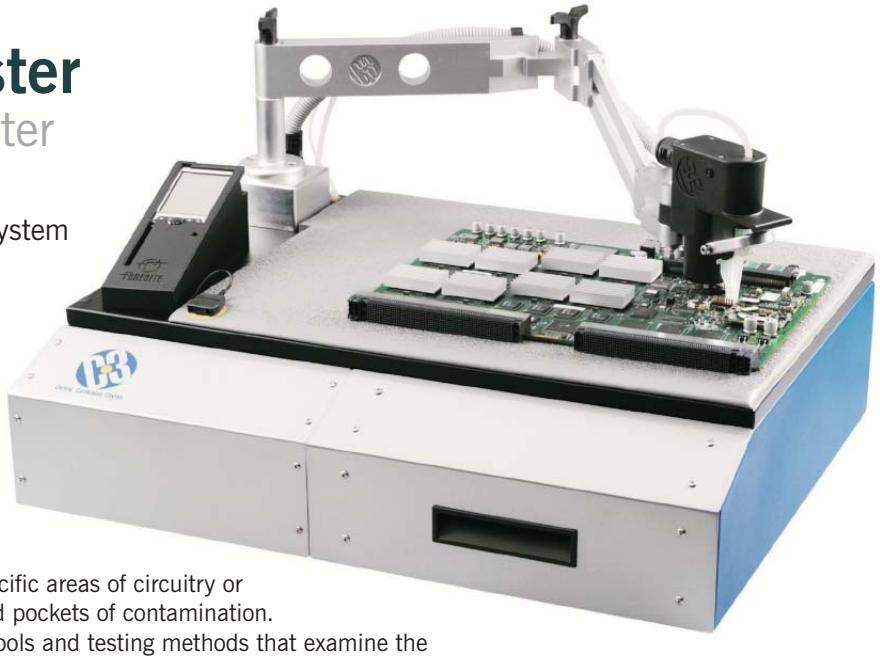
C3 Cleanliness Tester

Localised Cleanliness Tester



The Industry's Only Cleanliness Testing System Capable of Determining:

- *Volume of Contamination*
- *Location of Contamination*
- *Identification of Contamination (with optional IC Test)*

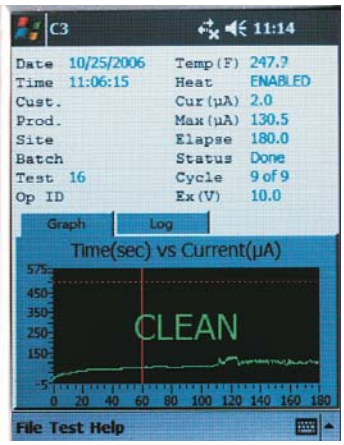
Developed out of an industry need to evaluate specific areas of circuitry or sensitive components that could hold concentrated pockets of contamination. These areas are overlooked by standard industry tools and testing methods that examine the total board. Methods such as ROSE testing and ion chromatography with standard total board extraction take a measurement of the average cleanliness of the board, thus overlooking pockets of contamination that can potentially cause quality concerns and field failures.

The C3 serves two main purposes:

- *To perform as a production-floor cleanliness monitoring tool that provides an immediate 'clean' or 'dirty' test reading for the 0.1 in2 area where the extraction is taken.*
- *To serve as an extraction tool for use in ion chromatography testing which will determine the exact type and quantity of ionic species present on a board or component area.*

Operation Principles

The C3 uses a deionized steam extraction system to collect a 2.2 mls sample from a 0.1 in2 area of circuitry. The system produces a microburst of steam that is allowed to soak for 20 seconds and is then aspirated into a collection cell. This steam is applied 8 times to achieve effective residue removal from the area of analysis. After 9 collection cycles, an electrical test is performed across a sacrificial y-pattern electrode to check for electrical leakage.



10v of electricity is applied, and the C3 makes a determination after 60 seconds as to whether or not the sample is 'lean' or 'dirty'. The current threshold forconsidering a sample clean is 500 uA, and is based on 13 years of ionic analyses performed by Foresite.

The extracted sample can then be used for ion chromatography analysis to determine the type and quantity of the localized contamination. C3 was developed by Foresite and is sold exclusively by Aqueous Technologies Corporation.

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C3 Principles of Operation

Extraction

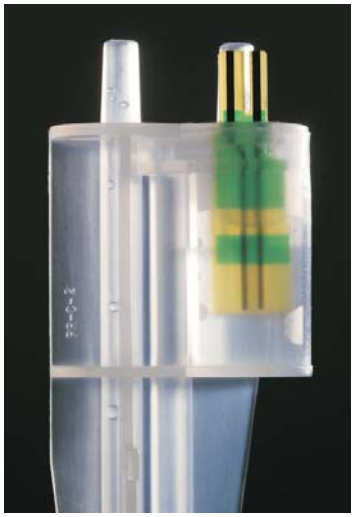
Any production floor or analytical test for cleanliness is only as good as the technique to remove the residue from the surface of the assembly. Process cleanliness relates to the type and level of residues that are able to be brought into solution in critical areas, such as pad to pad or hole to hole on a functioning assembly. It is these residues that the C3 has been designed to assess. The extraction process has been designed to achieve effective ionic residue removal using a heated delivery system consisting of 3 stages:

1. *Solution heating/delivery to the extraction site*
2. *Soak and ionization time*
3. *Aspiration of solution to collection cell*

This cycle is repeated 9 times to effectively remove the surface residues from a 0.1 in2 area, generating approximately 2.0 ml of extraction solution to be used during the testing and afterwards for any desired additional testing.

Electrical Testing

Using a sacrificial Y-pattern electrode immersed in the extraction solution, a 10 volt bias is applied to the electrode and an internal timer is started to measure the time it takes to achieve a leakage event. The system measures the leakage across the electrode generated by the extraction solution plus the residues extracted from the board surface.



A threshold of 500 uA has been set to identify when a current leakage event has occurred. This threshold has been established using a combination of SIR and ion chromatography data from 12 years of research.

The electrical measurement is determined by assessing the time it takes for the extraction solution and the 10 volt biased electrode to reach a 500 uA event. The system works under the theory that the more corrosive or conductive the residue the faster it will achieve this event. The less corrosive or conductive the residue the longer it will take.

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How Clean is this spot?

A Localized Cleanliness Tester and Extraction Tool for Ion chromatography Analysis Electronic assemblies are experiencing more residue related problems today than ever before. Increased circuit resistivity, closer spacing, greater portability, more rework and repair, and harsher operating environmental conditions are contributing to poorer field performance for products used by all industries.

The problem of how clean is clean enough for reliable operating performance is an ongoing issue for higher reliability assemblies. Using the different assembly techniques, such as no-clean or water soluble flux and water cleaning, has shown greater field performance trouble than the previous rosin assembly. We see electromigration problems and increases in no trouble found (NTF) returns due to bare board, component, assembly, and rework cleanliness issues.

Due to all of the recent advances in electronic assemblies, it is now necessary to understand whether a residue in a critical area is corrosive or insulative, and this should be done on the production floor for immediate response to problems. If the residue extracted from this specific area is corrosive, then we must be able to analyze this sample with laboratory support analytical tools, such as ion chromatography, to identify the type and level of each of the contaminants that were removed from that spot. Board fabrication residues or poorly cleaned flux residues are invisible at the levels that cause problems, but still able to cause electromigration or leakage problems.

A new process control tool has been developed to work on the production floor and in the laboratory for assessing a residue in a specific area (0.1 in2) using nondestructive extraction and testing techniques. This tool is the C3, (Critical Cleanliness Control), developed to create an automated, faster, localized extraction and cleanliness test for the production floor. This tester can be used to automate the extraction protocol for ion chromatography analysis. It can also be placed on the production floor and used to assess incoming material cleanliness and to monitor assembly and repair processes.

The production floor samples from the C3 can be used in conjunction with ion chromatography, FTIR or SEM/EDX to identify the type and level of residue that created a corrosive event on the test electrode.

An example of a C3 application

One medical manufacturer is currently using the C3 to check bare board, component and assembly cleanliness levels. They are also using the C3 after repairs to show rework operators the effects of using a small amount of extra no clean flux and not heating it adequately near where the flux spreads from the solder joint. The C3 has repeatedly indicated that the remaining flux was conductive in high humidity environments, which corresponded to a problem the manufacturer had been experiencing. As a result of this production floor information they have implemented a second, controlled, heating process to ensure that the no clean flux saw the proper amount of heat to complex completely and leave the intended benign residue on the board surface.