

## Engineered Coatings For Fluid Delivery Components



Precision liquid dispensing nozzles may seem straightforward, but they have hidden design challenges. Chief among these challenges is the ability to maintain high flow rates at low pressures. While it may not be visible to the untrained eye, small improvements to the geometry of the nozzle and its surface characteristics can have a big impact on flow rates.

Subrex, a leading supplier of these nozzles, has mastered the art of refining nozzle geometry to reduce flow restrictions. The company's standard-gauge and micro-precision nozzles feature thin walls, smooth transitions and a precise exit aperture – all of which contribute to optimize flow.

And now, the company has taken its nozzle performance a step further by applying General Magnaplate's engineered coatings that improve the lubricity, hardness, release and corrosion resistance of the nozzle surfaces. These coatings include Nedox® as well as electroless nickel.

Here's a look at how these coatings contribute to the performance of Subrex's liquid dispensing components.



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## Precision Nozzle Materials

Subrex precision nozzles are one-piece conical shells made from formable, low-cost metal alloys, mainly phosphor bronze and nickel silver. Once formed, these copper alloys make a thin, hard wall nozzle core with good mechanical properties.

Phosphor bronze (UNS C51000) yields between 19 and 80 ksi and has an ultimate tensile strength of 140 ksi. Its nominal composition is 94.8% copper, 5.0% tin and 0.2% phosphorus.

Nickel silver (UNS C73500), on the other hand, is a corrosion-resistant brass metal with an ultimate tensile strength of 110 ksi and a yield strength between 15 and 84 ksi. It has a nominal composition of 72.0% copper, 10.0% zinc and 18.0% nickel.

Beginning in an annealed state, these metal alloys become harder as they're cold-worked for increased rigidity and strength. Metal is pulled down through a successive series of smaller dies until a final work-hardened core shape forms.

Once the copper alloys are shaped and coated, the nozzle cores take on the coating's properties. Coated surfaces can optimize the anti-stick characteristics of the nozzle for better control of the fluid as it exits the tip.

Subrex nozzles are used in automated or robotic applications in medical, semiconductor and food and beverage industries. Some applications include:

- Placement of viscous, small diameter dots and lines
- Precise deposition of adhesive
- Depositing of high surface tension fluid into wells
- Under-filling of epoxy in semiconductor applications
- Silicone gasket applications
- Dispensing of UV cure adhesives
- Dropping of phosphor laden silicone onto LED components
- Dispensing of thermal grease
- Thermal adhesive applications
- Semiconductor encapsulation
- Cavity fill
- Pastes



## Engineered Coatings For Improved Performance

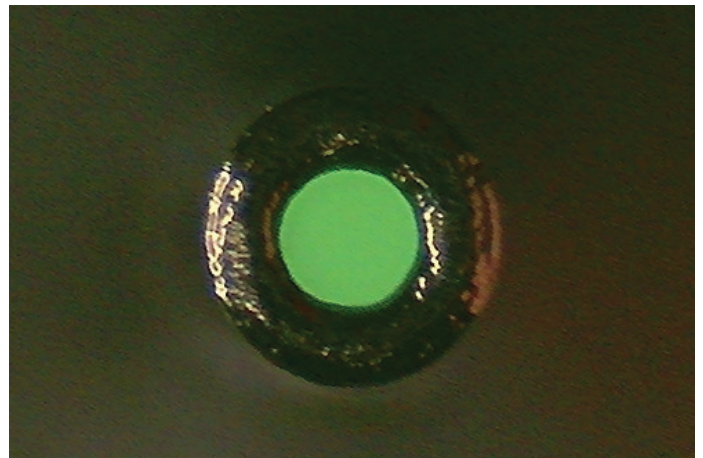
About half the precision nozzles that leave the Subrex factory come with a General Magnaplate coating. The coatings fully encase the nozzles' base metal, making the surfaces harder, smoother and anti-stick for better fluid release than uncoated nozzles. The coatings also radius the outside and inside diameter edges of the nozzle wall, which also helps with fluid control.

Other performance characteristics include low pressure, high flow and clog resistance with coating-enhanced fluid release to aid break off and reduce wicking and stringing.

The coatings increase the wall thickness anywhere from 40 to 50 percent, depending on the core size. Nickel-based coatings, for example, add 0.001 inch of nominal thickness to a wall, enhancing mechanical strength by improving the rigidity and surface hardness of a core.

In their precision nozzles, Subrex uses Nedox electroless nickel. These coatings cover asperities in small complex geometries while providing a smooth surface around the tip. Here's a more detailed look at these coatings:

- Nedox is a proprietary coating that, when applied to a nozzle core's interior and exterior, provides hardnesses up to RC 65 as well as corrosion, abrasion and wetting resistance. Other benefits include anti-stick, release and lubricity.
- Electroless nickel creates a smooth, hard surface that resists oxidation, corrosion and abrasive wear.



*About 0.005 inch of General Magnaplate's Nedox is applied to the inside diameter of the nickel silver nozzle's exit aperture. Once coated, the inside diameter is reduced by about 0.001 inch.*

## FLUID DELIVERY COMPONENTS FOR ROBOTICS AND AUTOMATION

Subrex fluid delivery components are used with a wide variety of fluids. Nozzle selection is based on application requirements that dictate size and surface properties needed for robotic or automated dispense applications. Common fluids include aqueous mixtures, epoxies, silver epoxies, silicones, oils, UV cure and thermal.

