



Degreasing with Superheat Prior to Vacuum Brazing

Ernie Ruiz, AERO-Classics

Ryan Hulse, Technical Manager, Honeywell

AERO-Classics, Inc. manufactures heat transfer products for aviation, marine, military, transportation, and industrial applications. The manufacturing and engineering staff at AERO-Classics has an extensive background in the design and production of military, marine and aviation heat exchangers. This includes products for major diesel engine manufacturers and virtually all diesel engines produced by General Dynamics Land Systems in Muskegon, Michigan. Past design projects have included the M60, Crusader, AAV and a variety of prototypes and experimental vehicles.



The Cleaning Process

AERO-Classics utilizes a Crest Forward Technology vapor degreasing cleaning process using HCFC-225 for contamination removal prior to the vacuum brazing process. They primarily process 6061 aluminum, and due to production requirements, process 10 baskets of parts per hour. Each basket contains a variety of parts, with each basket holding 2 to 17 pounds of parts to be degreased. The degreaser runs 8 to 10 hours each day. A unique feature of the degreasing system is its superheat mode. Superheat enables the solvent vapor blanket to be “superheated”, which enhances the parts drying within the vapor blanket of the degreasing system. Due to the nature and quantity of the parts being cleaned at AERO-Classics, the superheat vapor blanket allows the baskets of parts to be removed from the degreaser completely dry.



This greatly reduces solvent loss from the system during operation, as well as any possible solvent exposure to employees.

The contaminants to be removed include hydro-carbon-based oils and particulates. Contamination removal is required in order for the brazing process to properly bond to the substrate surfaces, as the brazing process requires a vacuum of 10^{-6} Torr. In order to draw this vacuum, a very robust cleaning process is needed to ensure all soils and solvent are removed.

When environmental regulation required AERO-Classics to find an alternative solvent for their degreasing process, they decided to evaluate Solstice® Performance Fluid (PF). AERO-Classics wanted to make sure their new cleaning process satisfied the following requirements:

1. Meets California's South Coast Air Quality Management District (SCAQMD) volatile organic compound (VOC) regulations
2. Safe for workers
3. Meets long-term safety and environmental requirements
4. Cleans at least as effectively as the current process – HCFC-225
5. Does not interfere with the vacuum brazing process



Aluminum Foils

New Solvent Technology

Solstice PF is a new solvent that offers exceptional cleaning power while satisfying long-term environmental and safety requirements. It is non-flammable according to ASTM E681 testing, has a global warming potential (GWP) of 1, and the Occupational Alliance for Risk Science (OARS) has assigned a Workplace Environmental Exposure Level (WEEL) value of 800 ppm (8-hour TWA). As volatile organic compound (VOC) limits are constantly being reevaluated, there is a need for non-VOC solvent alternatives. Solstice PF has been designated as VOC-exempt by the U.S. Environmental Protection Agency (EPA) and the South Coast Air Quality Management District (SCAQMD), and is listed under the EPA's Significant New Alternatives Policy (SNAP). Solstice PF has been registered under European Union's Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) regulation for volumes greater than 1,000 tons, as well as in Canada, Japan, South Korea, China and Australia.

Solstice PF is also designed to offer cleaning performance that is comparable to today's legacy solvents:

- Excellent cleaning ability with common soils
- Superior wetting – cleans tight spaces
- Compatible with a large number of commonly used polymers and elastomers (such as PET, PTFE, polycarbonate, DuPont™ Viton and DuPont™ Neoprene)
- Compatible with metals (such as aluminum, copper, titanium, magnesium/aluminum alloys)
- Recoverable or recyclable by simple flash distillation or through carbon adsorption with steam desorption
- Very stable – resistant to thermal and hydrolytic breakdown



Heat Exchanger Assembly

The solvent is compatible with a broad range of plastics, elastomers and metals, including nickel and aluminum alloys. However, as with any product, compatibility testing is recommended prior to use.

Testing

The on-site test allowed for parts to be degreased and then immediately placed in the vacuum braze oven, mimicking the current process. The vapor degreaser at AERO-Classics holds approximately 90 gallons of solvent and is fitted with an automated lift system to introduce parts into the solvent. The degreaser is also fitted with primary and secondary cooling coils to ensure proper solvent management. To ensure complete removal of solvent from the parts, the process utilizes the superheat function of the vapor degreaser. Production parts were processed for several days using the Solstice PF process to ensure proper cleaning, as judged by the effectiveness of the final vacuum braze.



Aluminum Fins

Results

AERO-Classics found that Solstice PF not only met their requirements, but cleaned better than the incumbent HCFC-225 process. Due to the enhanced operation of the vapor degreaser using Solstice PF, AERO-Classics is now able to clean more baskets of parts per shift, eliminating the degreasing process bottleneck that had previously hurt production times. AERO-Classics used the following degreaser parameters to achieve these results:

Primary Cooling: 5°F

Freeboard Cooling: -20°F

Superheat Vapor Blanket: 115°F

Ultrasonic Immersion: 5-10 minutes

With the use of superheat and proper cooling balance, AERO-Classics has found the degreaser to operate very efficiently - the parts turn out completely dry with low fugitive solvent emissions.



Aluminum Fins

Summary

Solstice PF is a safe and effective choice for cleaning parts in the vacuum brazing industry, and has been proven by AERO-Classics to be very effective at completely removing all contamination from parts prior to brazing. The use of superheat produces completely dry parts that are ready for the oven without bake-out. It also reduces solvent emissions, as the finned parts do not drag out excessive amounts of solvent. Solstice PF has an ideal combination of flammability, toxicity and cleaning performance characteristics, and can clean tight spaces quickly and effectively. According to Ernie Ruiz of AERO-Classics, "we are very happy with Solstice PF and how it degreases our parts."

The information provided herein is believed to be accurate and reliable, but is presented without guarantee or warranty of any kind, express or implied. User assumes all risk and liability for use of the information and results obtained. Statements or suggestions concerning possible use of materials and processes are made without representation or warranty that any such use is free of patent infringement, and are not recommendations to infringe any patent. The user should not assume that all safety measures are indicated herein, or that other measures may not be required.

Honeywell Fluorine Products

115 Tabor Road

Morris Plains, NJ 07950

Phone: 1-800-631-8138

www.honeywell-solvents.com



Solstice is a registered trademark of Honeywell International Inc.

October 2015 - PF-FP-178 - version 2

© 2015 Honeywell International Inc.

Honeywell