

Monday 3/10/14 10:30am

A CLEAN START

There's no doubt about it, clean contacts in contactors and sockets work a lot better than dirty ones. So what better place to start looking at burn-in and test strategies than with a close look at contamination control and cleaning processes to improve yields, test time and re-test reduction? This session begins with three hypotheses of the causes for contact contamination, Along with guidance on procedural changes for improved performance. The next presentation offers a solution to the havoc high temperature burn-in can wreak on devices under test (DUTs) with a specialized coating process to prevent solder contamination of contacts and deformation of the solder bumps on the DUT. The final two presentations examine online cleaning processes. The first focuses on a characterization tool that determines the effectiveness of online cleaning, while the second is directed at an automatic cleaning solution for a bowl fed handler used with a RF contactor. Hey, it's a dirty job, but somebody's got to do it.

Contamination Mechanisms of Contact Probes

Jon Diller, Kevin DeFord—Smiths Connectors | IDI

Special Coating Cleans-Up a Mess

Paul Ruo—Aries Electronics, Inc.
Erik Orwoll—Contact Coatings, LLC

Unique Methodologies for Investigating On-line Cleaning Process Parameters and Recipe Optimization

Jerry J. Broz, Ph.D., Soheil Khavandi, Bret Humphrey—International Test Solutions

This Paper

Yield and Test Time Improvement via Automated Online Cleaning

Brent Edington—TriQuint

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Yield and Test Time Improvement via Automated Online Cleaning

Brent Edington
TriQuint



2014 BiTS Workshop
March 9 - 12, 2014



Content

- Introduction
- Problem Statement
- Current Process
- Automated Cleaning Process Development
- Yield and Test Time Improvements
- Financial Impact
- Future Development
- Questions

What's the Problem?

Yield vs Test Time

- Contactor cleanliness adversely affects yield
- Reactive cleaning results in decreased yield
- Proactive cleaning results in increased test time

Can we improve yield without increasing test time?

Can we improve both?

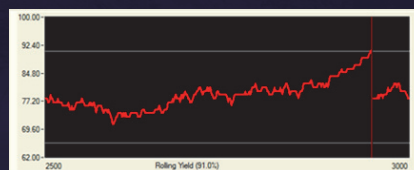
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The Current Process

Real Time Yield Monitoring System (RTYMS) with Manual Cleaning



- 3 sigma limits based on first 200 devices
- Tracks rolling average yield for 100 devices
- Pauses test when 3 sigma limits are exceeded
- False positives
- A good but reactive and time intensive process

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Potential Solutions

- **Proactive Manual Clean**
 - Different devices are more/less sensitive to contamination
 - Test time increase
- **Contactors Requiring Less Cleaning**
 - Some success, but cleaning still required
 - Device size and backside ground paddles issues
- **Automated Cleaning**
 - Fast
 - Proactive
 - Effective
 - Only works for tray fed handlers

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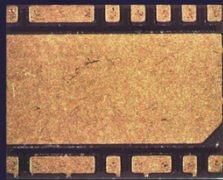
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Potential Solutions

- Can we adapt automated clean?
- Will it improve yield?
- How will test time be affected?

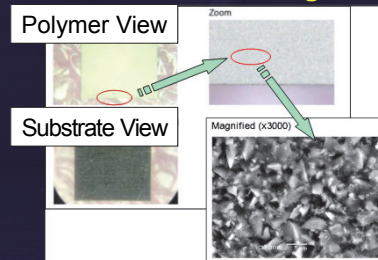


**SRM XD248
 Bowl Fed
 Handler**



**4.5 x 3.5 x 0.89 mm
 PA Duplexer Module**

ITS Socket Cleaning Device

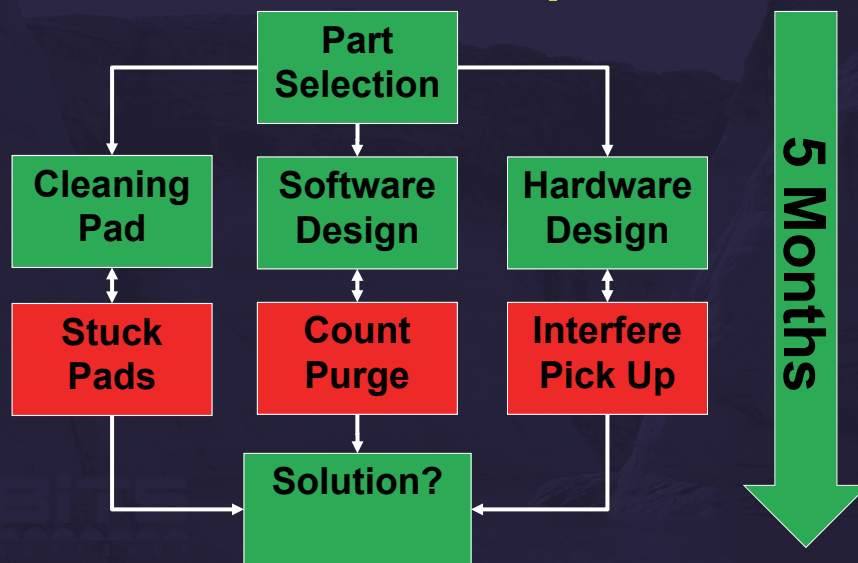


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Initial Development



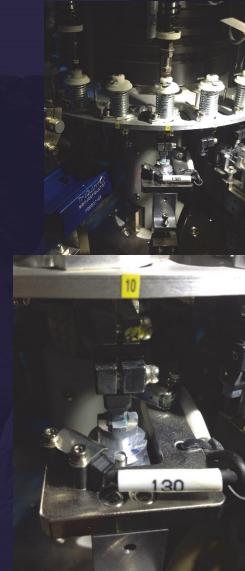
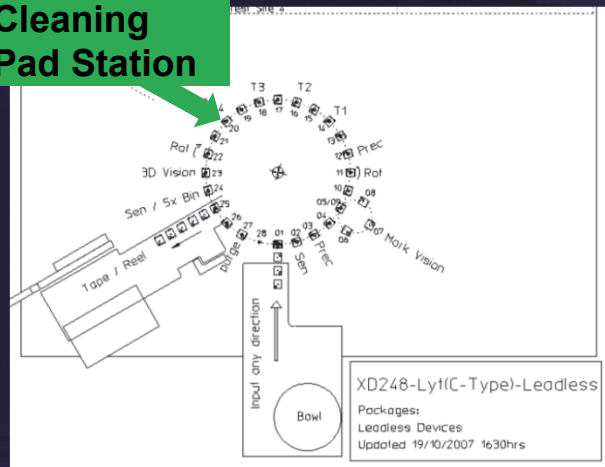
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Initial Development

Cleaning Pad Station

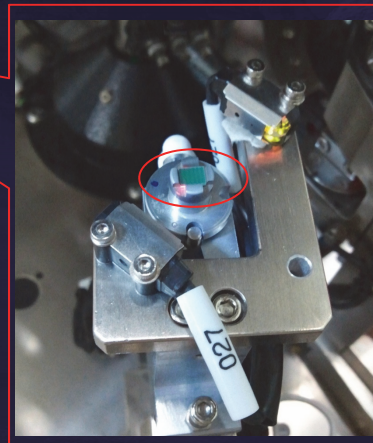
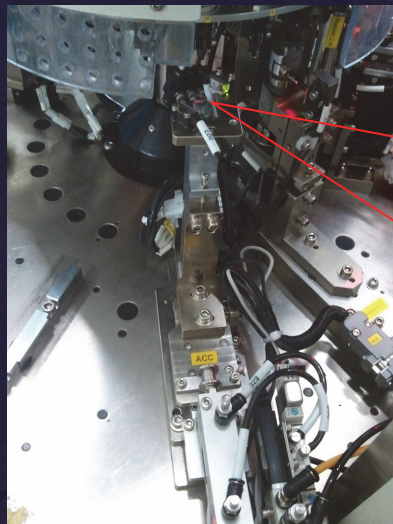


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Initial Development

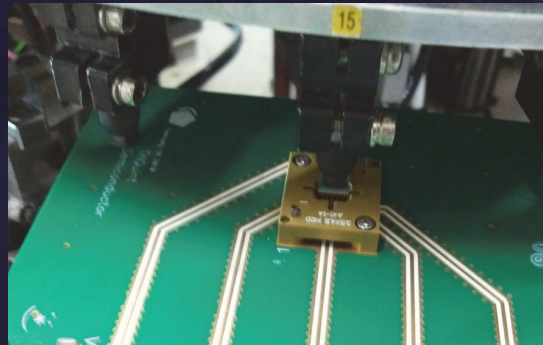


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Initial Development



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Initial Development

Setting	
Tape & Reel	Tape & Reel Setting
Tape (1 - 15000)	2500
Trailer (1 - 10000)	100
Leader (1 - 10000)	100
Unseal Leader (0 - 10000)	0
Seal Block Up Delay	2000 (2000 - 10000)
Seal Time	50 (0 - 50) ms
Tape Index Delay	0 (0 - 1000) ms
Carrier Tape Limit Reach Timer	2000 (100 - 5000) ms
Rotator 2 Rotate Angle	0°
Sealing Shoe PM Max Count	100000
Sealing Shoe PM Count	0 <input type="button" value="Reset"/>
Auto Clean Finger Max	1500 (0 - 100000)
Auto Clean Finger Test Max	4 (0 - 50)
Auto Clean Finger LifeSpan	50 (0 - 100000)
Auto Clean Finger Remaining	50 <input type="button" value="Reset"/>
Tape Seal Heater On/Off	<input checked="" type="checkbox"/>
Tape Seal PSA On/Off	<input type="checkbox"/>
Machine Continue After One Reel	<input type="checkbox"/>
Disable Stop When Index	<input type="checkbox"/>
Auto Cut Tape	<input checked="" type="checkbox"/>
Mix Lot	<input checked="" type="checkbox"/>

Total OI Tape, Trailer and Leader Must Be Greater Than 49

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Initial Evaluation

- 1 Online Clean System
- 2 Manual Clean Control Systems
- 1 Month
- ~ 600K – 700K Devices / System

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Initial Results

Yield Summary			
	Virgin Yield	Retest Yield	Composite Yield
Online Clean	98.36%	0.57%	98.93%
Ave Manual Clean	97.25%	1.40%	98.65%
Delta	1.11%	0.83%	0.28%

Test Time Summary (Hours)			
	Virgin Time	Retest Time	Total Time
Online Clean	10.16	0.22	10.38
Ave Manual Clean	10.57	0.41	10.98
Delta	0.41	0.19	0.60 (40 min)

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Victory?

- **Maybe, but...**
 - Single handler for online clean
 - Single system for online clean
 - Human factor
- **Invest and expand the data pool**
 - 2 different products
 - 4 online clean systems / product
 - 2 manual clean control systems / product
 - ~ 1M devices / system

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Final Evaluation

4.5 x 5.0 x 0.91 mm
PA Duplexer Module #1

4.5 x 5.0 x 0.88 mm
PA Duplexer Module #2



+7

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Final Results PAD #1

Yield Summary			
	Virgin Yield	Retest Yield	Composite Yield
Online Clean	93.26%	2.48%	95.74%
Ave Manual Clean	92.49%	3.04%	95.53%
Delta	0.77%	0.56%	0.21%

Test Time Summary (Hours)			
	Virgin Time	Retest Time	Total Time
Online Clean	10.15	0.77	10.92
Ave Manual Clean	10.37	0.89	11.26
Delta	0.22	0.12	0.34 (20 min)

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Final Results PAD #2

Yield Summary			
	Virgin Yield	Retest Yield	Composite Yield
Online Clean	91.99%	2.61%	94.60%
Ave Manual Clean	88.77%	3.86%	92.63%
Delta	3.23%	1.25%	1.97%

Test Time Summary (Hours)			
	Virgin Time	Retest Time	Total Time
Online Clean	12.64	1.06	13.71
Ave Manual Clean	13.36	1.56	14.93
Delta	0.72	0.50	1.22 (73 min)

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Show Me the Money

Final Evaluation Cost Savings		
	Credit	Debit
Initial Development		\$12,000
7 Additional Upgrades		\$35,000
Cleaning Pads		\$2000
PAD #2 Yield Increase	\$440,000	
PAD #1 Yield Increase	\$47,000	
Total	\$487,000	\$49,000

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\$438,000 Saved

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What's Next?

- Expand automated cleaning solution to all products using pogo style sockets
- Develop automated cleaning solution for non-pogo sockets
- Evaluate automated cleaning solution for high volume WLAN PAs in QFN packages with NiPdAu pads

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Recognition



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