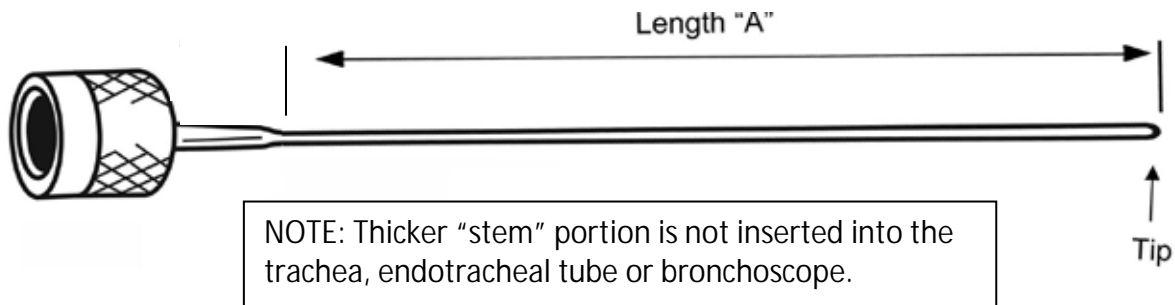


Guide to measuring a custom-length MicroSprayer® Aerosolizer – Model IA-1C



All Penn-Century aerosol drug delivery devices are available in custom lengths for intratracheal or other uses in larger species, in other locations of the body, or in *in-vitro*, *ex-vivo*, or other experimental laboratory set-ups. The intratracheal portion (Length A) may be straight, or have a bend.

For optimal intratracheal aerosol deposition in the lung and to avoid injury to the animal, the device must be measured correctly to assure that the portion inserted into the trachea is long enough to reach near to but not touching the carina (first bifurcation). In larger animals it may also be possible to insert the device in one lung, if desired. **It is the responsibility of the user to determine the correct measurement for their particular use.**

Methods of measuring the delivery tube for *in vivo* intratracheal use

If the custom MicroSprayer® Aerosolizer – Model IA-1C will be inserted in the trachea directly, or via an endotracheal tube or bronchoscope in a large animal, or used in a custom in-vitro lab set-up, it will require several steps to determine the correct length. Various methods have been used for determining the correct measurement for intratracheal use in larger animals, including:

- Dissecting an animal of similar size
- Using radio-opaque imaging agents to visualize the trachea
- In a primate, measuring the distance from the mouth to the teat (which is parallel to the carina) and adding an additional amount to assure sufficient length
- Ordering a Tubing Sample Kit from Penn-Century

Location of intratracheal portion is important to results

In prior published studies, optimal lung deposition is achieved when the very tip of the MicroSprayer® Aerosolizer is positioned near to, but not touching the carina and emerges slightly past the end of the endotracheal tube or bronchoscope. In this way, the aerosol can pass freely forward into the lungs, and not be forced into inner walls of the trachea, ET tube or bronchoscope.

General information: MicroSprayer® Aerosolizer – Model IA-1C

- The outer diameter of the MicroSprayer® Aerosolizer – Model IA-1C is .025" (0.64 mm), except at the very tip which is .028" (0.71mm)
- The particle size range of the Model IA-1C has been tested at a Mass Median Diameter of 16-22 µm (microns) NOTE: Particle size was analyzed with water using laser defraction method. Results may vary depending on the drug or material being administered, the method of particle size analysis used, the length of the sprayer tip or the manner of use.
- The tip of the MicroSprayer® Aerosolizer – Model IA-1C contains small aerosolizing components that contribute to formation of the aerosol. The passages through there are approximately 60 microns in diameter.
- The MicroSprayer® Aerosolizer – Model IA-1C does not have a luer-type hub. It can ONLY be operated with Penn-Century's patented FMJ-250 High Pressure syringe.
- The FMJ-250 High Pressure Syringe comes with two sets of volume spacers. These are attached to the plunger, and removed one by one, per instructions provided, to permit precise single doses of either 25-µl or 50-µl, or combinations of those amounts. Syringe can be used to hold and administer multiple doses.
- For best results, all Penn-Century devices are designed so that the user must push the plunger of the syringe rapidly and with sufficient force to produce an aerosol spray.
- The MicroSprayer® Aerosolizer is patented, and is the only air-free intratracheal device. Air must be eliminated from the syringe for the device to work as it is intended.
- The Model IA-1C can be used with liquids or particles in liquid suspension (solutions) in a wide range of formulations from small molecules to bioactive compounds. It is the responsibility of the user to test their formulation with the MicroSprayer® Aerosolizer and determine the feasibility of use at the dose intended.

Please select and read the section that applies to you:

___ The MicroSprayer® Aerosolizer will be inserted directly into the trachea or elsewhere:

- The user must pre-determine the correct length to assure that the portion inserted into the trachea reaches a point close to, but not touching the carina. The user may need to make this measurement by means of dissection or other means to establish the best length.

___ The MicroSprayer® Aerosolizer will be inserted into the trachea via an endotracheal tube:

- The outer diameter of the MicroSprayer® Aerosolizer – Model IA-1C .025" (0.64 mm), except at the very tip which is .028" (0.71mm)
- The MicroSprayer® Aerosolizer – Model IA-1C is made of tubing that is somewhat flexible, but must not be bent at a sharp angle, or the device will be damaged beyond repair.
- The inner diameter of the endotracheal tube must be large enough for the MicroSprayer® to pass through it easily.

- The user must pre-determine the correct length and placement of the endotracheal tube so that it reaches a point close to, but not touching the carina. The user may need to make this measurement by means of dissection or other means to establish the best length for the endotracheal tube.
- The MicroSprayer® measurement must be sufficiently long to pass through the endotracheal tube AND emerge very slightly from the far end of it – so that the aerosol spray is not trapped inside the ET tube and can flow freely into the lungs.
- Marking the insertion point: The user can place some tape on the MicroSprayer® or a mark to indicate how far they will need to insert the MicroSprayer® into the endotracheal tube, once the animal has been intubated, to assure that the tip of the MicroSprayer® is emerging from the end of the endotracheal tube.
- Administering large dose volumes: The MicroSprayer® Aerosolizer – Model IA-1C can only be operated with Penn-Century’s patented FMJ-250 High Pressure Syringe. This has a maximum capacity of 250 microliters. Two sets of dose volume “spacers” are provided with the device for measuring smaller doses of 25µl or 50µl (five of each). Administration of dose volumes larger than 250µl may require the user to detach and refill the FMJ-250 syringe multiple times, while maintaining the MicroSprayer® in position in the trachea.
- There are no calibration marks on the outside of the syringe. For precise administration of doses of 250µl, the user should contact Penn-Century for specific suggestions. The dose volume spacers provided with the device of the device have been tested with shorter MicroSprayers® and determined to be accurate. In the case of very long custom devices, there may be some sample loss the first time the device is used. This may be tested with water to determine if this is the case.
- Sterilizable and reusable: The MicroSprayer® Aerosolizer – Model IA-1C and FMJ-250 Syringe are made of stainless steel and other resistant components that can be re-used, sterilized, sonicated, autoclaved and/or flushed with any organic solvent.
- The tubing of the MicroSprayer® Aerosolizer – Model IA-1C is flexible and light. Care must be not to force the MicroSprayer® down into the endotracheal tube in such a way as to cause it to bend sharply, or crease, or the MicroSprayer® will be damaged beyond repair.
- Do not bend at sharp angle! The MicroSprayer® tubing is light compared to the weight of the syringe. Once the MicroSprayer® is inserted into the endotracheal tube with the syringe is attached, **the user must take great care not to manipulate or bend the sprayer at a sharp angle, or lose hold of the syringe and permit it to flop over, as this could put a crease in the MicroSprayer® that would damage it beyond repair.**
- When moving about the room with a very long MicroSprayer® Aerosolizer – Model IA-1C, it is best to take hold of both the hub and the tip to avoid damage or injury to others.

___ The MicroSprayer® Aerosolizer will be inserted into the trachea via a bronchoscope/endoscope:

- The outer diameter of the MicroSprayer® Aerosolizer – Model IA-1C is: .025" (0.64 mm), except at the very tip which is .028" (0.71mm).
- The MicroSprayer® Aerosolizer – Model IA-1C is narrow enough to be inserted down the working channel of a bronchoscope and can be flexed somewhat as the bronchoscope is moved around in the animal's chest.
- The MicroSprayer® Aerosolizer – Model IA-1C is made of tubing that is somewhat flexible but it must not be bent at a sharp angle, or the device will be damaged beyond repair.
- In prior published studies, optimal lung deposition from Penn-Century intratracheal aerosol devices was obtained when the device was positioned such that the very tip emerges from the end of the bronchoscope far enough to permit the aerosol to flow freely without hitting the inside of the bronchoscope, and when the very tip is positioned near to, but not touching the carina.
- If the device is inserted only partially down the bronchoscope, it is possible that the aerosol will impact on the walls of the bronchoscope or trachea, turn to large droplets and be coughed up or swallowed.
- For best results, the measurement of a custom Model IA-1C must be long enough to emerge slightly from the end of the bronchoscope – but not much more – so as to avoid injury to the lung of the animal. In
- For purposes of measuring the device prior to order, please note that the process of positioning, flexing and manipulating the bronchoscope while the MicroSprayer® is inside the working channel will cause the MicroSprayer® Aerosolizer to curve and retract slightly inside the bronchoscope – so that the tip of the sprayer is no longer emerging outside the bronchoscope .
- Therefore, the user must compensate for this by measuring the distance from the top of the instrument port to the end of the bronchoscope using sample tubing that will mimic the changes in length that can occur when the device is in use. It is better to have a device that is somewhat too long than one that is too short.
- Once the user has a correctly measured device, the user can place some tape on the MicroSprayer® or mark to indicate how far they will need to insert the MicroSprayer® into the bronchoscope after insertion in the trachea of the animal, to assure that the tip of the MicroSprayer® is emerging from the end of the bronchoscope.
- Administering large dose volumes: The MicroSprayer® Aerosolizer – Model IA-1C can only be operated with Penn-Century's patented FMJ-250 High Pressure Syringe. This has a maximum capacity of 250 microliters. Two sets of dose volume "spacers" are provided with the device for measuring smaller doses of 25µl or 50µl (five of each). Administration of dose volumes larger than 250µl may require the user to detach and refill the FMJ-250 syringe multiple times, while maintaining the MicroSprayer® in position in the trachea.
- There are no calibration marks on the outside of the syringe. For precise administration of doses of 250µl, the user should contact Penn-Century for specific suggestions. The dose

volume spacers provided with the device of the device have been tested with shorter MicroSprayers® and determined to be accurate. In the case of very long custom devices, there may be some sample loss the first time the device is used. This may be tested with water to determine if this is the case.

- Sterilizable and reusable: The MicroSprayer® Aerosolizer – Model IA-1C and FMJ-250 Syringe are made of stainless steel and other resistant components that can be re-used, sterilized, sonicated, autoclaved and/or flushed with any organic solvent.
- The tubing of the MicroSprayer® Aerosolizer – Model IA-1C is flexible and light. Care must be taken during insertion in the bronchoscope not to force it down the working channel of the bronchoscope or endoscope in such a way as to cause it to double over or crease, or the MicroSprayer® will be damaged beyond repair.
- **DO NOT BEND AT A SHARP ANGLE!** The MicroSprayer® tubing is light compared to the weight of the syringe. Once the MicroSprayer® is inserted into the instrument port of the endoscope/bronchoscope with the syringe is attached, **the user must take great care not to manipulate or bend the sprayer at a sharp angle, or lose hold of the syringe and permit it to flop over while the sprayer is inserted in the bronchoscope, as this could put a crease in the tubing of the MicroSprayer® that would damage it beyond repair.**
- When moving about the room with a very long MicroSprayer® Aerosolizer – Model IA-1C, it is best to take hold of both the hub and the tip to avoid damage or injury to others.

___ **The MicroSprayer® Aerosolizer will be used in a custom, in-vitro lab set-up:**

- The outer diameter of the MicroSprayer® Aerosolizer – Model IA-1C is: .025" (0.64 mm), except at the very tip which is .028" (0.71mm)
- If the device is to be used to deposit liquid aerosol particles onto a surface such as a cell culture medium, it is the user's responsibility to determine the rate and concentration of deposition of material, based on their own unique drug formulation.
- The MicroSprayer® Aerosolizer – Model IA-1C is made of tubing that is somewhat flexible but must not be bent at a sharp angle, or the device will be damaged beyond repair. If it is to be attached to an *in vitro* set up or clamp stand, care must be taken to avoid pinching or bending the tube at a sharp angle to avoid damaging it.

For any additional questions, please contact Penn-Century, Inc. at: info@penncentury.com, or call us at 215-753-6540.

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