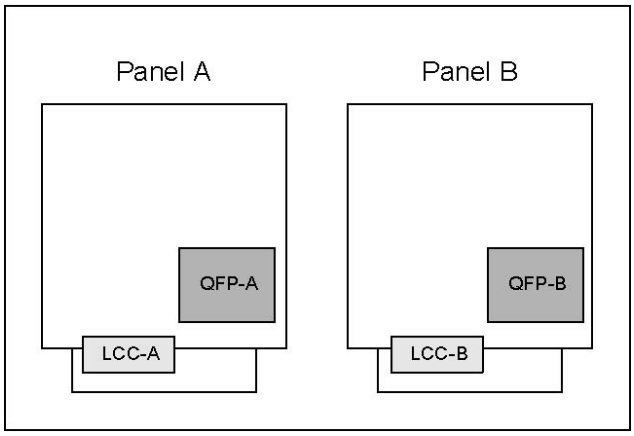
Just Crank Up the Pressure

Low pressure, high volume cleaning proves more effective

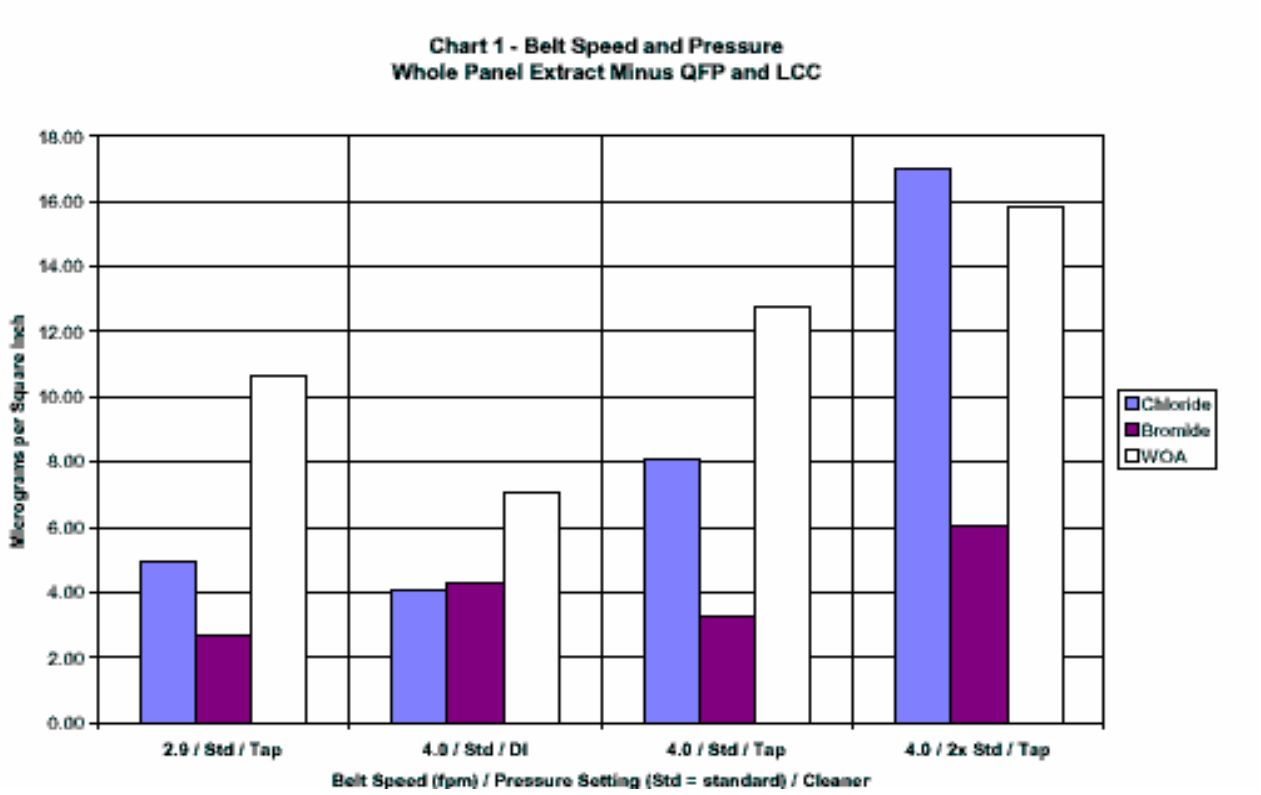
Foresite Inc.

In this case study, we look at a study in cleaning that focuses on two misconceptions: (1) that you get better cleaning by increasing the spray pressures; and (2) that global board extractions will always tell you if you have a contamination problem.

The assembler was a high-volume manufacturer of automotive electronics using water-soluble fluxes and pastes, followed by aqueous cleaning. The assemblies in question, processed in a 2-up array, were plagued by excessive electrical leakage during burn-in testing. A diagram of the assembly is shown on the right. The leakage almost always occurred between the leads of the LCC or between the leads of QFP (15 mil pitch). The assembler did a designed experiment looking at various spray pressures, tap water vs. DI water, and various belt speeds.



The assemblies were cut up so three samples were obtained: an LCC area, a QFP area, and the remainder of the assembly. Chart 1 shows the results of ion chromatography testing for the whole assembly without the problem areas. As might be expected, cleaning improved with the conversion to deionized (DI) water and by slowing the belt speed. When the spray pressures were increased to double the standard levels, cleaning dropped off dramatically.



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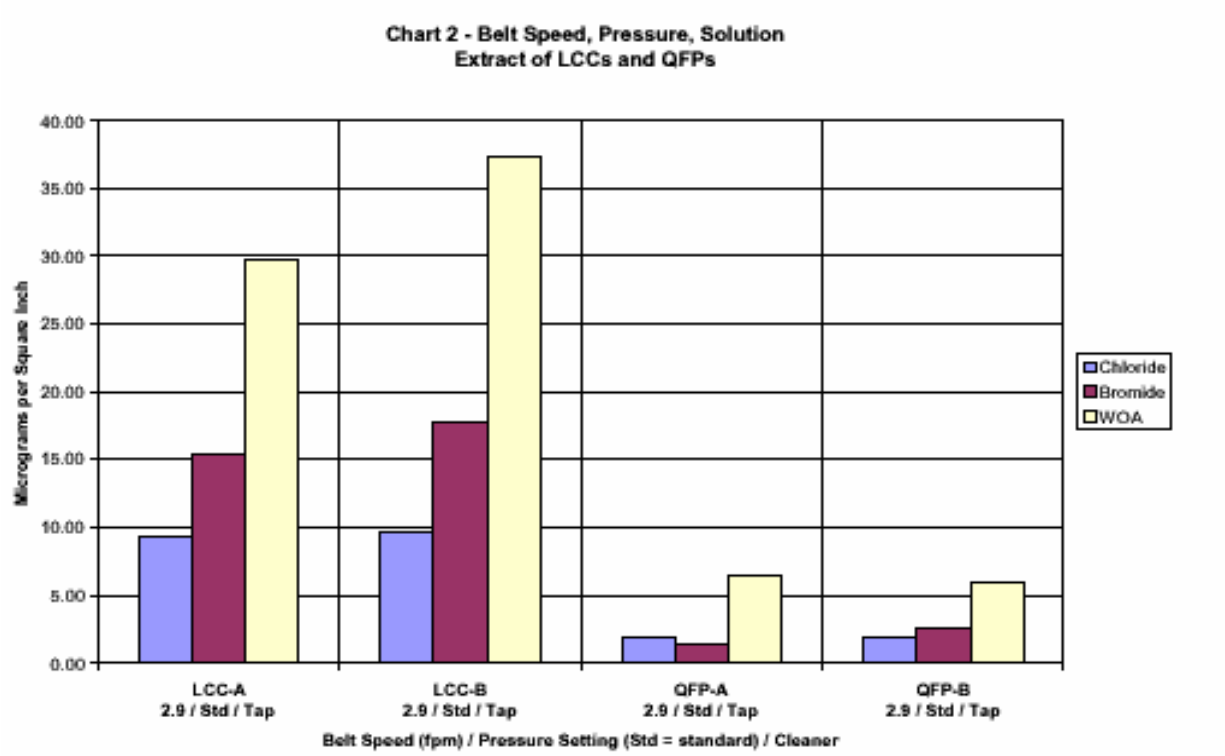
As a reference, Foresite recommends that for assemblies processed with water soluble fluxes, the chloride levels be held under 4.5 micrograms per square inch and the bromides to under 12 micrograms per square inch.

Conventional wisdom said that we should have cleaned more thoroughly, but the opposite effect was apparent. We believe that the higher pressure just caused the water to bounce off the assembly before it had the chance to do much cleaning. In a number of cases, we have found that a high volume / low-pressure (flooding action) wash has produced cleaner assemblies than a high-pressure wash or rinse.

Chart 2 shows the results of testing isolated LCC areas and QFP areas for the same assemblies. The background parameters were the slowest attainable cleaning process (2.9 feet per minute, standard pressures, and tap water -140F). This shows that most of the contamination originated in the two problem areas. If we had relied only on the data in Chart 1, we would not have been able to narrow the problem down. The contamination averaged over the surface area of the whole board did not seem to be hazardous (notice the scale of chart one is 0 - 20 not 0 - 60). We would not have realized the severity of the spot contamination. This should be a revelation to those who rely on ionic cleanliness testers, which use such an averaging principle, to tell them if they have a contamination problem.



Charts 3 and 4 show the cleanliness results for the problem areas at the other parameters of the designed experiment. We see in Chart 3 that all other factors being equal, deionized water cleans much better than tap water. In Chart 4 (compared to chart 2) we see that doubling the spray pressure results in more contamination. Increasing the belt speed also results in poorer cleaning. It's something to think about when you (or your Dilbert-style boss) are tempted to jack up the pressures to solve a contamination problem or increase belt speeds to meet quotas.

Chart 3 - Belt Speed, Pressure, Solution
LCC and QFP Areas

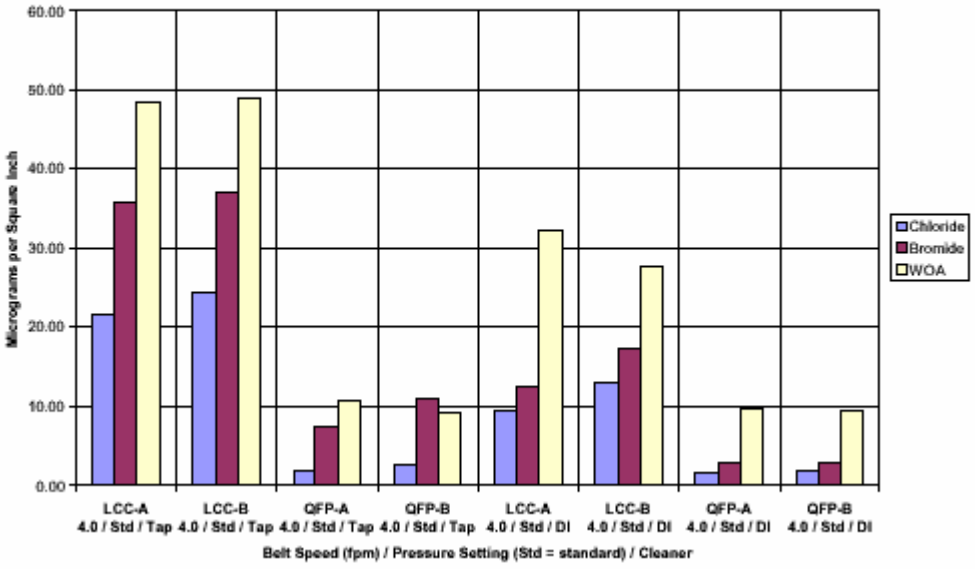
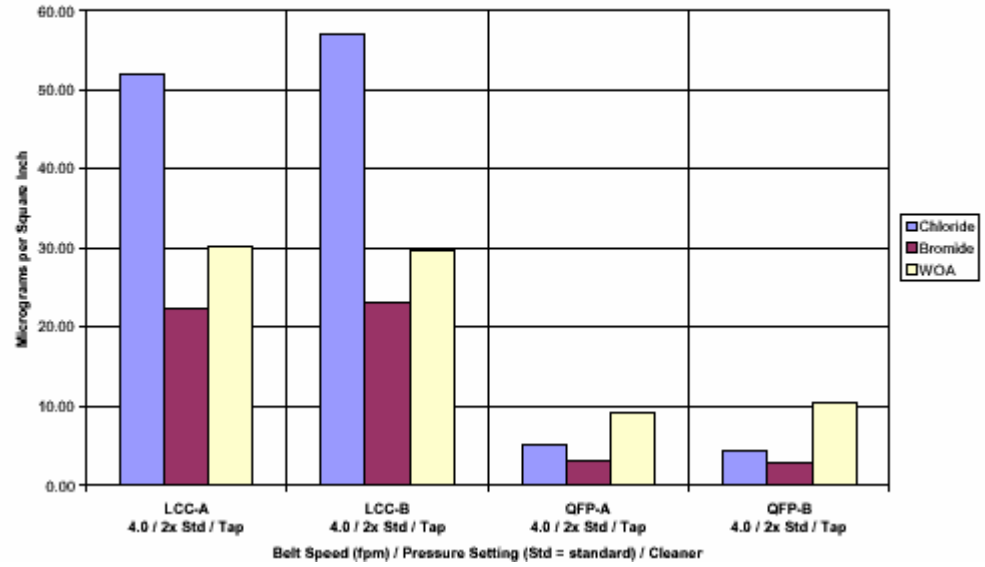


Chart 4 - Belt Speed, Pressure, Solution
QFP and LCC Areas



As a gentle reminder, be advised that Foresite will not divulge the names of any companies or individuals represented in the case studies. **All** specifics of our data are strictly confidential. We have had a number of calls asking for company names wondering if a particular bozo was THEIR particular bozo. You won't find out from us. As another gentle reminder, before you show this article as proof of your prowess, we also recommend that you black out the "D-style boss" comment. Remember that your boss may be wrong but he's always your boss.