To print: Click here or select File and then Print from your browser's menu

PF Online
www.pfonline.com

Case By Case:
Upgrading the Precision Cleaning Process

Here's a company that reevaluated its aerospace parts cleaning processes and implemented key changes to yield substantial savings.

By Scott E. Mackler

Companies are always looking for ways to improve efficiency, cut costs and make better products. For those plants involved in high levels of precision cleaning, significant improvements can often be found with a thorough restructuring of cleaning processes. The up-front costs can easily be offset by the savings, as shown at one manufacturer in the aerospace industry.

As part of its 2007 Precision Cleaning Path to Premier capital project, ITT implemented a new precision cleaning facility to provide critical cleaning and packaging of its aerospace flight hardware and optical payloads to meet customer performance requirements.

Formerly, the company's precision cleaning functions were carried out offsite in a leased building. A new facility, equipped with modern precision cleaning equipment including advanced process analytical technology and improved capabilities, was designed and built after outsourcing solutions were investigated and found lacking in ability to meet quality specifications and schedule needs.

ITT cleans parts that can range in size from a single threaded fastener all the way up to large composite structures. Materials that can be processed include optics, composites, metals and various high performance coatings. The company is required to provide verification to customers of meeting particulate and molecular cleanliness requirements. That analytical capability is operational in this new facility. The new facility footprint is approximately half the size of the former leased operation and provides double the amount of throughput.

Process improvements and new cleaning equipment are projected to increase first-pass yield from 78-98 percent, avoiding $300K+ per year in rework costs. Cost avoidance of $350K per year will result from elimination of rent, IT services, transportation, and decreased utility costs. Savings due to reduced staff is expected to net $400-500K per year.

The company's Precision Cleaning and Contamination Control verification facility enables precision cleaning of parts and assemblies, then verification of the cleanliness of each part per the IEST-STDCC1246D industry standard. Contamination Control Engineering reviews all prime and support hardware designs for material selection, design and cleanability with respect to the required cleanliness specification. Drawings and

LEARN MORE

Economical Process Changes
Read about the cleaning process change management system—an essential element in updating this critical part of a manufacturing environment.

PF ONLINE TOOLS

Cleaning and Pretreatment Zone

Printer-friendly Version

E-Mail this Article

The pre-clean area of the new facility for critical cleaning and packaging demonstrates ITT's attention to precision cleaning and contamination control.

A verification lab is used for

Manufacturing Instructions define the required cleanliness requirements for each piece of hardware.

continuous or periodic monitoring of cleanliness-critical hardware throughout the integration and testing cycle.

ITT currently has two precision cleaning locations. The new facility, which has been benchmarked against current industrial facilities across the United States, handles the cleaning and verification of mechanical parts and assemblies. The other facility is for the cleaning and verification of electrical and ESD sensitive parts and assemblies.

Continuous or periodic monitoring of cleanliness-critical hardware is performed throughout the integration and testing cycle. Direct hardware sampling processes or more indirect methods, including surrogate samples and visual inspection techniques, are used.

The new facility was programmed utilizing classical design/build facilities requirements analysis techniques as well as utilizing a number of lean tools, including a week-long cross-functional 3P exercise. Following is a list of features of the facility's improved process capabilities:

- Aqueous and explosion-proof solvent ultrasonic cleaning equipment. (This equipment operates at multiple programmable frequencies and power settings. The multiple ultra-sonic sweep frequencies and ultrasonic power are programmable to ensure safe cleaning of assorted metals and coatings.)
- Precision steam cleaning equipment
- Two complete contamination control verification trains for NVR (non-volatile residue) and particulate testing
- CO_2 snow jet cleaning equipment
- Power spray wash system
- 18 Meg ohm deionized (DI) single-digit total organic carbon (TOC) water system
- Class 100 cleanroom space
- Class 1,000 cleanroom space
- Class 10,000 cleanroom space
- Horizontal laminar flow cleanroom space

Problem: Offsite precision cleaning processes were not meeting quality specifications and schedule needs.
Solution: A new, on-site precision cleaning and packaging facility
Results: Improved quality while saving over $1 million per year

While process development and characterization of new processes continues, ITT has achieved 98 percent first-pass yield on over approximately 800 verifications to date. The facility is running one full shift, with capacity for two additional shifts as demand requires. ITT can provide cleaning and verification and perform thermal vacuum bake-out services for additional internal and external customers who require predictable, reliable, data-driven precision cleaning process solutions.

Investing in more efficient processes can make a significant difference in production costs. Finding better solutions has worked for ITT in its cleaning capabilities, and it can surely make a difference for any other company willing to put out the effort. **PC**

Table 1: Verification Capabilities

METHOD	EQUIPMENT	APPLICATION	COMMENTS
Silicon Wafers	Surface Analysis System (SAS)	Particle Fallout	Automated instrument to measure particles between 0.3um 25um. Counts the entire wafer.
Silicon Wafers/Optical Coupons	Scanning Optical Microscope (200x)	Particle Fallout	Uses reflection or dark field. Automated system to measure particles between 5um - 100um. Can be complimentary with SAS instrument giving a particle measuring range 0.3um -

			100um.
Tape Lift/Direct Inspection	200x Optical Microscope, Gridded Oculars	Particle Fallout	Manually counted. Direct sample from hardware.
Optical Coupons	Optical Scanning Microscope	Optical Fallout	Automated system to measure particles between 5um - 100um. Completeness of the data allows curve fitting and % obscuration calculations.
Silicon Wafers	Ellipsometer	NVR	Measures thickness of molecular layer on Silicon Wafers. Measures down to A/100.
Stainless Steel Plates	Micro-Balance, Hot Plate / RotoVap / Vac Oven	NVR	Solvent flush that is gravimetrically analyzed. Accuracy a function of the balance (usually +/- 0.01mg/ft2). Solvent dependent.
Extracted Wipe	Micro-Balance, Hot Plate / RotoVap / Vac Oven	NVR	Solvent wipe that is gravimetrically analyzed. Direct sampling of a surface. Accuracy a function of the balance (usually +/- 0.01mg/ft2). Solvent dependent.
Particle Counters	Lasair II or equivalent, Network Drops, Realtime compiling software	Facility Monitoring	Monitors airborne particulate counts in clean areas. Alarm ranges can be set with automatic page/email notification.
Airborne Molecular	AiM unit (SAW), Network Drops, Realtime compiling software	Facility Monitoring	Monitors condensibles in clean areas. Alarm ranges can be set with automatic page/email notification.

Scott E. Mackler is the Operations/Assembly Department supervisor for contamination control, electrostatics, precision cleaning, thermal vacuum bake-out and test chambers for ITT Space Systems Division, based in Rochester, NY. For more information from ITT Space Systems Division, call 585-269-5600 or visit ssd.itt.com.
