Applications

Many applications require a test aerosol, i.e. an aerosol whose relevant properties for each use are known and which features a corresponding reproducibility and consistency (VDI 3491-1). Some typical examples of these applications are described below.

Aerosol Research

Atomizer aerosol generators are used in various fields of aerosol science, for example for inhalation studies, toxicology experiments or environment characterization.

Calibration of Measuring Instruments

The droplet size and output concentration of ATM aerosol generators makes them suitable for dispersing PSL size standards for instrument calibration (particle sizers, optical particle counters and photometers).

Filter Testing

Product quality assurance and safety aspects require regular testing of high-efficiency filters, certification of laminar air flow boxes and clean room measurements in general.

For this purpose a suitable test aerosol needs to be generated as atmospheric aerosols or ambient air do not have stable particle size or concentration. VDI-guideline 3491 suggests using aerosol generators to produce test aerosols in a definite manner.

Aerosol generators of the ATM series produce highly concentrated aerosols, whose mean particle size is close to the most penetrating particle size (MPPS). This enables leak locations to be found in a quicker time.

Using an oil aerosol material (DEHS, PAO (Emery 3004)) provides long term stability.

Flow Visualization

Particles of known size and material are introduced into the measuring zone in order to optically measure flow velocity and profile. Atomizer aerosol generators are well suited to generate such tracer particles.
Standard Generators
ATM 210, 220, 226, 230

Device Designs
Depending on the application the individual device models differ in their technical implementation of this operating principle.

The ATM 220 is powered by compressed air and is therefore particularly suitable for use in the lab or on the filter test stand.

The ATM 226 has an internal compressor, thus being suitable for mobile use for example for validation measurements in clean rooms. The stainless steel casing can be cleaned very easily.

The ATM 210 is pressure tight. With this device, mainly compressed air filters are tested under real operating pressure.

The ATM 230 is also operated with compressed air, but has a ten times higher particle production rate in comparison with the ATM 220.

The devices ATM 221 and ATM 231 are designed as "Laskin version", which allows a very accurate and reproducible adjustment of the aerosol generation for very low mass flows. Here, the ATM 221 works with a two-substance nozzle in submerged operation, the ATM 231 with a Laskin nozzle.

Applications
The generators of the ATM series generate test aerosols according to VDI guideline 3491, and feature stable and reliable operation. The generators facilitate atomizing various oily liquids, e.g. DEHS, PAO (Emery 3004) or paraffin oil (Shell Ondina). Alternatively, salt aerosols and latex aerosols (PSL) can be generated.

Operating Principle
The essential part of the aerosol generators is a patented atomizer completely made of stainless steel, which has been developed by Topas. It works as a two-substance nozzle based on the injection principle and is combined with a baffle placed close to the spray outlet. This integrated particle impaction section removes coarse spray droplets and results in a submicron particle size distribution.

Alternatively, these aerosol generators can be operated in the Laskin mode, meaning the nozzle is dipped into the test liquid. This results in significantly reduced particle production rates at almost unchanged particle size distribution.

Principles of pneumatic atomizers
(Taking into account the VDI 3491-2, preliminary draft 2013)
1 Dispersion gas volume flow
2 Aerosol
3 Two-substance nozzle
4 Baffle
5 Feed tank

(Liquid reservoir)

Two-substance nozzle, open operation, with baffle as separator (ATM 210, ATM 220, ATM 226, ATM 230)
Two-substance nozzle, submerged operation, with liquid as separator (ATM 221)
Aerosol Generators for
High Particle Production Rates
ATM 241

Aerosol Generators for Higher Mass Throughputs

Very high aerosol production rates can be realised with the aerosol generators of the ATM 241 series. The aerosol flow rate of these generators is adjustable by setting the nozzle operation pressure and switching the number of nozzles (1 to 4 nozzles). The big liquid reservoir enables long term operation. For safety reasons a protection valve is included in each generator.

Operating Principle

For the ATM 241 series, a new nozzle type has been developed (patented). Compressed air is blown through a thin ring slit into the liquid to be nebulised. Shear forces acting between air jet and the liquid at the circumference of this so-called ring slit nozzle form the droplet aerosol. The resulting aerosol stream is fed directly into the aerosol liquid (Laskin-mode). Inertial effects prevent big droplets from leaving the liquid.

Compressed air

Nozzle gap

Venturi effect causes droplets to be taken up by air stream

Larger particles are retained in the liquid

Feed pipe and nozzle holder

Principle of slit nozzle of ATM 241

More than 10 hours of nonstop operating time is provided by the huge liquid reservoir. The atomizers are made of materials resistant against corrosive liquids. The liquid level can easily be checked at the indicator outside the generator or at a dipstick.
### Specifications of Atomizer Aerosol Generators

<table>
<thead>
<tr>
<th>Specification</th>
<th>210</th>
<th>210/H</th>
<th>220</th>
<th>221</th>
<th>226</th>
<th>230</th>
<th>231</th>
<th>241</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compressed air supply</td>
<td>max. 1500 kPa (15 bar)</td>
<td>max. 800 kPa (8 bar)</td>
<td>max. 250 kPa (2.5 bar)</td>
<td>Built-in Compressor</td>
<td>max. 800 kPa (8 bar)</td>
<td>max. 250 kPa (2.5 bar)</td>
<td>max. 800 kPa (8 bar)</td>
<td></td>
</tr>
<tr>
<td>Counter-pressure</td>
<td>10 bar</td>
<td>10 bar</td>
<td>200 mbar</td>
<td>200 mbar</td>
<td>200 mbar</td>
<td>200 mbar</td>
<td>200 mbar</td>
<td>12 mbar</td>
</tr>
<tr>
<td>Filling volume</td>
<td></td>
<td></td>
<td>10...80 ml</td>
<td>0.1...0.5 l</td>
<td>0.1...0.5 l</td>
<td>4.7...8.0 l</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flow rate</td>
<td>50...250 l/h</td>
<td>500...2500 l/h</td>
<td>50...140 l/h</td>
<td>70...300 l/h</td>
<td>500...2500 l/h</td>
<td>800...1700 l/h</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mass flow</td>
<td>max. 2.0 g/h</td>
<td>max. 20 g/h</td>
<td>max. 2.0 g/h</td>
<td>max. 0.6 g/h</td>
<td>max. 2.5 g/h</td>
<td>max. 20 g/h</td>
<td>max. 3.5 g/h</td>
<td>max. 240 g/h</td>
</tr>
<tr>
<td>Aerosol materials</td>
<td>DEHS, PAO (Emery 3004), DOP ¹, salt solutions (not for ATM 210 and ATM 210/H), paraffin oil, PSL etc.</td>
<td></td>
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</tbody>
</table>

¹ In the Globally Harmonised System (GHS), DOP is classified as a hazardous substance. DEHS or PAO (Emery 3004) are recommended as a replacement for DOP.

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Particle size distribution of a DEHS aerosol measured by the Scanning Mobility Particle Sizer system in the size range 0.15 µm to 1 µm.

QMS certified to DIN EN ISO 9001.

For more information please visit our website at www.topas-gmbh.de

Specifications are subject to change without notice.

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