

## NanoAerosol Generator

### Model 3250

NanoAerosol Generator Model 3250 is a pneumatic-type nebulizer that produces an ultrafine aerosol from an aqueous solution or colloid suspension. Without the complexity and limitations of electrospray, the NanoAerosol Generator nebulizes a sample for low-charge gas-phase particle analysis, toxicity studies, or basic aerosol research. It is ideal for clean aerosolization of nanoparticle calibration standards.

Compared to traditional aspirating nebulizers, the NanoAerosol Generator:

- Produces significantly smaller droplets minimizing the influence of non-volatile residue
- Aerosolizes primary particles with reduced potential for agglomerate artifacts
- Uses pressurized sample delivery for high-purity and low-volume consumption
- Includes an integral heater and dilution air to evaporate droplets and lower the dew point eliminating the need for a separate desiccator
- Extends operation time with a highly stable output – sample solvent does not evaporate over long term operation maintaining a stable solution concentration and thereby, a more stable generated particle size
- Displays nebulizer operating status on a color touch-screen panel

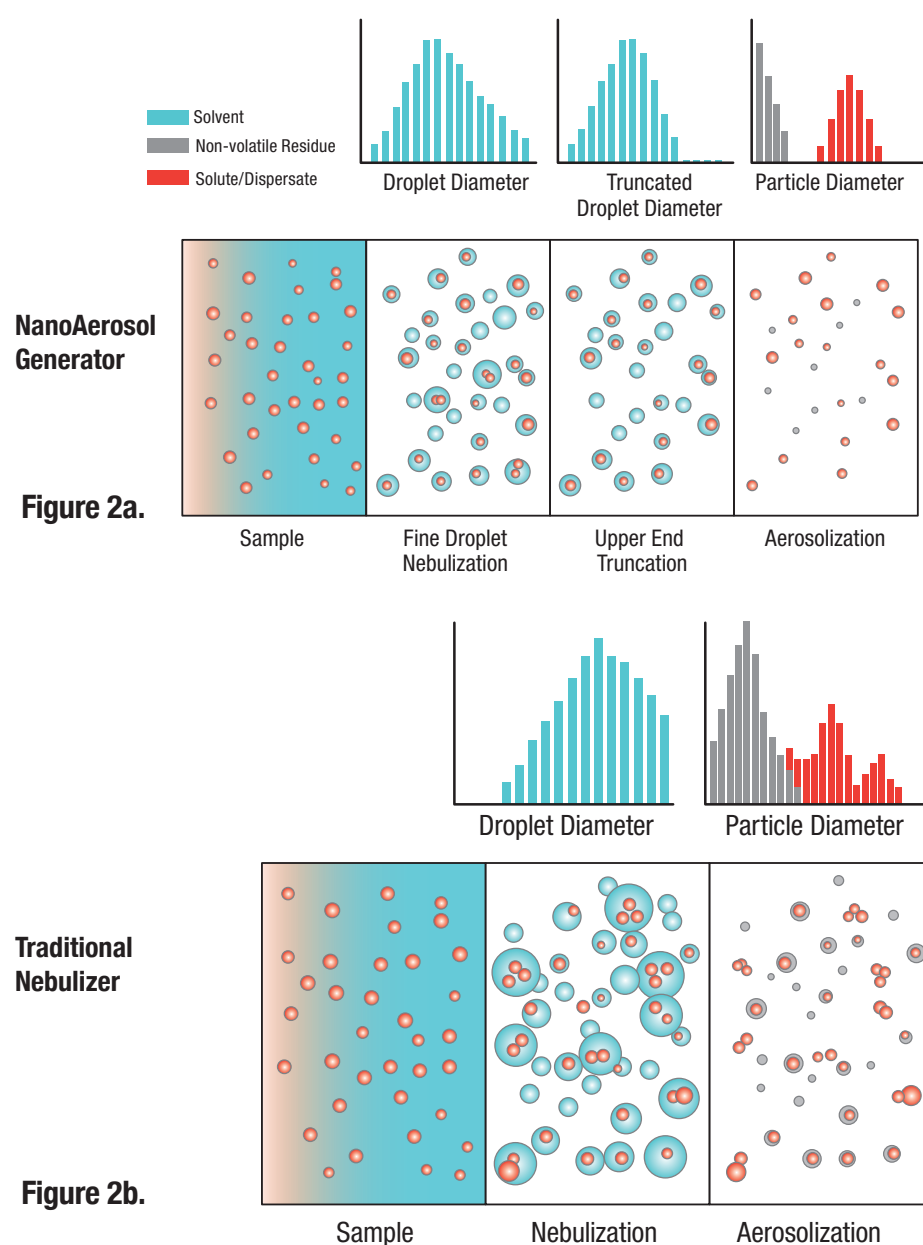


**Figure 1.** Photo of the NanoAerosol Generator with a pressurized sample vessel.

## How It Works

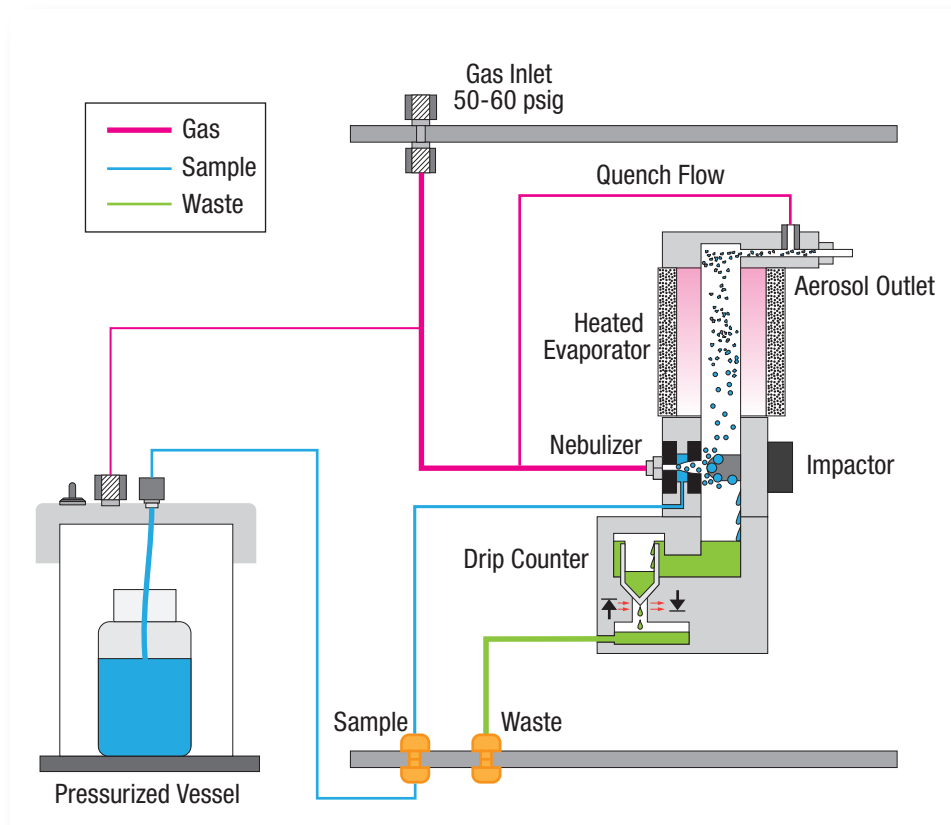
Using a pressurized liquid sample delivery and patented dual-orifice design, the NanoAerosol Generator produces a stable ultrafine droplet mist. When nebulizing a particle suspension, each droplet contains zero, one, or multiple primary particles. An impactor immediately removes larger droplets that may contain more than one particle. An integrated heater and clean dry dilution air evaporate the water and dry the aerosol avoiding the need for a desiccant or membrane dryer. The resulting aerosol contains predominantly primary particles with significantly reduced artifacts due to precipitated non-volatile solvent residue.

When using a traditional nebulizer, which produces much larger droplets, interference from non-volatile residue present in the sample is significant. After desolvation, empty droplets evaporate into non-volatile residue particles. When a particle is in the droplet the non-volatile residue forms a thin coating on the particle. This coating can be problematic when aerosolizing small particles ( $< 30$  nm) or when surface properties are of interest (such as in toxicology studies). By minimizing the size of the nebulized droplets, the NanoAerosol Generator reduces both the presence of non-volatile residue particles and the influence of non-volatile residue coating.

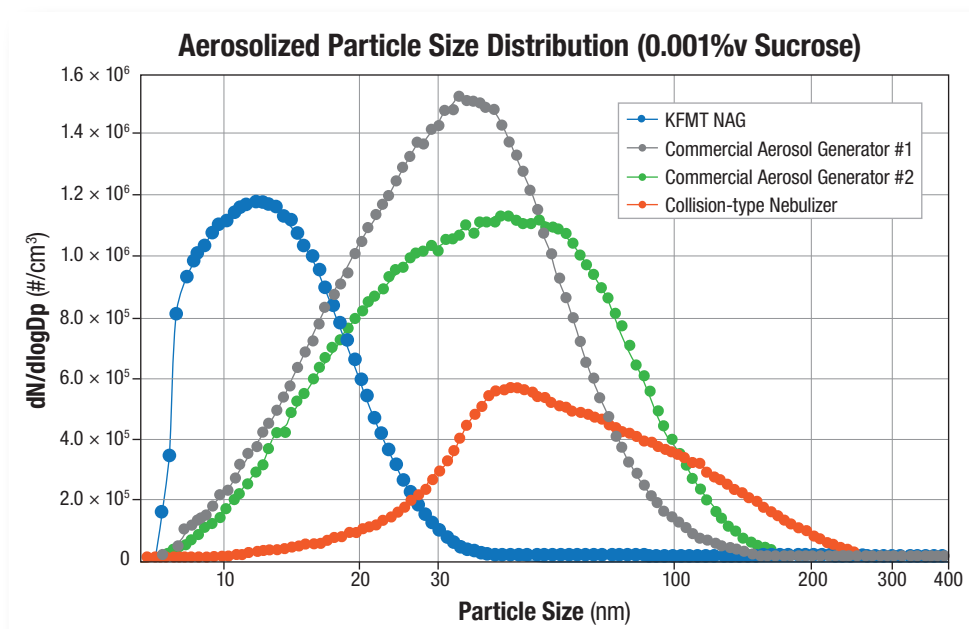


**Figure 2a.** NanoAerosol Generator minimizing non-volatile residue particle coating.

**Figure 2b.** Traditional nebulizer with non-volatile residue particle interference.



**Figure 3.** Schematic diagram illustrating the flow and internal components of the NanoAerosol Generator.



**Figure 4.** Comparison of nebulized particle size distributions.

## Specifications

Droplet peak diameter	550 nm calculated from dry particle distribution of 0.001% V/V Sucrose solution
Droplet size distribution GSD	1.6 – 1.8
Concentration of generated droplets	$>3 \times 10^7$ droplets/cm <sup>3</sup>
Concentration of aerosolized colloid particles (excluding residue particles)	Up to $1 \times 10^5$ particles/cm <sup>3</sup>
Inspection volumetric rate	0.2 – 1.0 µL/min
Sample flow rate	0.5 – 3.0 mL/min, regulated
Aerosol flow rate	Passive dilution gas mode: 1 – 1.5 L/min Active dilution gas mode: $2 \pm 0.3$ L/min
Sample pressure	9 – 18 psig
Compressed air supply flow rate/pressure	2.5 std L/min clean dry air (CDA) or nitrogen 2.8 bar (50 – 60 psi)
Wetted surfaces, sample	PFA Teflon®, PTFE, Sapphire, Stainless Steel 316L, PEEK®
Wetted surfaces, waste	Acetal, Polypropylene, EPDM
Ambient temperature range	15 – 35°C (59 – 95°F)
Ambient relative humidity range	0 – 85% non-condensing
Dimensions in cm(inches) (WHD)	Nebulizer: 23(9) × 23(9) × 35.5(14) Sample reservoir: 13(5)Dia. × 23(9)H
Weight	3 kg (6.6 lb)
Power	Universal 100 – 230 VAC 50/60 Hz, 90 W max.
Internal data storage	SD card stores operational status parameters for diagnostics
Display	3.5 inch color, touch screen
Run Time	Nominally 8 hours using 1 liter pressurized vial; continuous operation using optional injection pump

Specifications subject to change without notice.

Teflon® is a registered trademark of E.I. du Pont de Nemours. PEEK® is a registered trademark of Victrex Manufacturing Limited.

## Bibliography

Oberreit D. “A Nanoparticle Nebulizer for Generation of Aerosolized Colloid Particles with Reduced Influence by Non-volatile Residue.” Poster Presented at 2014 AAAR Conference, Orlando, FL.

He S. and Oberreit D. “Comparison of Aerosolization Devices for Colloidal Particles.” Presented at 2016 AAAR Conference, Portland, OR.

**Patents:** U.S. Patent numbers 8,272,253 and 8,573,034 have been issued to CT Associates, Inc. and licensed by Kanomax FMT, Inc. U.S. Patent number 7,852,465 has been issued to Kanomax FMT, Inc.



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