Ultrasonic precision cleaning technology

A mechanical agitation technique that uses ultrasonic sound waves to “scrub” soils from surfaces, even reaching inside complex shapes, tiny holes and crevices.

Ultrasonic systems use a transducer submerged in the washer tank to produce intense, high-frequency sound waves in the bath. As the sound waves collide with surfaces they create a cavitation effect - tiny voids that open and violently collapse between the sound waves - that blasts soils off with pinpoints of high-intensity energy. Cavitation occurs throughout the liquid, effectively cleaning complex surfaces, holes and small crevices.

Ultrasonic systems can be combined with aqueous, semi-aqueous or solvent systems to enhance cleaning effectiveness while enabling reductions in chemical concentration, temperature and process time.

Industry Applications:

Ultrasonic agitation can significantly increase cleaning effectiveness, particularly for complex parts with holes, crevices and hidden surfaces. Ultrasonics provide fast, consistent cleaning for:

- Jewelry: watches, clock movements, precious stones, chains and charms, coins, intricate settings
- Medical: dental instruments, dentures, laboratory glassware, scientific instruments and components
- Electronics: printed circuit boards with through-hole and surface mount components, disk drive components, switches, wafers, ceramic substrates, capacitors, packaging materials, crystals
- Optics: optical lenses, contact lenses, eyeglass frames, laser components
- Web and flat plate surfaces: used in high-tech converting, metalizing and optical film processing, which must be cleaned with a non-contact system
- CDs: glass compact disc masters used in CD production
- Precision parts and assemblies: particularly when cleaning must be accomplished without disassembly
- Aviation: brake parts, generator components, actuators, shuttle valves, filters, turbine engine blades and vanes, aircraft wheels, bearings
- Metalworking: for removal of oils, greases, metalworking fluids, abrasive polishing compounds, metal fines and shop soils
- Metal plating: to remove buffing compounds and other soils for better adhesion
- Ceramic molds: to remove baked-on, carbon-based soils from ceramic molds used in the latex rubber industry

Selection Criteria:

Ultrasonic agitation may enhance the effectiveness of aqueous, semi-aqueous or solvent cleaning systems. Liquid bath chemistry must be formulated in balance with the ultrasonic agitation system. Ultrasonic performance is influenced by all of the liquid’s physical properties including temperature, vapor pressure, surface tension, viscosity and density. Tank size and complexity are significant factors. Aqueous and semi-aqueous ultrasonic systems may use a simple open tank. More complex systems may have several tanks, a recirculating pump, filter systems, and rinse and drying stages. Parts loading must be carefully considered. Neither the parts nor baskets designed to hold them can rest on the bottom of the tank. Poorly designed baskets can absorb ultrasonic energy, reducing cleaning effectiveness. The sum of the parts’ cross-sectional areas should not exceed 70 percent of the tank’s cross sectional area.

Compatibility Concerns:

Frequency compatibility is an important concern. Below about 20 Hz, operating noise may be unacceptable and may exceed OSHA minimum safety standards. Low-frequency 25 kHz transducers produce larger cavitation bubbles, and are most often used for heavy-duty industrial applications. Equipment that operates at a frequency of about 40 kHz is often recommended, especially for smaller, more delicate parts or porous surfaces. Above 50 kHz, the power required to produce cavitation increases dramatically. Frequencies as high as 400 kHz can be used when intense cleaning capability is required.

Diagrams courtesy of F. John Fuchs, "Ultrasonic Cleaning Fundamental Theory and Application," PC '96 Proceedings
As THE INDUSTRY GROWS
precision cleaning technology

It has been a year since the critical cleaning industry embarked on a new era as a result of the ban on CFC imports. As the search continues for the “perfect” replacement process and/or agent, Precision Cleaning magazine continues to provide up-to-date, technical information through supplement, directories, articles and product/literature announcements.

The Technology Handbook is one way Precision Cleaning serves the industry. This year’s handbook focuses on 14 general categories within the critical cleaning arena.

Each category includes a brief definition, a basic overview, and a list of implications, compatibility traits, benefits and potential drawbacks.

Highlights include breakdowns of cleaning system use by industry, compliance efforts, user satisfaction levels, cost factors and current use of various systems/methods. Photographs, diagrams, charts and illustrations have been added to enhance the text for you - the reader.

The purpose of the handbook is to acknowledge as many cleaning categories as possible without recommending one over another. Precision Cleaning hopes to see this annual guide grow as the industry grows, but we need your help. We hope you will use this guide throughout the year, and offer us your thoughts and feedback.

Please use the reader service cards in the issue to solicit more information from the advertisers in your categories of interest. And, as always, the editorial staff of Precision Cleaning is here to offer you support and help in any way we can.

Christina M. Cline
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