



sifco asc

The Benefits of Automated Selective Plating

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& Project Engineer

Who We Are

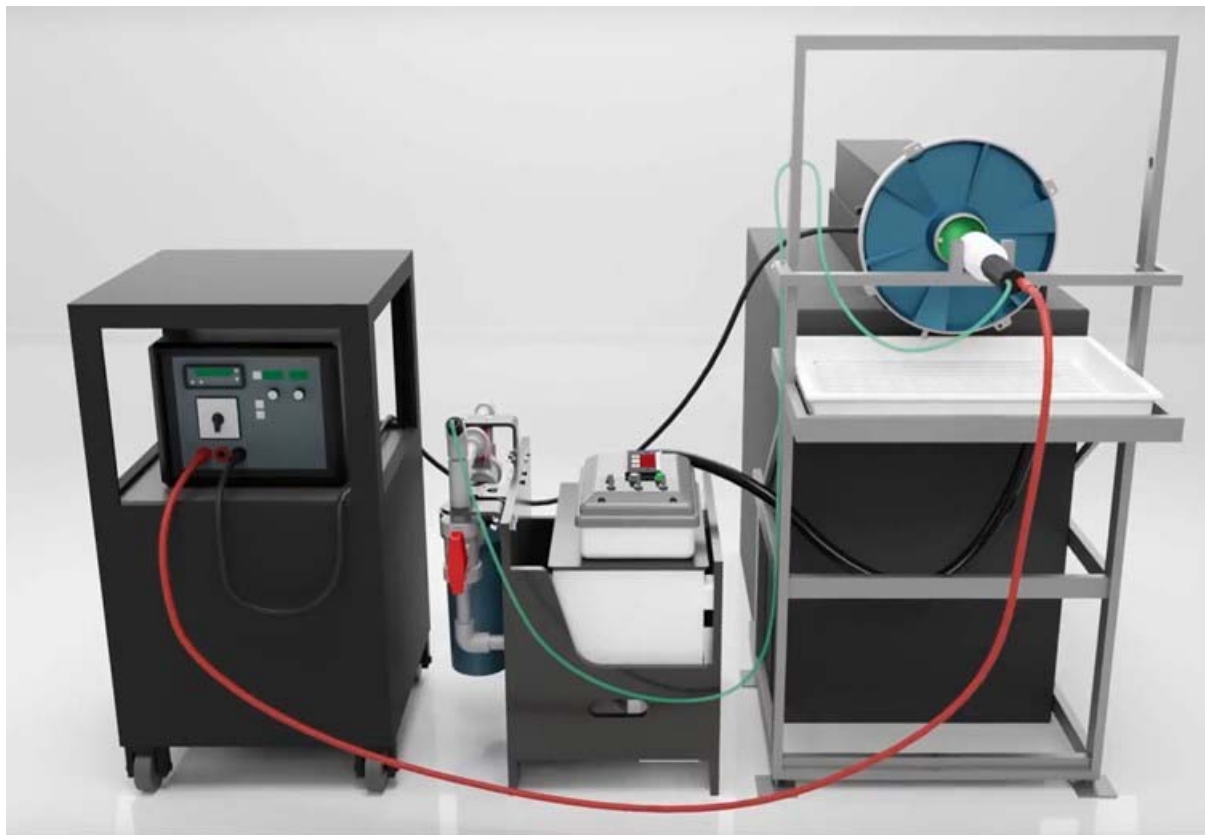
- **SIFCO Applied Surface Concepts**
 - Founded in 1959
 - Headquartered in Cleveland, Ohio, USA
 - Acquired as part of the Surface Coatings Division of Norman Hay in 2012.
 - 4 US and 3 European Locations
 - USA: Ohio, Texas, Connecticut, & Virginia
 - Europe: UK, France, & Sweden
- **Norman Hay Group**
 - Founded in 1940 doing Chromium Plating and Hard Anodizing
 - Headquartered in Coventry, UK
 - Ultraseal International, Surface Technology, and NHE

Overview

- What is Selective Plating?
- Why do we automate?
- Rectifier Software Control
- Mechanization
- Semi-Automated Systems
- Fully-Automated Systems
- Benefits of Automation
- Summary/Conclusions
- Questions

What is Selective Plating?

- The SIFCO Process® is a portable method of electroplating localized areas without the use of an immersion tank.



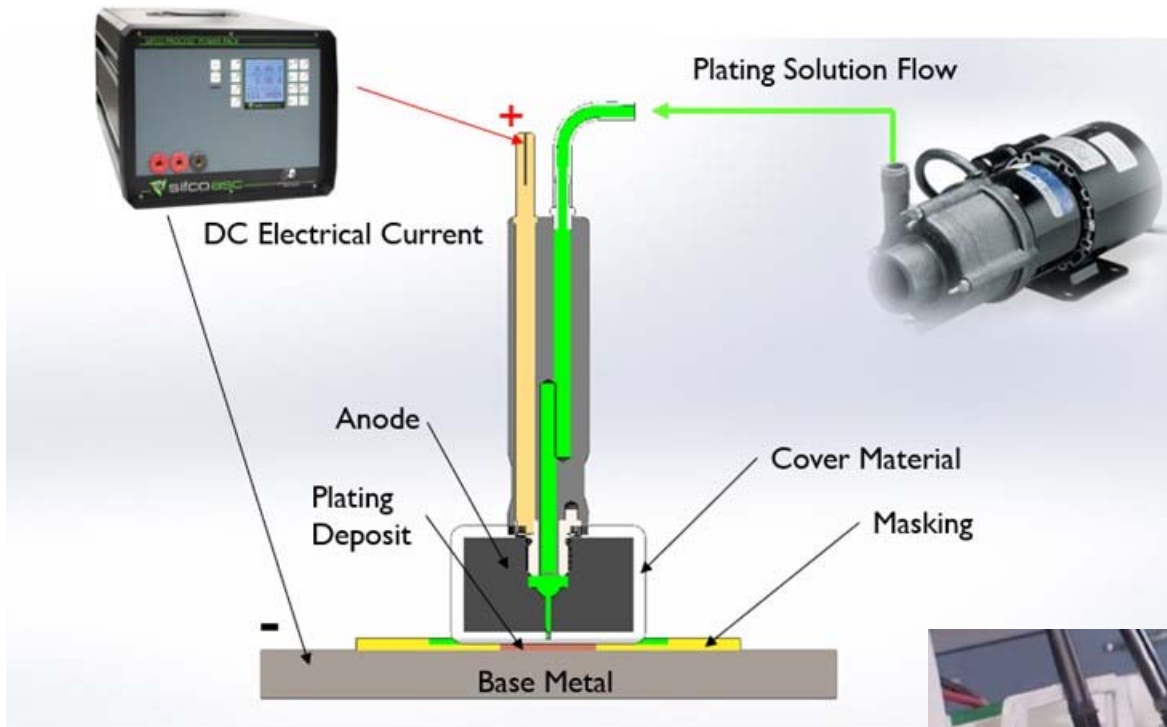
Key Requirements:

1. Workpiece
2. Rectifier
3. Plating Tools
4. Solution

Other:

- Solution Flow System
- Masking Materials
- Auxiliary Equipment

Selective Plating/Brush Plating



Surface Preparation

- Pre-Clean
- Electroclean
- Etch
- Desmutting
- Activation
- Preplate
- Plate

Advantages of Selective Plating vs. Immersion

- Portable
- Faster method (high current density)
 - Higher metal concentrations
 - High solution velocity replenishment of metal ions at the surface
 - Brushing action disturbs the hydrodynamic boundary layer at the surface resulting in faster solution movement.
 - Hydrogen gas bubbles are removed by the brushing action and high solution velocity.
- Reduced masking needs
- Ideal for large parts not suited for immersion baths
- Reduces chemical volumes needed for plating

Manual Selective Plating

- During the selective plating process operators perform various tasks:
 - Part handling
 - Post plating visual inspection
 - Modify rectifier settings (amps, volts)
 - Change and move anodes
 - Open and close valves
 - Rinse parts
 - Move and dump chemical trays
 - Monitor and document rectifier settings (amps, volts, and amp-hours)
 - Adjust amp-hrs based on solution life
 - Maintain specific gravity of chemistry
 - Detect equipment issues
 - Handle distractions and more
- Variations occur during plating process
 - From part to part
 - From operator to operator
- Process must be documented for quality assurance
 - Have little time to monitor and record the actual versus the targeted process settings

Why do we automate?

- To increase labor productivity (greater output per hour of labor input)
- To reduce labor cost
- To mitigate labor shortage
- To reduce or eliminate routine manual tasks
- To improve worker safety
- To improve product quality
- To reduce manufacturing lead time
- To accomplish processes that cannot be done manually

Rectifier Software Control



Manual Plating Tasks:

- Part handling
- Post plating visual inspection
- **Modify rectifier settings (amps, volts)**
- Change and move anodes
- Open and close valves
- Rinse parts
- Move and dump chemical trays
- **Monitor and document rectifier (amps, volts, and amp-hours)**
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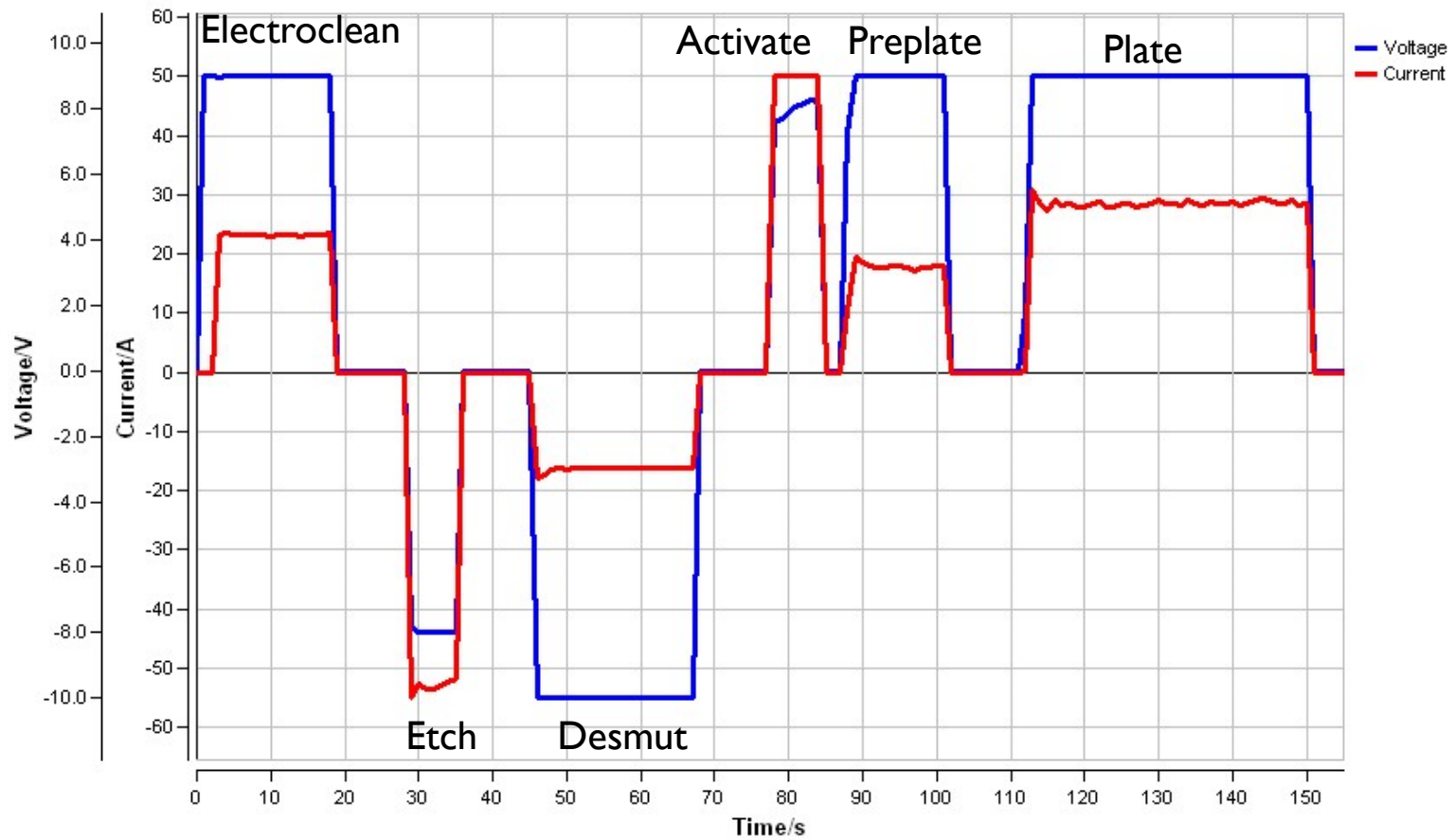
Rectifier Software Control



Process Improvements:

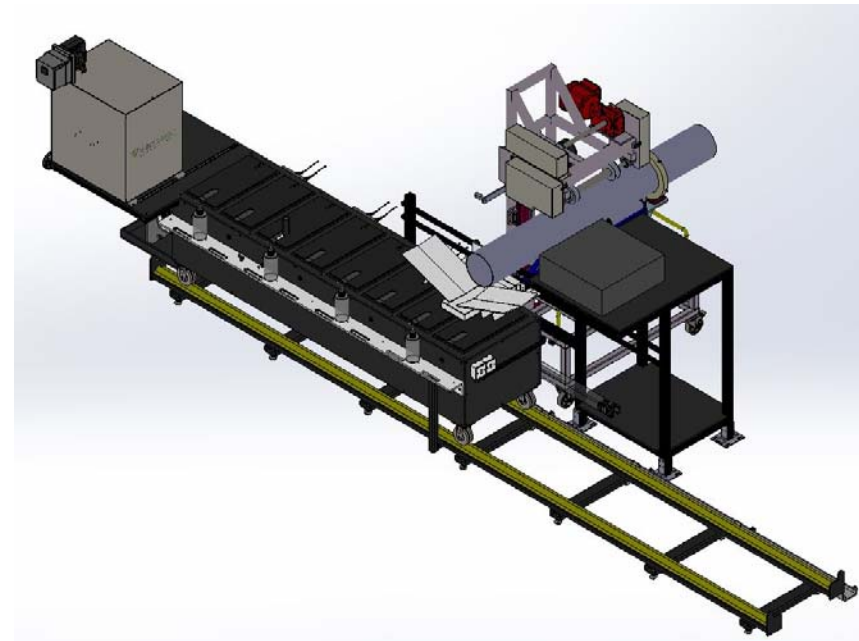
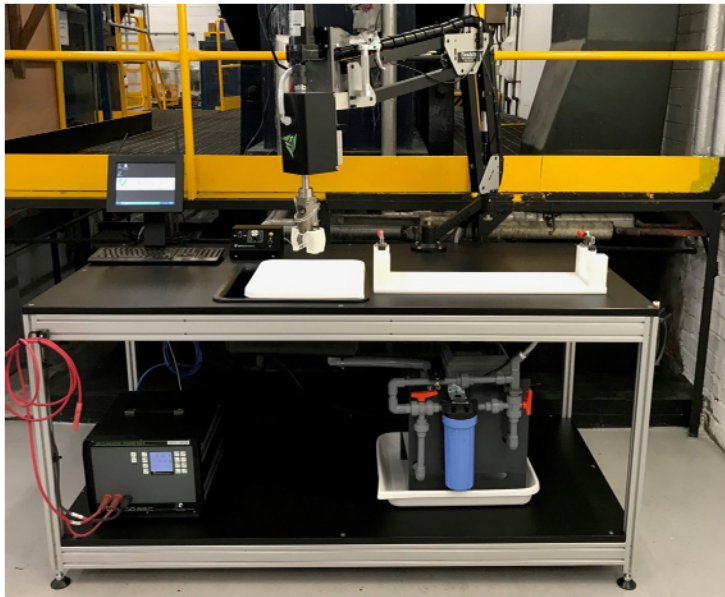
- Frees operator from adjusting rectifier
- Repeatable and reproducible
- Optimizes deposit properties with standardized amps, volts & amp-hrs
- Increased throughput
- Fewer errors
- Data logging captures actual amperage, voltage and time
- Overall improved quality control and assurance

Programmed Rectifier Data Report

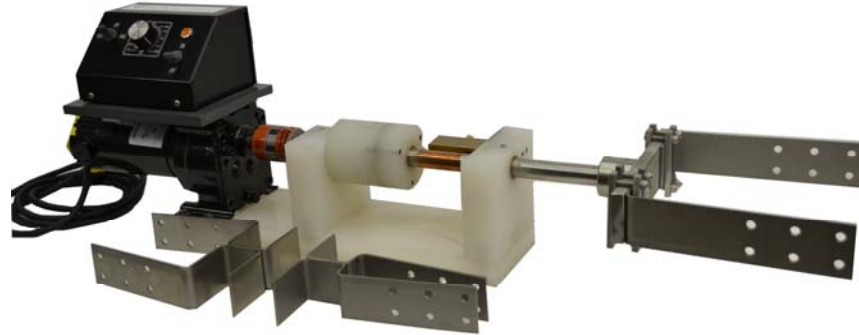


Mechanized Solutions

- Utilizes programmable software for rectifier
- Assists operator with tasks during plating process
 - Change and move anodes
 - Open and close valves
 - Rinse parts
 - Move and dump chemical trays



Application 1:



Oil Well Blow Out Preventer (BOP)

- Application: Corrosion Protection
- Deposit: Nickel
- Base Material: F22 Carbon Steel
- Thickness: 0.030" – 0.060"
- Plating Process Steps
 - Electroclean
 - Etch
 - Desmut
 - Nickel Sulfate Preplate
 - Nickel Sulfamate Plate



Corrosion damage inside critical seal pockets, parts require repair/refurbishment in order to utilize again in the field
Desired turn time was 4-6 parts every 4-6 weeks

Application 1:

- Off-center pockets require anode rotation via ID plater
- Plating horizontally requires flipping part 180 degrees to prevent uneven thickness distribution
- Plating vertically prevents flipping parts by flooding the pocket
- Difficult to align with bore with mechanical setup
- Misalignment creates anode wrap wear building plating in the cover
- Requires more setup and masking time (increased labor)



Application 1:



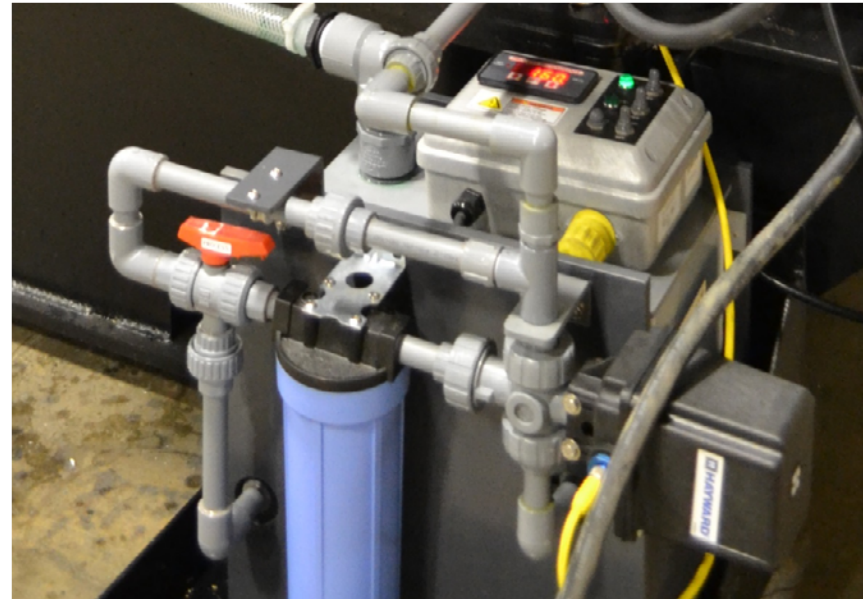
- Semi-Automated machine built to increase throughput and reduce changeover time
- Automated PLC controlled servos and digital position readout for anode alignment
- Part locating tooling
- Masking fixtures
- Rectifier software control
- Operator preps plating area with hand tools
- Carbon filter ventilation

Application 1:

Manual Valve



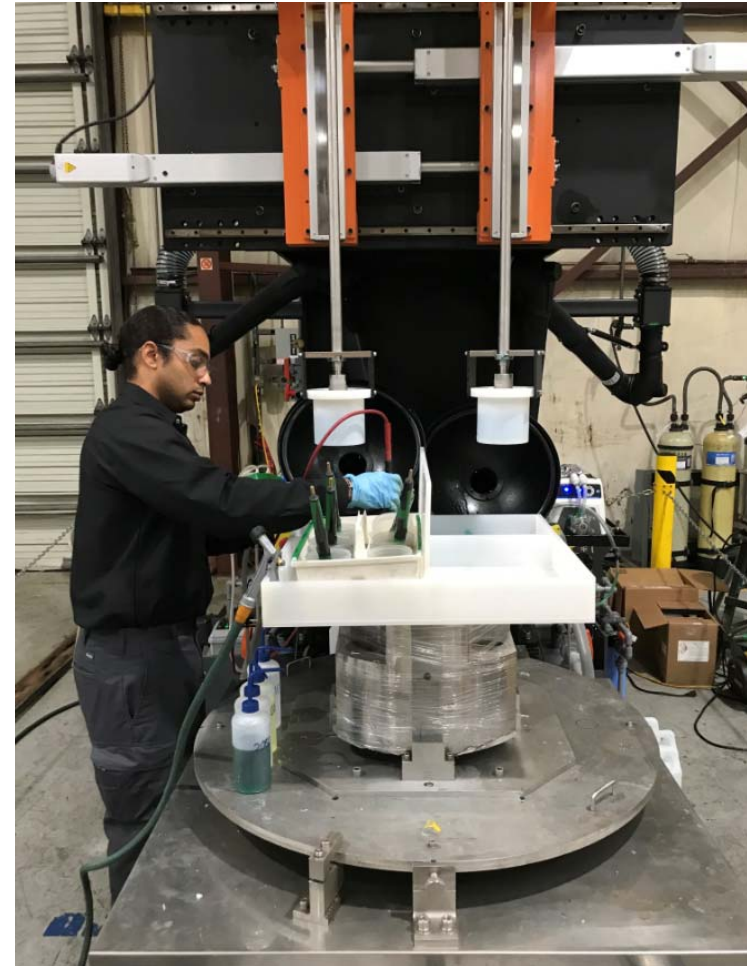
Automated Valve



Application 1:

Benefits of Semi-Automated Machine

- Increased throughput by plating two areas at the same time
- Productivity improvement by decreasing setup and masking time
- Reduced labor
- Process control and consistency with anode alignment repeatability
- Optimized deposit properties with standardized plating recipes
- Data logging records actual amperage, voltage & amp-hrs for every part
- Reduced human errors
- Reduced lead time from 25 days to 8 days to finish one part



Application 1:

Total Productivity Improvement

Event	ID Plater (Horizontal)	ID Plater (Vertical)	Machine
Setup	2-3 hrs	3-4 hrs	1 hour
Masking	2-3 hrs	3-4 hrs	0.5-1 hour
Applications/Bore	4	2	1
Applications/Day	1	1	2
Total Processing Time	25 days	18 days	8 days

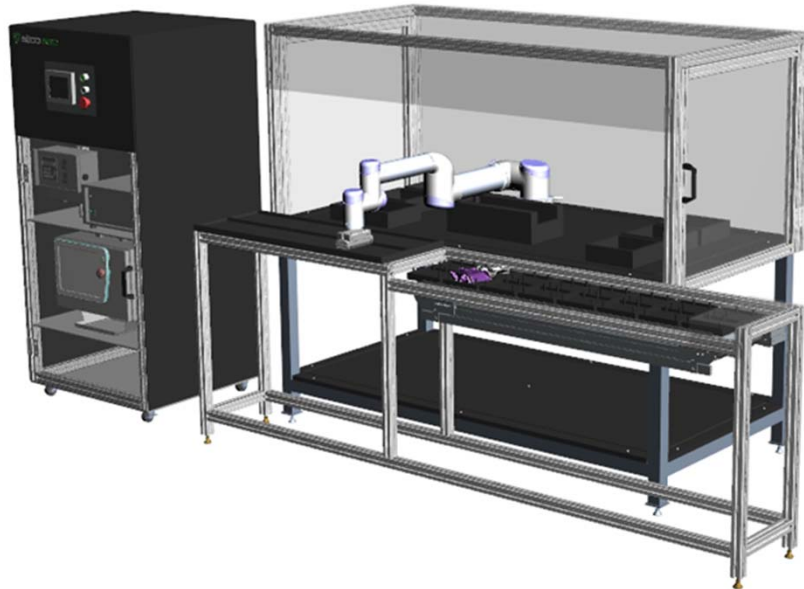
Application 2:

Engine Vane

- Application: Pre-Braze
- Deposit: Nickel
- Base material: Rene 80
- Thickness: 0.0001”-0.0003”
- Labor intensive process
 - Ergonomic Concerns
- Part geometry difficult to mask
 - Required bringing part to anodes
- Larger volume production (required dedicated person)



Application 2:



Robotic Plating System Features

- PLC controlled rectifier with HMI recipe control
- Robotic part handling to bring parts to anodes
- Automated DI water rinse and air blow off
- Part load conveyor
- Unload table

Application 2:



Benefits of Automating

- Ergonomic risk reduction
- Labor savings
- Optimization and standardization of cycle times
- Process control and consistency
 - Process capability improvement from 1.5 Sigma to 4.15 Sigma
- Reduced human errors
- Chemical exposure reduction

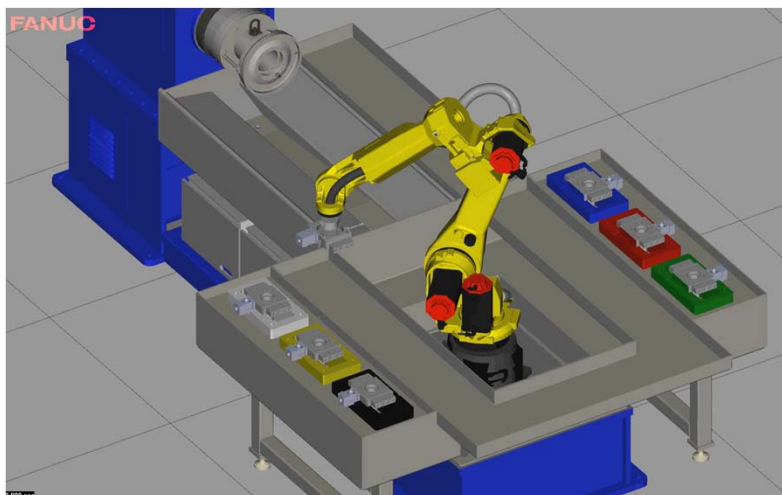
Application 3:



Turbine Engine Components

- Application: Pre-Braze
- Deposit: Nickel
- Base Material: Inconel
- Thickness: 0.0002"-0.0006"
- 10"-30" Diameters
- Time consuming part masking (wax dipping & cutting)
- Large Space Requirement (Dedicated Room ~7000 sqft)
- Operator chemical exposure
- Environmental requirements
- Air scrubber required

Application 3:

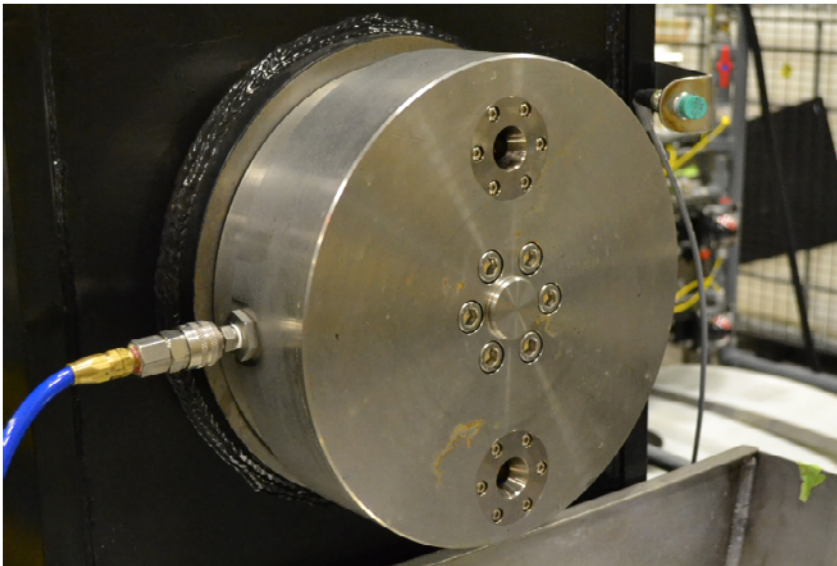


Fully Automated Robotic Selective Plating System

- Quick change masking tooling
- Anode tool changers
- Solution level and flow control/monitoring
- RFID tag monitoring
- Barcode driven recipe selection
- PLC controlled rectifier
- Data collection/reporting
- Operators fill solution tanks once a week
- Rinse water collection tanks
- Carbon filter fume extraction with airflow switch

Application 3:

- Quick change tooling utilized for fast changeovers and precision locating
- Air pressure causes the cylinders to unlock and receive and locate their mating retention knobs.
- Removing air pressure from the cylinder allows the internal piston cam to mechanically position five hardened steel balls around the knob, locking it into place until air pressure is applied again to release it.
- The precision surfaces of the cylinder locks and mating knobs offer repeatability of .0002", with thousands of pounds of fail-safe mechanical holding strength. No need to center part in a traditional lathe chuck
- Eliminates the need for operators to manually center parts into traditional lathe chucks



Application 3:

Anode Tool Changing

- Master Tool Changer plumbed with all plating chemicals, DI water, compressed air, electrical connector and RFID tag reader
- Robot picks and places each tool in plating process
- Poka-yoke plumbing and RFID tags prevent using wrong tool or chemical
- Collision sensor to prevent crashing tooling



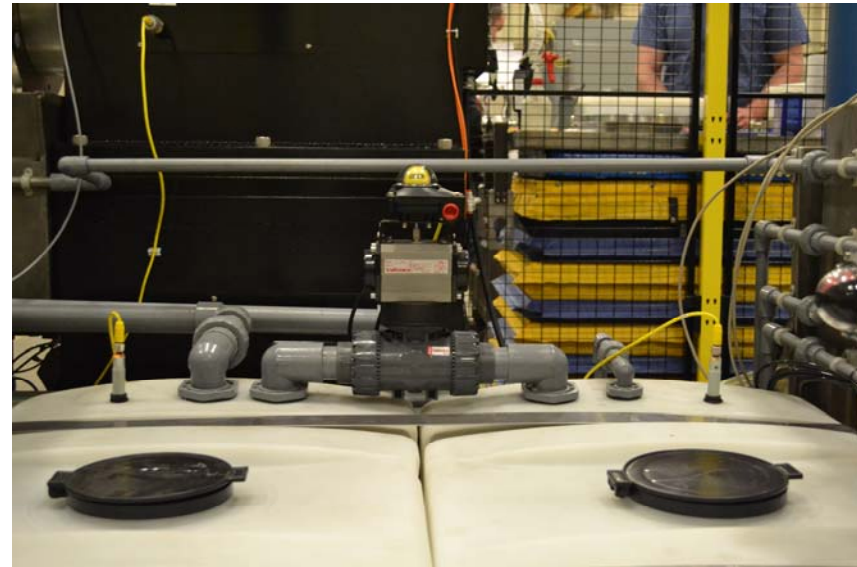
Application 3:

- PLC controlled pump flow
- Clamp-on flow meters for feedback
- Tank level sensor probes
- Tank temperature sensors
- Amp-hr tracking on Nickel bath



Application 3:

- Automated valving to divert recirculated chemicals and rinse waters to proper locations
- Rinse water collection tanks to store prep waste and nickel waste before being pumped to larger totes
- Separating waste streams means the Nickel waste water can later be recycled and reclaimed



Application 3:

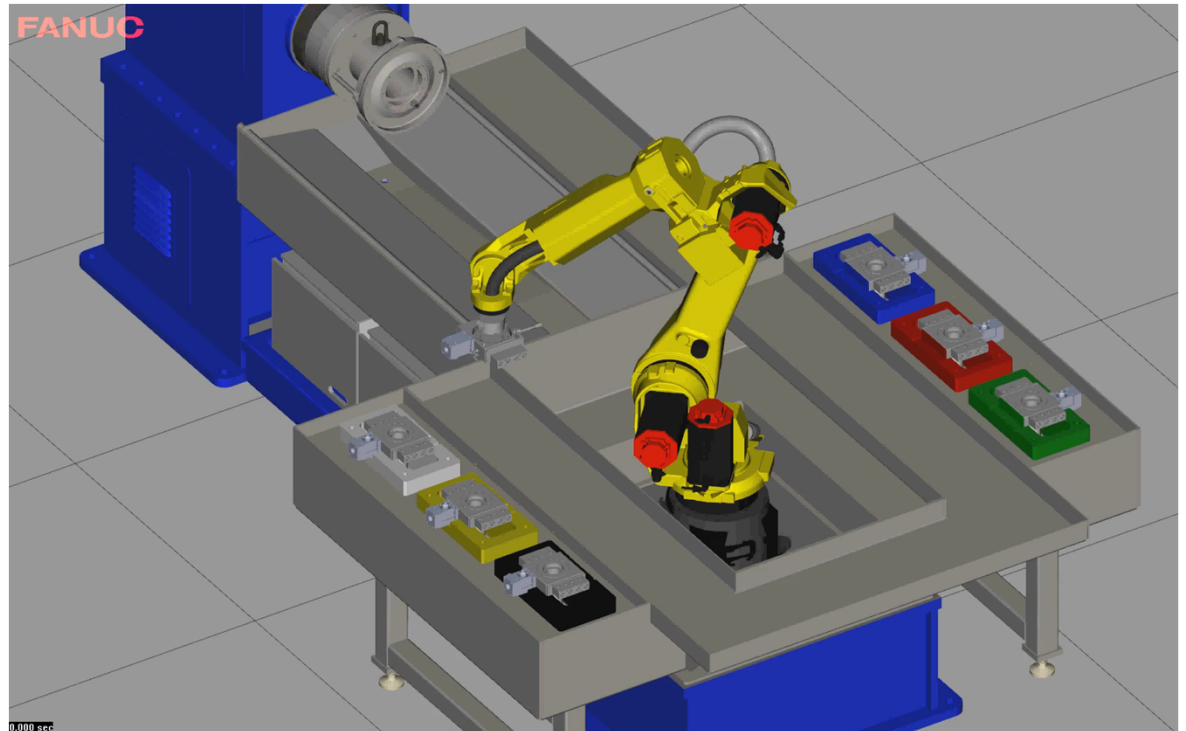


Benefits of Fully Automated Robotic Selective Plating System

- Optimization of standardization of cycle times
- Increased throughput and productivity
- Reduced human errors
- Reduced labor
- Reduced operator chemical exposure
- Data collection/reporting
- Space savings (~700 sqft)
- Removed air scrubber system

Benefits of Automating Selective Plating

- Optimization and standardization of cycle times
- Increased throughput and productivity
- Process control and Consistency
- Reduced human errors
- Reduced labor
- Ergonomic Risk Reduction
- Chemical Exposure Reduction
- Data Logging/Reporting



Summary/Conclusions

- Selective Plating is not just a manual process
- There are many different reasons to automate a selective plating process
- It is important to understand your application and what goals you have in automating your process

Thank you!

Questions?

Contact us

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