Single-Jet Atomizer

Model 9302

Owner's Manual

P/N 1990142, Revision J
August 2024

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Manual History

The following is a manual history of the Model 9302 Single-Jet Atomizer manual (part number 1990142).

Revision	Date
A	1988
B	May 1989
C	January 1994
D	May 1996
E	August 1999
F	September 2000
G	July 2010
H	August 2015
J	August 2024

Warranty

Part Number 1990142 / Revision J / August 2024

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About This Manual

Purpose

This manual describes how to use TSI® Incorporated's Model 9302 Atomizer.

Getting Help

To obtain assistance with this product, or simply to submit suggestions, please contact Customer Service:

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MODEL 9302

Single-Jet Atomizer

Description

The Model 9302 Single-Jet Atomizer is an aerosol generator originally designed to align and check out laser velocimeters (LV). It can also be used as a simple atomizer for a variety of laboratory uses.

A supply of laboratory compressed air is connected directly to the input of its built-in pressure regulator; the pressure gauge shows the air pressure at the output side of the pressure regulator.

In this aerosol generator, the compressed air expands through a small orifice (0.5 millimeter in diameter) in the form of a high-velocity jet located in the jet-nozzle assembly.

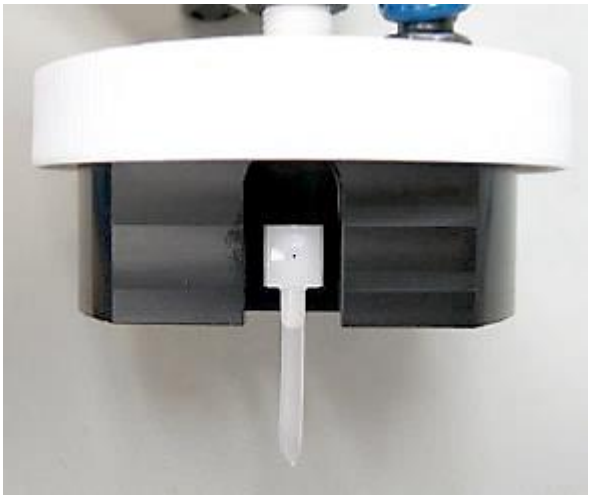

Figure 1
Location of the Orifice (impactor has been removed)

The jet creates an area of low pressure near the orifice which, in turn, causes the liquid in the reservoir to be sucked up into the orifice. The liquid is then broken into tiny liquid droplets as the liquid and water impact on a spherical impactor, and the compressed air carries the droplets through the outlet tube.

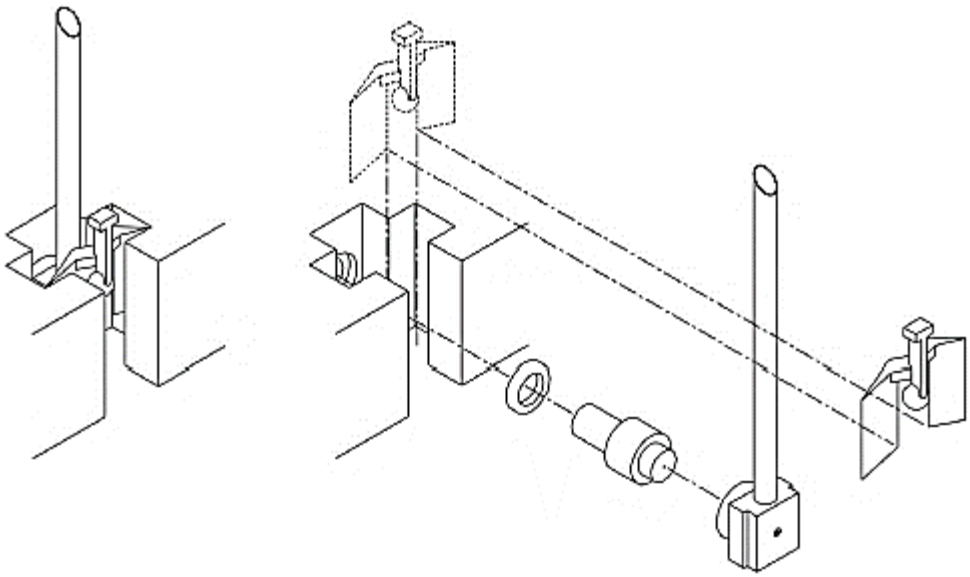

Figure 2
Atomizer Jet Assembly

The Atomizer is designed to generate a simple aerosol and should not be used to feed aerosols into a system under pressure.

Operation

Connect the 1/4-inch-dimeter (6.35 mm) compressed air hose to your laboratory air supply (typically 100 psi). Fill the reservoir approximately half-full with the selected liquid. The liquid should be below the level of the black assembly, but high enough so that the liquid draw tube dips into the liquid.

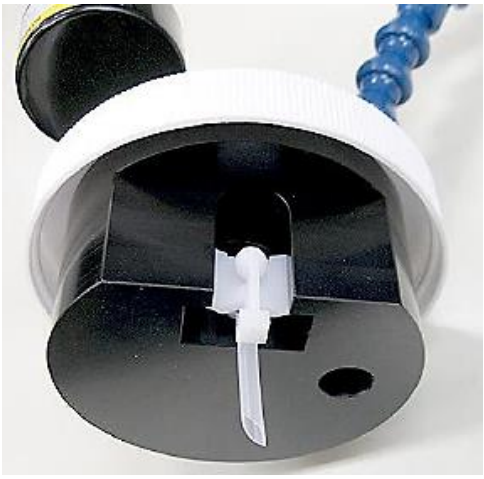

Figure 3
Atomizer Liquid Draw Tube

Set the pressure regulator to 25 pounds per square inch (172 kPa).

Figure 4
Adjusting the Pressure Regulator

The aerosol output rate is a function of the pressure setting, and the atomizer can be operated at any pressure between 5 and 55 pounds per square inch (34 and 379 kPa, respectively). The table below shows the relationship between pressure, as indicated by the pressure gauge, and output rate. Note that the atomizer outlet is open to the atmosphere.

Table 1
Relationship Between Input Pressure and Aerosol Output Rate

Pressure		Aerosol Output
Psi	kPa	L/min
5	34.5	2.4
10	68.9	3.7
15	103	4.7
20	138	5.7
25	172	6.6
35	241	8.3
45	310	10.2
55	379	12.0

The Atomizer may be used to generate aerosols from different materials. Four common applications are described in the following sections.

Generating Water Droplets

The easiest way to use the Atomizer for laser velocimeter alignment is to fill the liquid reservoir with tap water.

NOTICE
It is normal for some water to drip from the outlet tube; simply collect it.

The diameter of the water droplet at the outlet depends on the pressure setting—droplet diameter decreases with increased pressure. A setting of 25 pounds per square inch (172 kPa) will yield a number mean diameter of approximately 1.5 micrometers.

Generating Salt or Sugar Particles

The Atomizer generates solid particles from water-soluble materials such as salt or sugar. Fill the Atomizer's reservoir with an aqueous solution of the desired material. The atomizer will then generate droplets of that solution. Smaller diameter particles of the solute will result if sufficient time is allowed to evaporate the water from the droplets. The resultant particle size depends on the concentration of the solute in the solution.

Dispersing Polystyrene Latex Particles

A common method of generating monodisperse aerosols is to atomize a hydrosol that contains monodisperse particles.* For this application, add a drop of monodisperse particles to one liter of distilled water in the reservoir. Such a large dilution is necessary to ensure that each droplet contains only one polystyrene latex particle. The Atomizer output must be mixed with a large volume of dry air. When all the water from these droplets is evaporated, polystyrene latex particles of the original diameter are obtained.

Generating Oil Droplets

The Atomizer can also generate particles from silicon oil, dioctyl phthalate and various vegetable oils such as olive, corn and peanut oil.

C A U T I O N
The mist of any oil, even that of edible oil, is unhealthy; exhaust it into free air outside the laboratory. The atomizer is not recommended for atomizing suspensions of solid particles such as aluminum oxide, titanium oxide, and silica; they will damage the jet-nozzle assembly.

To generate these particles, fill the Atomizer's reservoir with the selected oil. The diameter of the droplets depends on the setting of the pressure regulator. For a setting of 25 pounds per square inch (172 kPa), the number mean diameter of the particles will be approximately 0.8 micrometer.

Adjusting the Dilution Air

The 9302 also has an internal dilution set screw that can be used to adjust the amount of dilution air that runs through the orifice.

A design change has been made to the Model 9302 Atomizer. Previously, the entire airflow through the Atomizer passed through an orifice nozzle and generated particles. Thus, the full pressure drop was across the nozzle. A rough-adjustment screw has now been added to allow some of the pressure to bleed off as dilution air. (This is useful if the seeding concentration is too high.) Now, a portion of the pressure drop is across the

*A wide size range of monodisperse particles is available from Dow Chemical, 1-800-258-2436.

nozzle and the rest of the pressure drop is across an orifice that supplies dilution air to the flow and decreases the concentration of particles out of the larger exit nozzle.

Figure 5
Location of the Dilution Air Set Screw

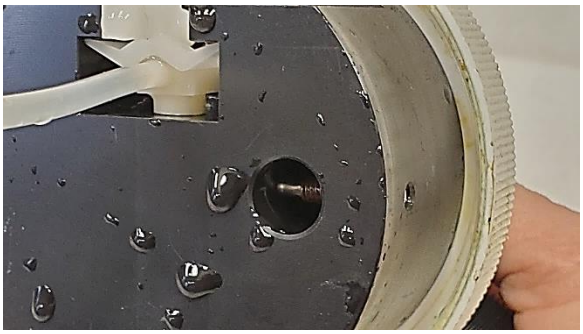

Figure 6
Dilution Set Screw Set to Fully Closed

The rough adjustment screw is factory-set to provide no dilution air. To change this setting, follow these steps:

1. Remove the plastic reservoir bowl from the bottom of the Atomizer.
2. Located along the outside diameter of the black aluminum cylinder (attached to the plastic cap) is a no. 10-32 setscrew. Turn it counterclockwise to open the orifice for dilution. Since slight rotation increases the dilution air substantially, withdraw the setscrew slowly. Several adjustments may be necessary before you achieve the correct particle density.

   Again, this adjustment is useful only if you want to decrease the particle concentration at the exit of the nozzle. This feature may be useful if you are looking at signals from the flow produced by the Atomizer.
3. To shut off the dilution air flow, turn the setscrew clockwise and tighten firmly.

Maintenance and Troubleshooting

Generally, the Atomizer requires little maintenance. However, should a piece of dirt become trapped in the parts of the jet-nozzle assembly, compressed air may bubble through the assembly's long plastic tube. To correct this minor problem, simply dismantle the assembly and carefully clean each part.

Clearing a Clogged Jet or Orifice

Generally, the atomizer requires little maintenance, However, should a piece of dirt or other contaminant become trapped in the parts of the jet-nozzle assembly, compressed air may bubble through the assembly's long plastic tube. To correct this minor problem, simply dismantle the assembly and carefully clean each part.

If you suspect the orifice is clogged, begin by turning the internal Dilution set screw completely clockwise so the dilution air is turned OFF. This will give you the most amount of pressure at the jet. Then adjust the pressure to about 10 or 20 psi and see if the atomizer is working.

Next remove the lower plastic jar, and with some water in a cap or small container, see if the atomizer draw tube is sucking up any water and spraying.

If not, it is possible there is some contamination in-between the jet and the venturi cap which has the draw tube attached.

Refer to the view below which is tipped upside down as its easier to disassemble and to re-assemble. To disassemble, pull up on the square plastic knob. Once the Impaction disk is removed you can remove the draw tube/venturi and jet. Check both to make sure they are clear of any contamination. Also verify that the O-ring is still in place.

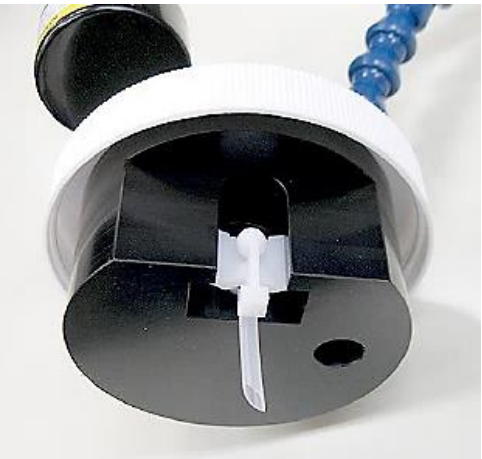

Figure 7
Disassembly of the Atomizer

Figure 8
Impactor, Orifice, and Jet

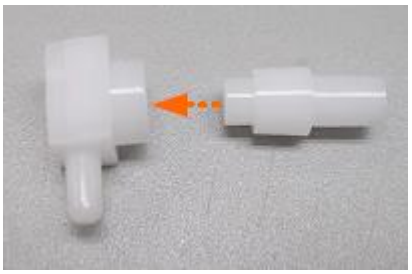

Figure 9
Insert Jet into the Orifice Assembly

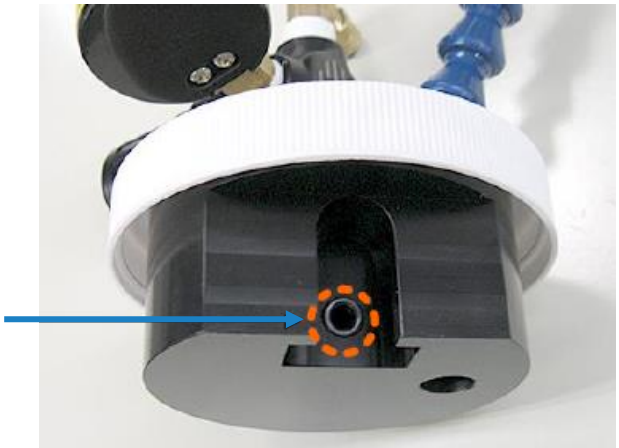

Figure 10
Location of the O-Ring

Replacement Parts

Description	Part Number
Atomizer Nozzle Assembly 8026	2401041
O-Ring	2501514

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Reader's Comments

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