Troubleshooting your Modern Pretreatment System

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Troubleshooting Basics

- Occam’s Razor
  - “Pluralitas non est ponenda sine neccesitate“
  - “More things should not be used than are necessary.”
  - "Keep things simple!“
  - If you have two theories that explain the observed facts, then the more likely is the simplest
    - (until you have more evidence to the contrary)

- William of Ockham, Franciscan Monk, 1287-1347
Scientific Method

- Do Experiment
  - Keep good records, gather and organize all pertinent data.
- Observe Results
- Reflect & Discuss
- Plan Next Experiment
- Accountability
  - Who’s RESPONSIBLE
- Repeat as needed
Troubleshooting Strategy

- Define your problem
  - What does the issue look like?
  - Where does it appear?
  - When does it appear?
- Hurry, but be diligent
  - Work from back to front
  - Never change more than one thing at a time
    - Isolate parameters, so you know the effect of your change
Which part(s) have a problem?

- Where does it appear, on all parts?
  - Usually systemic – e.g., paint bake, application, pretreatment, cleaner, etc.

- Some parts?
  - Geometry, fixturing or hanging, spray patterns

- One particular part?
  - (Cleaning, metallurgy, passivation, cupping)
Unique Substrate Issues

- Chromate passivated galvanized and alloy coated steel (galvannealed, etc.)
  - Doesn’t white rust, but won’t adhere paint either
  - Is it oiled...probably OK. If dry and not rusted, probably passivated.
- Steels of foreign origin with unknown rust preventative oils
  - Cleanability in alkaline cleaners
- Sudden substrate changes...did we acquire some “secondary steel”?
- Hot rolled black (not Pickled & Oiled)
  - Not intended for powder paint
- Pickle cut edge corrosion carefully
Where is the problem?

- A particular or repeatable area
  - Nozzles or pattern
  - Dripping or pressure at top risers
  - Water quality or obstructions
  - Poor Rinsing
    - Vertical parts
  - Dripping from conveyor chain
How frequently does it occur?

- Frequency/timing of incidence gives us clues
  - Only the morning
    - Startup related parameter issues
    - Bath temperatures, paint bake oven zones, and so on
  - More common in the evening
    - Rinse quality, rinse temperatures, concentrations dropping, dry down, streaking
  - Happens throughout the day, inconsistency
    - This is when it gets tricky, and you need a strategy for isolating the root cause
    - Start with a defect diary and record everything extraordinary
Method for isolating sources

- Some issues can come from paint or pretreatment
  - So who do you call, pretreatment or paint vendor?
- Use a panel study first
  - Bare test panel (ACT or Q) isolates substrate-related issues if this pretreats and paints well.
  - Solvent Cleaned panel – isolates cleaning difficulties
  - Solvent Cleaned panel, prior to paint – isolates the coating application and cure systems.
  - Pre-treated panel, prior to paint – isolates pretreatment or perhaps seal rinse as probative to defects
- With your initial study in hand, call the right vendor
Which part(s) have a problem?

- You suspect a pretreatment issue
  - Use Solvent Cleaned panels
    - Between each stage
      - Isolates the impact of each stage
  - Use a pre-phosphated (or pretreated) panel, hung before paint, as a reference
    - You can also use a pre-phosphated panel in front of your final seal, if you suspect a seal issue
      - (make sure it is a DI rinsed panel!)
Corrosion Resistance Studies

- You can again use a Differential Panel Study
  - Isolate each stage
  - Find an optimum process (perhaps your vendor may even be able to process some of your parts there), and then compare yours with that process
    - Clean, Conversion Coating, and Seal

- Be aware of less obvious problems
  - Long drain zones, dry down
  - Quality of rinses
  - Incipient Corrosion (flash rust)
  - Metal oxides
    - (many are not removed under normal conditions)
“WATCH” what you clean!

- Water
  - Water quality is critical, particularly in your final rinses and pretreatment stages
- Action – physical impingement
  - The pressure and coverage of your nozzles are critical to good cleaning and rinsing
- Time
  - Each process takes time
  - Speeding your line reduces the time in each process
- Chemical
  - Maintaining correct chemical concentrations and pH insure proper performance
- Heat
  - Temperature improves cleaning, speeds pretreatment
  - Excess heat can dry parts between stages, “overcoat” parts
Common Problems

- Monday morning issues
  - Temperatures, Parts that sit over the weekend
- Operating Parameters
  - Rinse quality, concentrations
- Routine Maintenance
  - Blocked nozzles, spray patterns
Suspect Cleaning

- Mechanical
  - Low Spray Pressure
  - Clogged or Misaligned Nozzles
  - Poor rack design or implementation
- Chemical
  - Low Concentration or pH
  - Low Temperatures
  - Spent cleaning solution
  - New/Different soils
Examples - Water Beading before/after drying
Pretreatment Difficulties

- Exposure Time
- Cleaning
- Nozzles Clogged, Misaligned
- Incorrect pH, other application parameters
- Low Temperature
- Substrate Quality
- Solids or sludge
  - In Pretreatment
  - In Rinse
Examples

Line Stop in Pretreatment

Cleaner Loaded with Oil
Poor Pretreatment - Powdering

- pH in bath too high or low
- Poor rinse quality
  - Carry-in
  - Insoluble phosphate redeposition
- Extreme Dry-Off temperatures (using paint bake oven for dry-off)
- Long exposure times (line stops)
Poor Pretreatment - Uniformity

- Cleaning
- Nozzles clogged or misaligned
- Drying between stages
  - Can include excess heat in process
- Phosphate pH too high or low
- Variations in substrate
- Excessive dry-off temperatures
Examples

Flash Rust

Streaking
Wrapping up your Strategy

- Define the problem
  - Isolate the cause
  - Prepare a corrective action
- Implement the correction
- Check to make sure its effective
- Act or Adjust to our measures
Troubleshooting Tools

- Reagents/Titrants
- Test Kits
- Raw Panels
- Standard Panels
- Q-Tips and Solvents
  - Acetone, MEK, Toluene, Hexane
- Scribe or Crosshatch tools and tapes
- PH Meter
- Mil-Thickness Gauge
- Impact Tester (or Ball Peen Hammer)
- IR Temperature Probe
- Spot Light
- Datapack
- Conductivity Meter
- USB Microscope
Additional Resources – You aren’t in this alone.

- “Pretreatment for Industrial Finishing Applications”
  - Published by the CCAI
  - Edited by a panel of industry experts
- ASM Handbook of Surface Engineering
- Other Technical Society handbooks and publications
- Your specialty chemical, coatings, and washer engineering vendors and their experts.
Thank you!

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