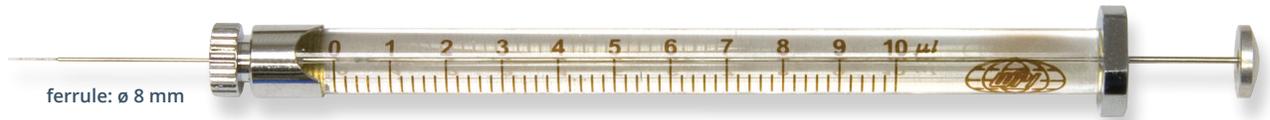


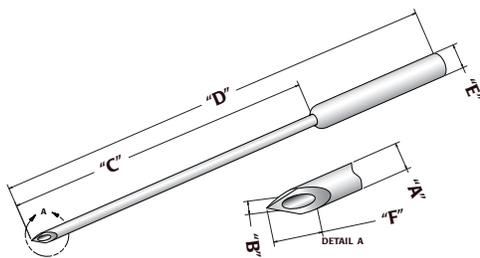


Sub-microliter Injection System for Small Animal Research



- The world's smallest dead volume injection syringe
- Comes with various needle sizes from 26 ga. to 36 ga.
- Versatile research applications — RPE and IO Kits
- Custom needle shapes available — blunt, sharp, beveled
- Compatible with WPI's UMP3 pump

NanoFil is a specially designed 10 microliter syringe developed in response to customer requests for improved microinjection in mice and other small animals. It makes quantitative nanoliter injection much easier and more accurate than any other method currently in use.



NanoFil's low dead volume eliminates the need for oil backfilling, a messy process which risks contamination of the injected sample. Injection is now simpler, and less messy, and there is no

possibility of oil contamination in critical applications such as ophthalmology research (see the Retinal Pigment Epithelial (RPE) and Intra Ocular (IO) injection kits listed below).

When the inner tip diameter of a conventional syringe is reduced to less than 100 micron, it is very difficult to backfill the solution at a reasonable speed. NanoFil solves this problem by using a tip coupling mechanism that makes it possible to change the syringe tip during the experiment. Simply load the sample using a larger tip, such as the 26 gauge needle provided with the syringe, and then replace it with a micro tip for sample injection. On a conventional 10 microliter syringe, a solid ring or bushing is permanently bonded to the tubing. Replacing the tip in middle of the experiment is not practical. With the NanoFil, tips can be exchanged by a simple twist of the brass lock, gently pulling out the tip, and replacing with the desired new tip. To secure the tip, NanoFil uses an olive shaped silicon gasket that is similar to, but much sturdier than, some of the microelectrode holders used for electro physiology recording. The silicone gasket makes it possible to hold not only metal tips but also glass and quartz tubing. Many types of tubing can be easily connected to the syringe as long as the outer diameter (OD) is close to, but not more than, the inner diameter

(ID) of the inside barrel. Flexible quartz capillaries used in Gas Chromatography (GC) and Capillary Electrophoresis (CE) can also be easily coupled to the syringe.

Specially designed tips as small as 36 gauge (110 micron OD) are offered in both blunt and beveled styles. Our studies have shown that these tips will cause less trauma to the tissue than any other form of micro syringe currently in use. NanoFil has a unique coupling mechanism that allows many different forms of small tubing and tips to be coupled with the syringe barrel.

Tip Order Number	Tip O.D. "A"	Tip I.D. "B"	Tip Length "C"	Total Length "D"	Shank O.D. "E"	Bevel Length "F"	Total Dead Volume	Tip Material
NF33BV-2	210 µm	115 µm	10 mm	40 mm	460 µm	≈348 µm	0.416 µL	Stainless Steel
NF34BV-2	185 µm	85 µm	5 mm	35 mm	460 µm	≈290 µm	0.199 µL	Stainless Steel
NF35BV-2	135 µm	55 µm	5 mm	35 mm	460 µm	≈204 µm	0.435 µL	Stainless Steel
NF36BV-2	120 µm	35 µm	3 mm	33 mm	460 µm	≈156 µm	0.340 µL	Stainless Steel
NFQ34-5	160 µm	100 µm	55 mm	75 mm	460 µm	n/a	0.589 µL	Quartz
NF33BL-2	210 µm	115 µm	10 mm	40 mm	460 µm	≈348 µm	0.416 µL	Stainless Steel
NF34BL-2	185 µm	85 µm	5 mm	35 mm	460 µm	≈290 µm	0.199 µL	Stainless Steel
NF35BL-2	135 µm	55 µm	5 mm	35 mm	460 µm	≈204 µm	0.435 µL	Stainless Steel
NF36BL-2	120 µm	35 µm	3 mm	33 mm	460 µm	≈156 µm	0.340 µL	Stainless Steel
Silflex		100 µm		35 cm			2.749 µL	
NF26BV-2	460 µm	140 µm		40 mm	460 µm		0.380 µL	

Selecting the Correct Tip for Your Application

The replaceable needles used with the NanoFil are available with either blunt or beveled tips. The blunt tip is used for injection into soft tissue and when a uniform solution distribution is needed. The beveled style is used for applications that involve the penetration of a tough tissue.

One of the main factors that limit the resolution and accuracy of conventional micro syringes to the upper tens of nanoliters range is diffusion in the large tip ID. When the tip ID is equal or larger than 100 micron, the error caused by tip diffusion is in the nanoliter range level [(100 micron)³ = 1 nanoliter]. With a 36 gauge needle installed on the NanoFil, the error caused by diffusion will be reduced to the sub-nanoliter level, making accurate injection of a nanoliter possible.

All of WPI's beveled tips have a unique 25 degree tri-surface bevel that is optimized for microinjection. A 10 degree single-surface beveled tip penetrates better than one with a 25 degree angle, however the distance between the upper opening to the tip (the dimension "F" in the drawing, overleaf) is longer. As a result, it requires a deeper penetration of the tip to achieve the same level of liquid delivery. Deeper penetration means more tissue damage. WPI's unique 25 degree beveled tip solves this problem with two extra beveled surfaces. The tip of a single surface beveled tip is actually a blade instead of a point. It dulls very quickly. In contrast, the tri-surfaced tip has a real point. It not only penetrates much better but is also much more durable. Our tests show that our 33 gauge, 25 degree beveled tip penetrates easier and lasts longer than other manufacturers' 33 gauge, 10 degree single beveled tips. With a 35 gauge tri-surface beveled tip, the resistance to the penetration becomes even less. Each of our tips undergo a penetration test before leaving the factory to guarantee the best results for our customers.

Available Tips

33 gauge: This tip is similar to Hamilton's 7762 and 7803 series removable needles in both tip length and outer diameter. However, our beveled tip version is shorter, more durable, and penetrates better due to the special tri-surface grinding technique. In the past, 33 gauge tips were the smallest size sold by other manufacturers and were frequently cited in literature. However, our new 35 gauge tip is much better for injections involving small animals, especially mice. Compared with Hamilton's 33 gauge, 10 degree

beveled tip, our 35 gauge 25 degree beveled tip can reduce the depth of penetration by almost 80%. The distance between the tip and the upper rim of the opening (dimension F on the drawing) is 348 microns for the 33 gauge tip. The distance for our 35 gauge tip is only 230 microns. In addition, the smaller tip size significantly reduces the required penetration force. In nearly all applications, a 33 gauge tip can be replaced with our 35 gauge tip and produce better results.

34 gauge: This is a transitional size between the 33 gauge and 35 gauge. If the 35 gauge is too weak and the 33 gauge is too large, this makes a good alternative.

35 gauge: This was the most popular and preferred tip of most scientists during our field trial. The combination of its strength, length, durability, and clogging resistance creates a balance with very little compromising of the individual properties. It is much smaller than the 33 gauge tip offered by other manufacturers. It is only slightly larger than the 36 gauge tip but is much stronger and less likely to be clogged. Samples can be directly loaded with this tip. Its 5 mm length is sufficient enough for almost all injection applications in mice.

36 gauge: This is the smallest tip that is commercially available. The tip is so small that it can be inserted into the opening of the 33 gauge needle tip. Because this is pushing the limits of what current technology can produce, there are some limitations to consider before using. Its thin diameter makes it necessary to limit its length to 2.5 to 3 mm in order to maintain a usable strength. Since the tip ID is in the 25 to 50 micron range, it is very easily clogged. Therefore, only well filtered solutions can be used. Depending on the viscosity of the sample, the user might also need to pre-load the syringe with a regular tip before switching to this tip for injection. We recommend using the 35 gauge tip instead of the 36 gauge unless it is absolutely necessary.

SilFlex Flexible Quartz Tubing: The flexible quartz tubing tip is made of 160 micron OD polyimide coated quartz tubing with a special adapter sleeve mounted at the end. It is designed for filling glass capillary electrodes or pipettes, just like WPI's traditional MF34G Microfil. However, unlike the traditional MicroFil, which has about 50 microliters of dead volume in its luer hub, the dead volume of this tip is less than 0.4 microliters. It is useful for loading electrodes with solutions that have a limited volume or are too expensive to waste.



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