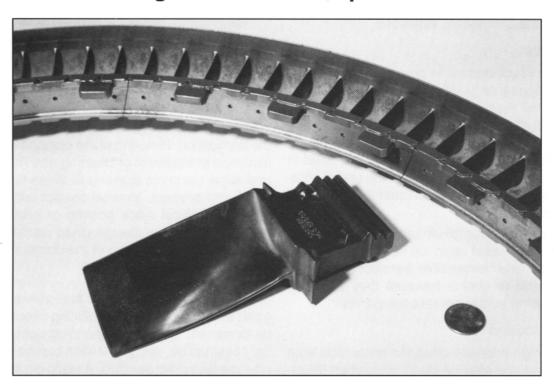
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Marketing Brief

Ultrasonic Cleaning of Aircraft Components



Many applications exist in the aircraft industry that can benefit from ultrasonic cleaning. Typical applications include brake parts, generator components, actuators, shuttle valves, filters, engine blades and vanes, aircraft wheels and bearings.

Turbine blades and nozzle vanes from jet engines (pictured) – critical operational components – can be cleaned successfully with ultrasonics. The ultrasonic cleaning of these components has yielded results equal to or better than those gained from traditional solvent cleaning methods without harmful metal loss, erosion of the base metal surface, or potential surface defects inherent with sand-blasting.

Following are some factors to be considered for effective cleaning of precision aircraft components.

Size

The size and shape of the components will vary. Some of the components are as small as one cubic

inch; the larger units might be as much as 30 inches in diameter by 10 inches high.

Material of Construction

The components are made of materials such as aluminum, stainless steel, carbon steel, copper, ceramic, and high-strength alloys.

Typical Contaminant

Soils range from organic residues to inorganic scales, rust, oxides, and carbon.

Reason for Cleaning

Most of the applications are for aircraft preventive maintenance and pertain to the safety of operation of each individual component. Air passages in the vanes and blades, for example, must be cleaned of carbon build-up to allow for adequate cooling during use. Rust can cause the malfunction of gears, and particulates can obstruct the proper flow of fluids.

Conventional Cleaning

Generally, the components are chemically treated with an aqueous-type cleaner. After this pretreatment, they are water pressure blasted, solvent sprayed, vapor or grit blasted. All of the above procedures result in inconsistent cleaning as the size and shape of components can vary over wide ranges. These operations require intensive labor to accommodate component variations.

Ultrasonics

The use of ultrasonics in precision cleaning for aircraft components greatly reduces the man-hour requirements. Many components previously handled individually in pressure spray operations are now batch loaded in ultrasonics for effective cleaning. Chemical pretreating generally is still used in front-end manufacturing areas with the use of ultrasonics limited to the precision cleaning portion of the process.

The size and amount of ultrasonic equipment will be directly dependent upon the size of the components. In general, immersible transducers will be the equipment of choice because they allow for easy upgrading as the operation expands.

Typical Process

- 40 kHz high-intensity ultrasonic immersion in an 8% by volume alkaline cleaning solution (Branson Class 5 chemistry) at 180°F for a 3-5 minute processing period. Filtration required with membrane sizes as low as 1 micron. Selection of membrane size is application dependent. If oils are to be removed in this initial cleaning process, then the use of oil extraction equipment for the cleaning solution is required.
- Hot tap water spray rinse with spray impingement focused on intricate areas of the aircraft component. Typical exposure time between 45 seconds to 1 minute. The use of tap water as an initial spray is recommended for the majority of the applications encountered in this industry.
- 3. Hot deionized (DI) water ultrasonic immersion rinse (40 kHz). DI water in this primary immer-

- sion rinse is supplied by subsequent overflow rinses. Depending upon the critical nature of the application, additional four-sided overflow rinses may be required. DI water quality is again application dependent. Typical rinse water quality is assumed to be between 3-5 Megohm.
- Forced hot air recirculating dryer operating at a temperature of approximately 230°F. HEPA filtration units can be provided if the application requires a low particulate drying environment.

Fixturing

It is well documented that fixturing is a critical player in the cleaning, rinsing, and drying phases of the application. Fixturing of the components should minimize entrapment of cleaning and rinsing fluids and allow complete draining of these fluids during the drying process. Minimal contact with the component is critical since pooling or entrapment of water by the fixture design could cause extended drying times and spotting of the component.

Rust Prevention

If the application calls for rust prevention, inorganic or organic type rust inhibiting chemistries can be furnished. Typically, depending upon the material construction, rust prevention can be performed after the final rinse position. A static dip in an appropriate rust preventative prior to hot air drying is suitable. However, some applications will rust in the rinse water. In such cases inhibitors must be implemented in the rinse water itself through use of metering or injection pumps.

For those applications that require a thin film of oil for storage, water displacing oils have been successfully implemented for such purposes. Water displacing oils will eliminate the need for hot air dryers and will provide a thin coat of oil for storage requirements. Depending upon the complexity of the component being processed, one or two water displacing oil stations can be implemented.

For case histories on specific components or help with your aircraft component cleaning needs, contact your nearest Branson office or Branson's Cleaning Applications Laboratory at (203) 796-0522.



BRANSON ULTRASONICS CORPORATION

41 Eagle Road, Danbury, CT 06813-1961 (203) 796-0400 • FAX (203) 796-9813