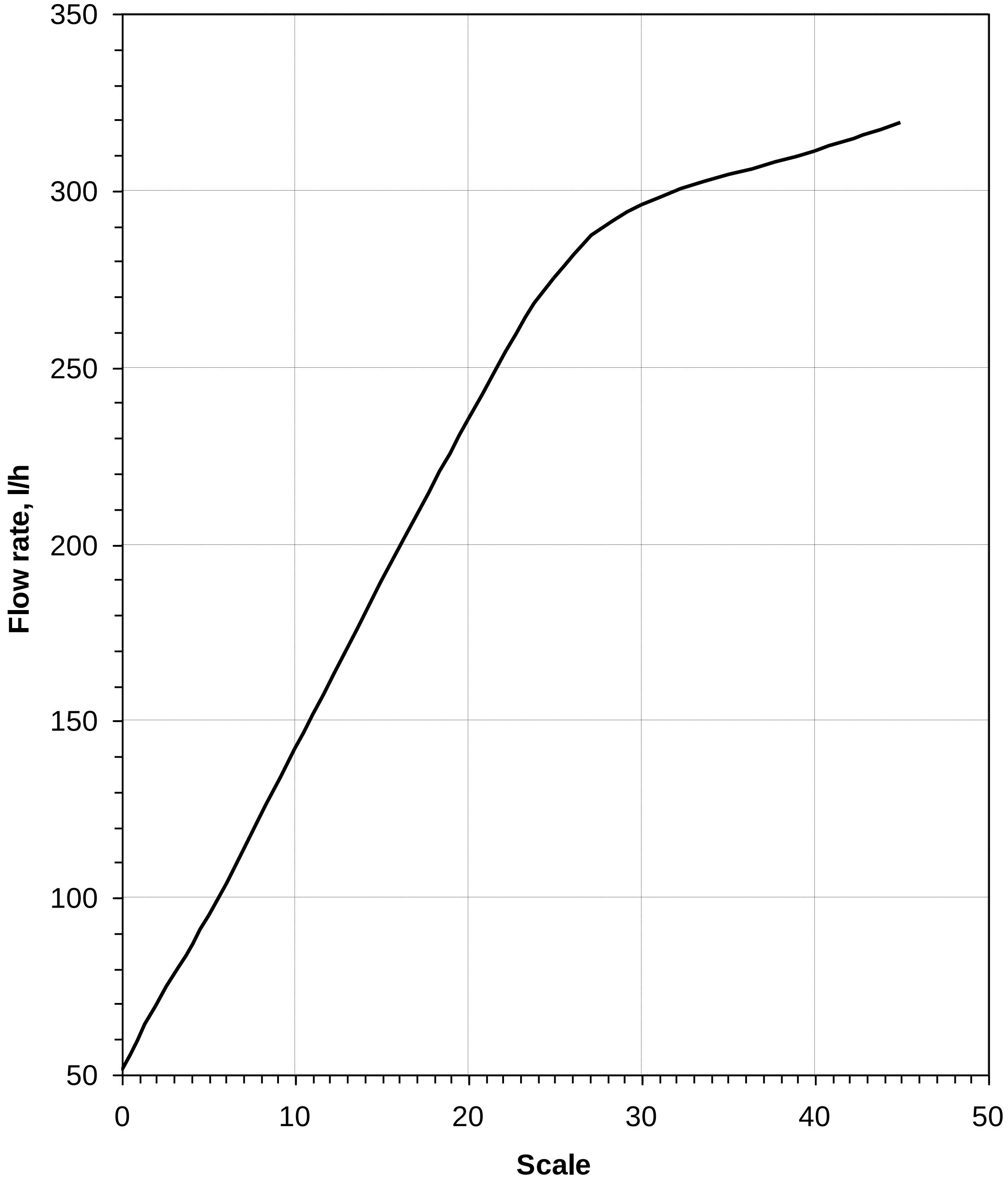
Depending on the volume flow of the Model 3079A specified by the selected valve position, the following performance characteristics have been determined to be seen in the table. The values were determined with the substance DEHS and a particle counter, measuring range 0.3 to 20 µm.

Flow rate		Generation of particles > 0.3 µm					sufficient for	
			0.3 to 0.5 µm	0.5 to 0.7 µm	0.7 to 1.5 µm	>1.5 µm	Filter area of	Volume flow of
L/h	SKT	#/min	%	%	%	%	m²	m³/h
310	40	$2.65 \cdot 10^{10}$	52.26	25.38	19.82	2.53	13.6	19600
295	30	$2.58 \cdot 10^{10}$	52.48	25.23	19.74	2.55	13.3	19200
275	25	$2.42 \cdot 10^{10}$	52.33	25.19	19.97	2.51	12.4	17900
235	20	$2.04 \cdot 10^{10}$	51.49	25.27	20.60	2.65	10.3	14900
190	15	$1.58 \cdot 10^{10}$	49.66	25.28	22.12	2.94	7.7	11100
142	10	$9.27 \cdot 10^{9}$	46.74	24.98	24.33	3.94	4.2	6100
95	5	$1.44 \cdot 10^{9}$	39.91	23.46	29.27	7.36	0.6	800
70	2	$1.43 \cdot 10^{8}$	36.83	22.66	31.48	9.03	0.05	75

The Model 3079A can cover a wide particle production range. From the above table it can be seen that the maximum concentration is up to 300 times the minimum concentration.

For calculations regarding the verification of laminar flow boxes a filter outlet velocity of 0.4 m/s and a particle concentration of $1.2 \cdot 10^{6}$ #/cf was assumed. Only particles of the size 0.3 to 0.5 µm were taken into consideration.

Flowmeter Calibration



Disposal of End-of-Life Equipment

End-of-life equipment has to be decontaminated in an appropriate professional manner.

Disposal must be handled according to legal provisions especially for electrical and electronic equipment as well as according to special local regulations and recycling instructions.

Waste electrical and electronic equipment can be returned to the manufacturer only with an attached completed declaration of decontamination. TSI does not cover shipping costs.

EC Declaration of Conformity

TOPAS®

ATOMIZER AEROSOL GENERATOR ATM 226

EG-Konformitätserklärung

Hiermit erklären wir, dass der oben bezeichnete Aerosolgenerator in der von uns in Verkehr gebrachten Ausführung folgenden EG-Richtlinien entspricht.

Maschinenrichtlinie 2006/42/EG vom 17.5.2006
Angewandte harmonisierte Normen: EN ISO 12100:2010

Richtlinie Elektromagnetische Verträglichkeit 2004/108/EG vom 15.12.2004
Angewandte harmonisierte Normen: EN 61000-6-1:2007
EN 61000-6-3:2007

Die Schutzziele der Niederspannungsrichtlinie wurden gemäß Anhang I, Nr. 1.5.1 der Maschinenrichtlinie eingehalten.
Bei einer mit uns nicht abgestimmten Änderung am Gerät verliert diese Erklärung ihre Gültigkeit.

EC Declaration of Conformity

We confirm that the conception and the design of the aerosol generator meet the requirements of the following guidelines of the European Community (EC).

EC-Directive machinery 2006/42/EG (17 May 2006)
Harmonizing standards: EN ISO 12100:2010

EC-Directive for electromagnetic compatibility 2004/108/EG (15 December 2004)
Harmonizing standards: EN 61000-6-1:2007
EN 61000-6-3:2007

The safety objectives of the Low Voltage Directive in accordance with Annex I, No. 1.5.1 of the Machinery Directive are satisfied.
This declaration is no longer valid if the device has been modified without a written permission of the Topas GmbH.

Topas GmbH Dresden, 05. 03. 2013

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Geschäftsführer
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