

Aqueous ultrasonic cleaning: Technology improved by use of optimized wire cloth baskets

**By Peter DiAngelis
Vice President
Weiss-Aug Co., Inc.
East Hanover, NJ**

Part of the Weiss-Aug commitment to total quality is an attitude of environmental responsibility. As soon as the issue of removing harmful CFCs (chlorofluorocarbons) from ultrasonic cleaning solutions was raised, the company determined to convert its ultrasonic cleaning procedures from solvent-based to aqueous and semiaqueous chemistries.

Three years ago, Crest Ultrasonics of Trenton, NJ developed an aqueous cleaning process and equipment to complement Weiss-Aug's output of custom precision stampings, moldings and assemblies.

Crest developed the desired system, first as a simulated process in their applications lab, and then scaled-up to meet the specified needs. That system has been operating successfully at the East Hanover, NJ facility of Weiss-Aug.

Precision miniature components

Weiss-Aug is a manufacturer of custom precision stampings, moldings and assemblies. The company provides innovative design engineering and production in a state-of-the-art facility in North Jersey. Industries served include surgical and medical supply, automotive, telecommunications and electronics. Weiss-Aug produces precision parts such as blades and handle/switches for electrostatic surgery, components of hypodermic needles, and high-tech stampings like clips and connectors for electronics.

Advanced, computer-controlled automation and robotics are employed. Company capabilities include product development and computer aided design, prototyping, tool building and custom automated assembly, as well as heat treating, passivating, tumbling and degreasing. Stringent standards assure complete control over traceability and documentation.

"Camel's hair brush" effect

Weiss-Aug considers ultrasonic cleaning to be an excellent and cost-effective method of precision cleaning, achieving an effect as if all dimensions of each and every component were painstakingly brushed clean with a camel's hair brush. Ultrasonically cleaned components are free of particles that might become encapsulated during the stamping operation, as well as ionic contamination by oils, salts and residues. Such almost clean room quality is becoming a requirement for many of the industries served by the company.

The real issue is fixturing

The original aqueous ultrasonic cleaning system supplied by Crest Ultrasonics for Weiss-Aug was designed to handle typical hybrid parts. As precision miniature components became an increasingly important segment of the company's production, it was soon clear that a second ultrasonic cleaning system was needed.

The cleaning system for standard parts utilized large baskets, which did not adapt well to handling small parts. So the company designed another system, this one dedicated to accommodation of high-volume production of small items.

Clearly, the real problem was how to "fixture" the parts: design the optimum basket to safely contain small parts, allow the necessary cleaning action without "leaking out" parts into the cleaning stations, and yet discharge the entire lot easily and smoothly from the cleaning fixture when the cleaning process is complete.

Designed for aqueous

Crest explained to Weiss-Aug that different types of baskets are preferred for different processes. When ultrasonic cleaning involved simple immersion in a solvent bath, the parts were simply spread out on flat trays. Aqueous cleaning of small mass quantities of parts, however, involves a good deal of movement: tumbling and oscillation for cleaning, rinsing and drying - as well as the possibility of tiny parts simply floating away.

As a result, aqueous cleaning baskets have to be enclosed. They have to be designed to accommodate the size and quantity of parts to be cleaned: clearly, a large volume of small parts in a large basket will see some damage by weight and abrasion. The weight of a poorly designed basket full of small metal parts can even cause deflection of the drive motor shaft, leading to excessive wear and premature failure.

Rotating basket system

Crest recommends its RoTumbler™ rotating baskets for aqueous systems. The RoTumbler drive system is based in the process tank, (see attached photos,) not in the basket; a large rotating basket containing 4 small wire cloth baskets is attached by pulley and simply dropped into a durable friction drive.

Drop-in design makes it easy to run multiple baskets (4 in each enclosure) for high throughput. The baskets are lightweight, with easy-load/unload ergonomic design. In some cases, stampings can be discharged from the machine press directly into the basket - an almost continuous, assembly-line operation.

"Jewelbox" internals

The frame of the RoTumbler™ basket is laser-cut sheetmetal. The material is usually stainless steel, but may be Hastelloy™, or any alloy the customer desires. Depending on the size of the parts to be cleaned, the frame is fitted with wire cloth or open mesh. For the smallest parts, hinged-cover stainless steel "jewelboxes" were designed to slide into the larger rotating basket.

A jewelbox design was developed by Weiss-Aug, with four of the small boxes fitting into the larger basket, carousel style. Their design involved several important considerations:

- The baskets must "dump clean." Parts sticking inside the baskets would mix up production lots - a specific problem in view of the need for traceability and documentation of parts for medical supplies and other industries.
- In particular, the possibility of entrapment of small parts in a welded seam area had to be avoided.
- The wire cloth size and mesh had to be selected to let contaminating particles escape while

keeping the parts in.

- Strength and durability of the wire cloth, and its material of construction, had to be appropriate for the service.
- The sheetmetal/wire cloth interface is, of course, critical.

Especially desirable is the corner seam-weld produced by Newark Wire Cloth: considered strong and rugged, but very smooth to preclude parts entrapment.

Newark Wire Cloth Company can supply the desired wire cloth and affix it to any configuration of customer-supplied basket frame. The company also produces standard baskets or custom designs them to customer specifications. Both welded and weld-free assemblies are available. Materials are selected from an extensive inventory of wire cloth in all stainless steels, nickel and nickel alloys, and over a thousand combinations of mesh and wire diameters. Electropolishing is also available.

Future considerations

Crest Ultrasonics is a specialist in the fine sheetmetal work needed to produce basket frames. The company prepares sheetmetal frames, precision-cut with a laser cutter, and entrusts Newark Wire Cloth Company, of Newark, NJ, with the specialized task of supplying the optimum wire cloth and attaching it to the sheetmetal configuration of the baskets.

Crest Ultrasonics is currently involved in studies of the effect of ultrasonic energy on various wire cloth styles supplied by Newark Wire Cloth - size and type of mesh and open area. The performance of welded wire mesh seems to be superior to woven mesh, but welding is not practical in very small wire diameters or very fine mesh. On the other hand, in both large and small sizes, the woven wire cloth seems to resist abrasive wear better than welded.

Superior technology - when properly fitted

Aqueous ultrasonic cleaning is indeed a superior technology, and an important part of the Weiss-Aug commitment to quality and accountability. In this technology, however, a relatively minor component can have a disproportionate influence on optimization of system operation. Weiss-Aug feels that the ultrasonic cleaning systems in its state of the art facility are improved by their fixturing with ergonomically designed, precision-crafted wire cloth baskets.

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For additional information contact:

NEWARK WIRE CLOTH CO.

351 Verona Avenue

Newark, NJ 07104

Telephone 800-221-0392

FAX 201- 483-6315