Transitioning Away From Open Top Vapor Degreasing

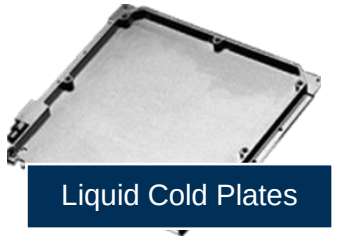
BOYD
TRUSTED INNOVATION

Boyd (Woburn)

Who is Boyd

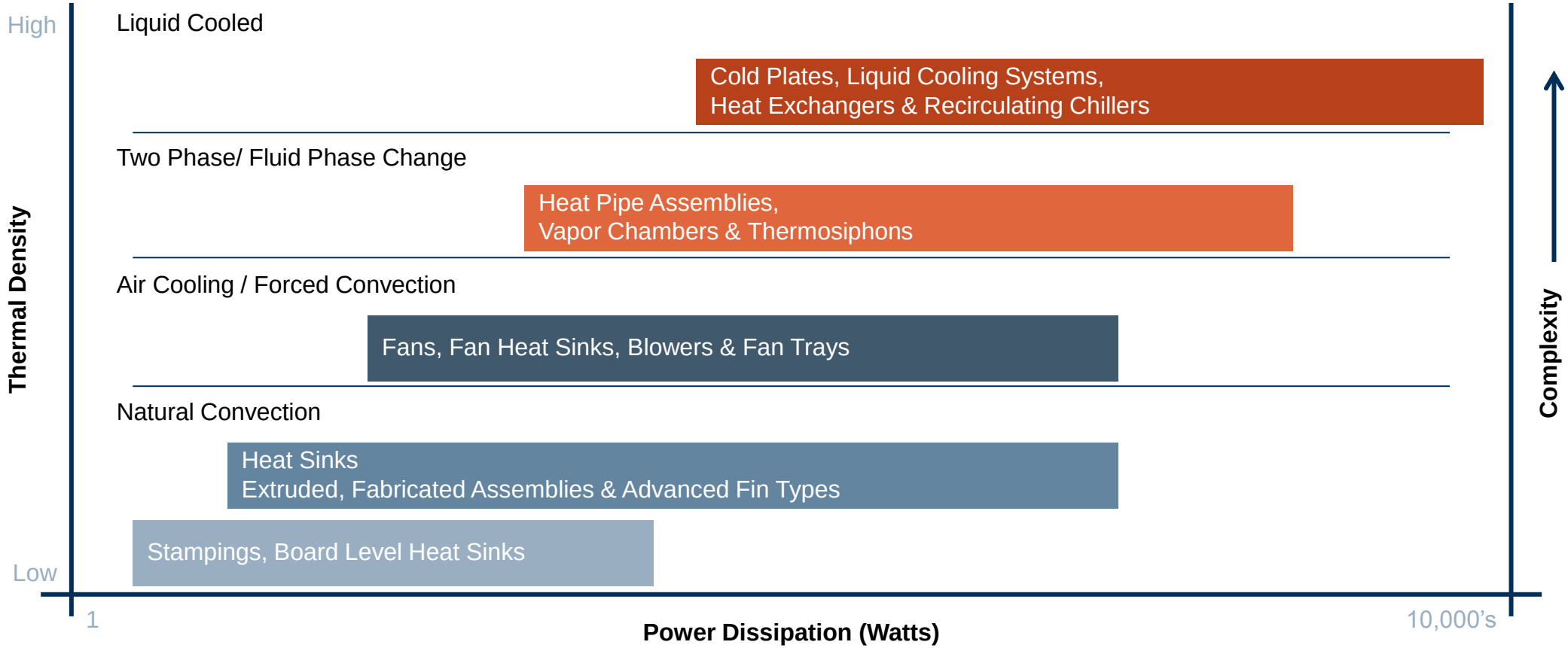
Advanced Fin Assemblies

Heat Exchangers



Liquid Cold Plates

Complex Chassis



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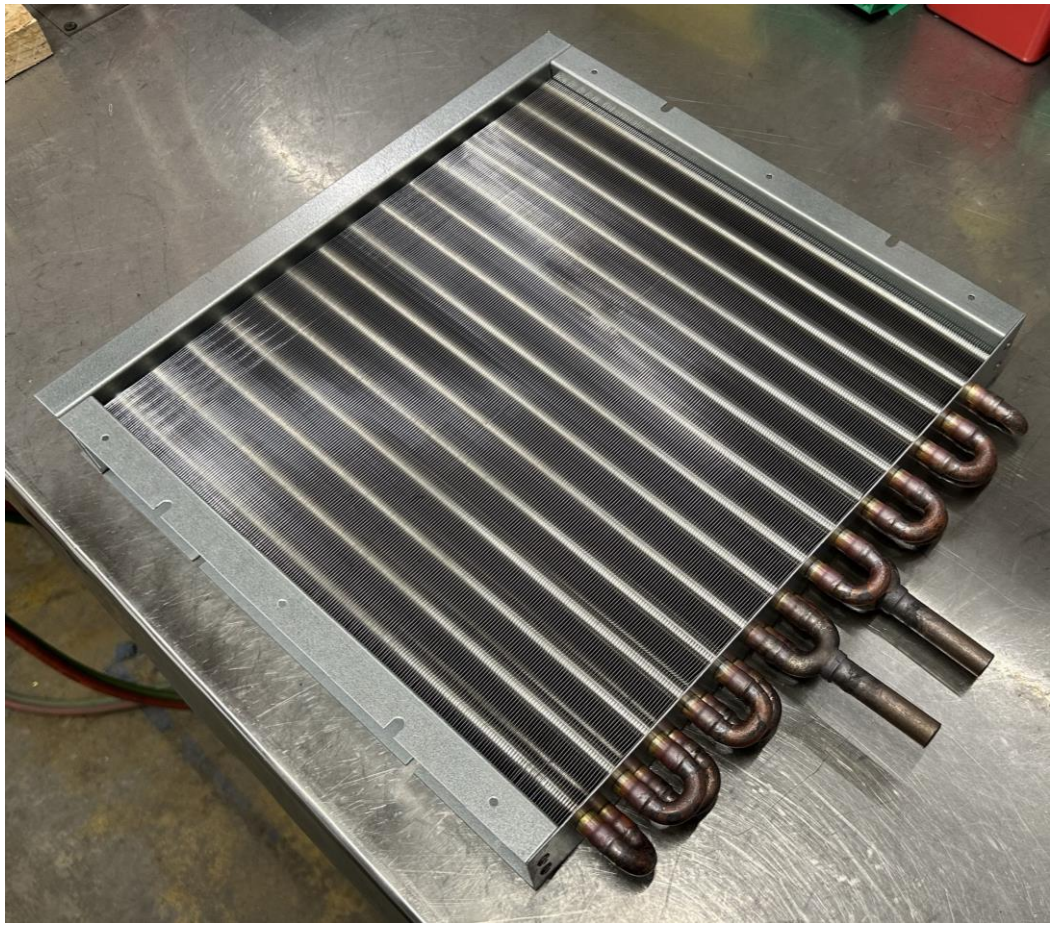
Intro to Boyd (Woburn) Products

Copper Value Stream



Aluminum Value Stream

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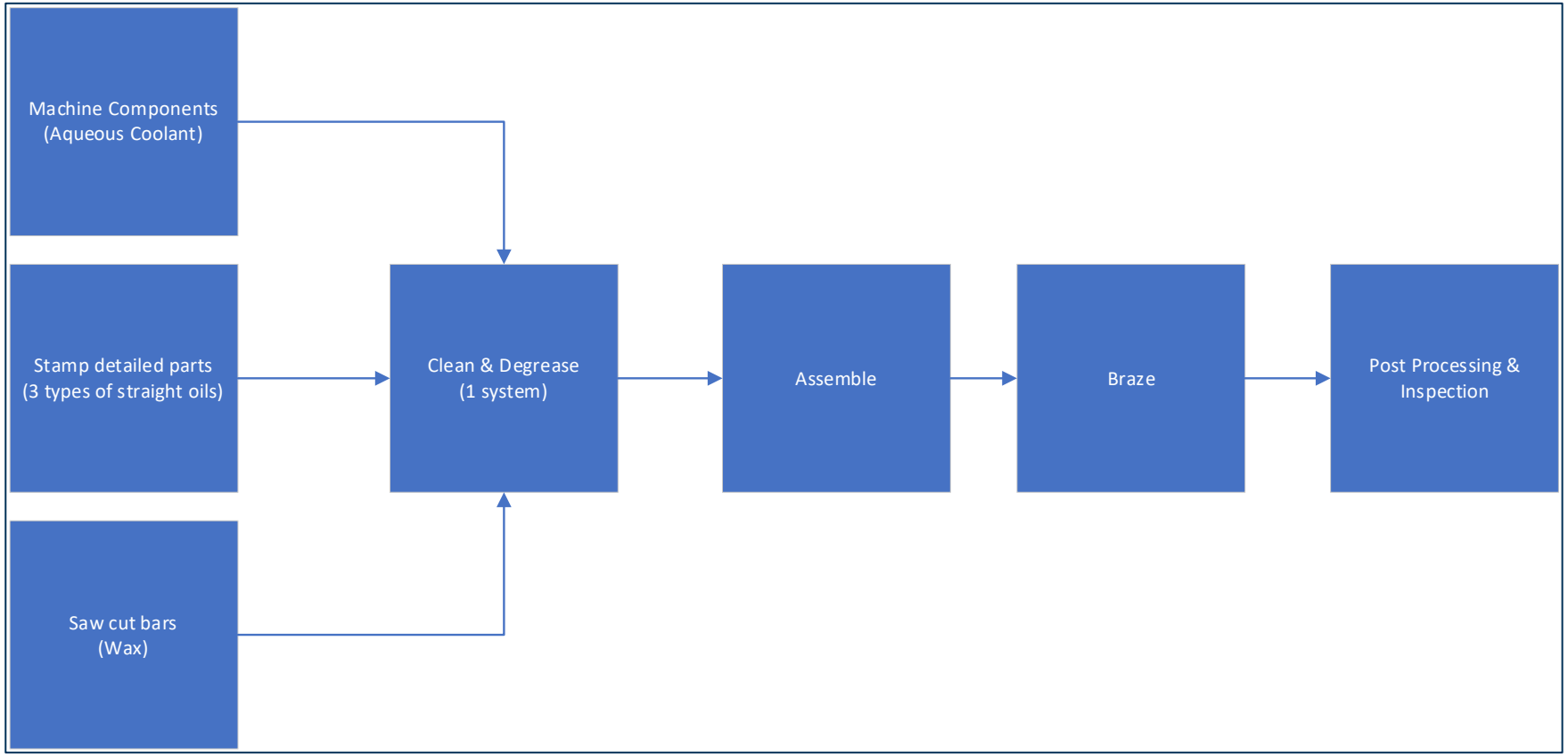
Aluminum Value Stream Processes

- **5 Soils**
  - Machining coolant @10% concentration
  - 3 straight forming oils
  - Saw blade wax
- **Why is cleaning so important?**
  - Need a system effective on all soils used
  - Post processing requires a high level of cleanliness
- **What happens when it goes wrong?**
  - High part cost, with no reworking potential
  - Potential $10,000+ lost per batch



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Transitioning to a VCN System From VPS

Aluminum Value Stream

Trichloroethylene

Tergo Metal Cleaning Fluid (Trans-dichloroethylene)

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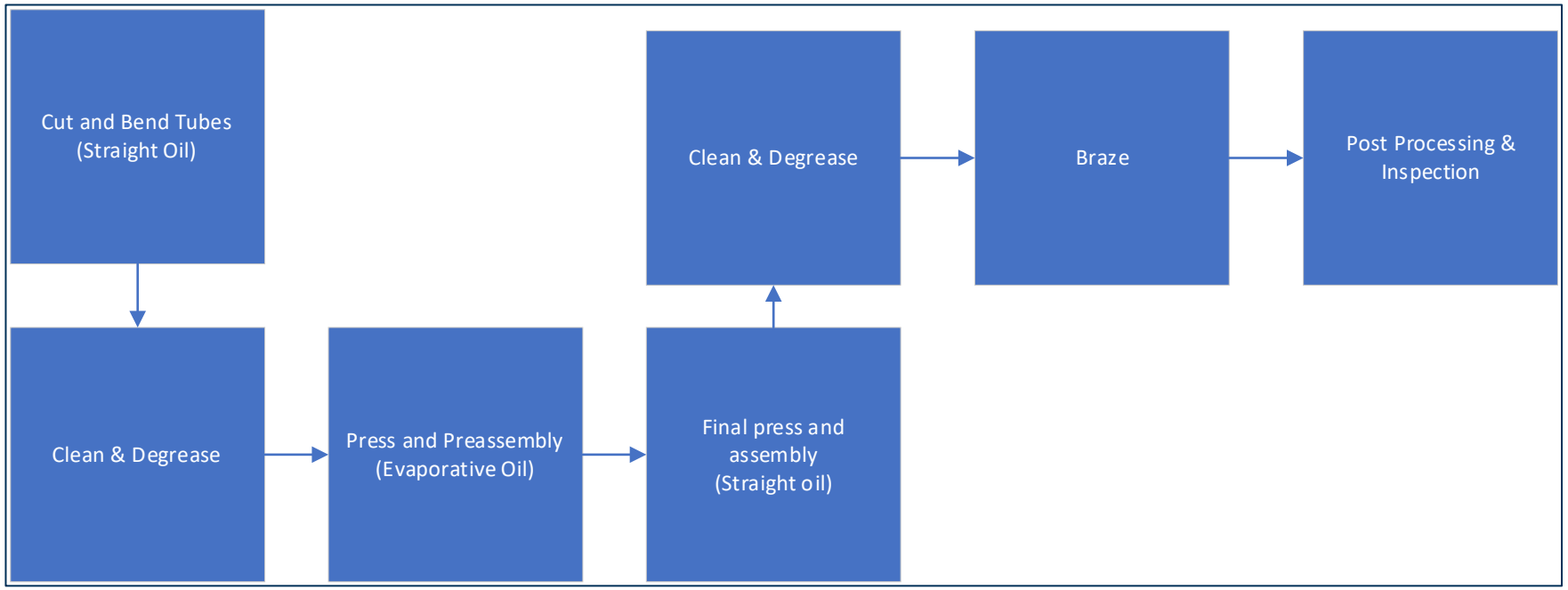
Copper Value Stream Processes

- **What soils**
  - 2 straight forming oils
  - 1 evaporative forming oil
- **Why is cleaning less important than aluminum?**
  - Less difficult soils to clean
  - Manual process allows operator to adjust if cleanliness is poor
- **What happens when it goes wrong?**
  - Most parts can be reworked if they leak
  - $100 - $1,000 lost if cleaning fails



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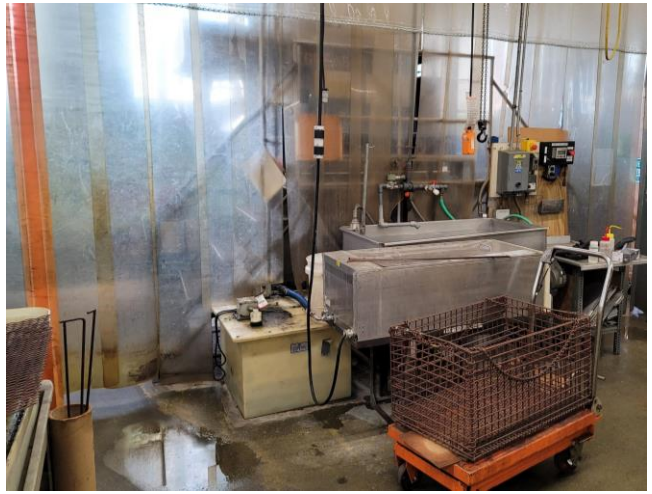
Transitioning to an Aqueous Cleaning System from Ramco

Copper Value Stream

Trichloroethylene



Aquaease PL732

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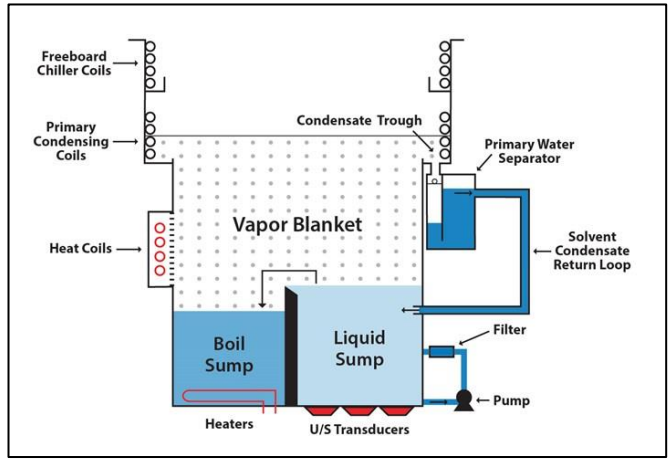
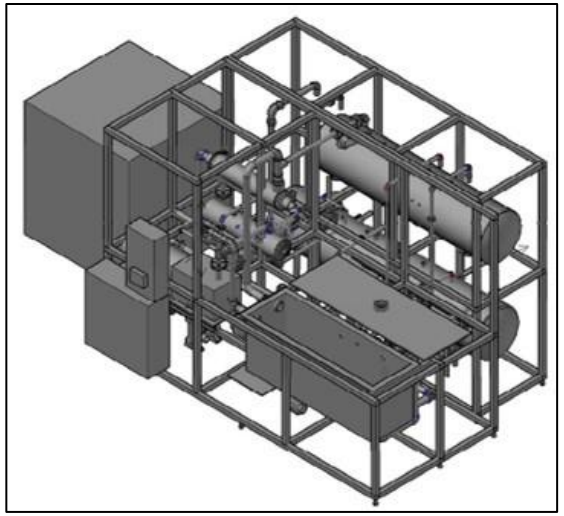
Common Cleaning Technologies

- Open-top vapor degreaser (Old cleaning systems)
  - Semi-automated and manual options
- Open-top aqueous degreaser (Our Copper cleaning system)
  - Semi-automated and manual options
- Closed-loop solvent degreaser (Our VPS system)
  - Usually, semi-automated
- Closed-loop aqueous degreaser
  - Usually, semi-automated
- Closed-loop alcohol degreaser
  - Usually, semi-automated

Open-Top Vapor Degreaser



Closed-Loop Solvent Degreaser



Open-Top Aqueous Degreaser

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Comparison Between Boyd (Woburn)'s Cleaning Systems

	Open-Top Vapor Degreaser	Closed-loop Solvent Degreaser (VPS)	Multi-Tank Aqueous Degreaser
Operating Cost	Highest	Middle	Lowest
Upfront cost	Lowest	Highest	Middle
Environmentally Friendly	Lowest	Highest*	Highest*
Ease of use (operation)	Hardest	Middle	Easiest
Flexibility (process changes)	Most Flexible	Least Flexible	Middle
Cleaning potential	Middle	Highest Potential	Lowest Potential
Recipe/process development	N/A (W/out automation)	Hardest	Middle

*Most environmentally friendly is subjective. Would your company prefer a greater volume of less hazardous chemicals to manage in the waste stream, or a lesser volume of a more hazardous material to manage in the waste stream. As long as progress is being made to lessen the total environmental impact.

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Comparison Continued

Open-Top Vapor Degreaser

- More room for operator error
- Highly affected by environment factors (Temp/humidity)

Vacuum Solvent Degreaser

- The most consistent process run after run
- Typically, the most mechanically complex to modify and maintain

Open-Top Aqueous (Automated)

- Can often achieve highest thruput with multichambered system
- Requires the most mechanical agitation to be affective
- Large volume for fluid management

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How to Select the Right Equipment

Identify your needs

- Cleanliness level, floor space, technical requirements, customer exemptions

Find and test a chemistry

- Try a variety of chemistries with your soils on your materials to see what works
- kB value is a good place to start

Find a system that works with your chemistry

- Material compatibly of the equipment, mechanical agitation, temp ranges, etc…

Test your parts with the OEM system and selected chemistry

- Find the closest model to your desired requirements and do as close to full test runs as possible. (See next slide for tests)

Make any modifications to the equipment that may be needed

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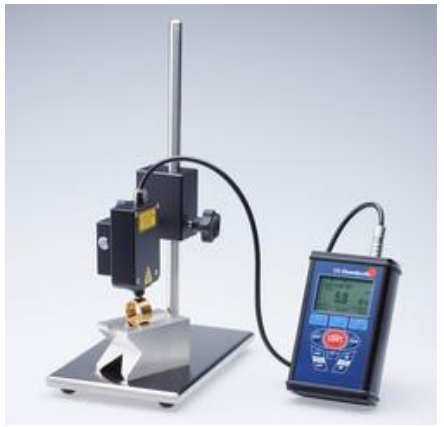
Cleanliness Test for Effectiveness

Quantitative Methods

- Gravimetric
- Surface chemical analysis
- X-ray photoemission spectroscopy (XPS)
- Cleanospector (Similar to XPS)

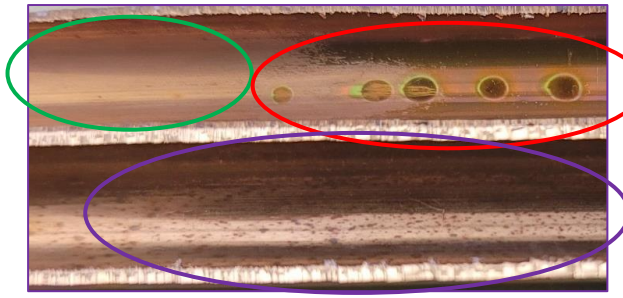


Surface Energy

- Dyne pen
- Contact angle (Water drop)
- Water break test

Visual

- Swab/white glove
- Bake out & visual inspect
- Black light
- Endoscopic analysis



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Lessons Learned Bringing in New Cleaning Equipment

Equipment safety

- Light curtains, protection from fluid splashing, heat hazard, etc..

Customer Approvals

- Customer banned chemical list

Cleaning solution management

- Concentrations, oil saturation levels, particle by products, etc…

Waste stream management

- How and when to dispose of waste stream products

Operator training

- What can they do and what can’t the do, or what do you want to lock them out of

Engineering training

- Programming equipment

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Lessons Learned (continued)

Automation

- Will this need to be manned full-time or can someone run this and other processes

PM requirements (and schedule)

- Spare parts, frequent PM, filter changes, etc…

Layout and how the system will be interacted with

- Where are the parts loaded/unloaded, where do you interact with the control panel and maintenance, is it safe to operate

Material handling

- Into/out of the system, into/out of the container, onto some other racking
- Fluid handling

Post processing effects

- Some chemicals like silicone reduce metal joining even if it is “Clean”

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Contact Information

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