Conversion Coating Troubleshooting Matrix

Cause	Condition (Defect)				
	Selective Coating	Loose Coating (Powdery)	Dull Brown Color	Salt Spray Failure	Comments
Solvent Cleaning					
Incomplete removal of inks	X				
Emulsion Degrease					
[Na_2SiO_3] too low (<100ppm)				X	
Excessively long immersion time				X	
Alkaline Cleaner					
Incomplete removal of grease/lube	X				
Concentration too low				X	
Alkaline Etch					
Immersion time					
Too long				X	
Too short	X*				*(scale not fully removed)
Deoxidizer					
Concentration too low				X	
Mixed acid deoxidizer	X				
Non-Cr deoxidizer (not recommended)				X	
pH is too high				X	
Immersion time					
low	X*			X**	*(smut not fully removed) **(6061 needs longer times)
high				X	(especially for high [Al], aged solutions)
Ion contamination					
Chloride concentration					(more pronounced for non-Cr deoxidizers)
low (<12ppm)				X	(for low [Al], new solutions)
high (>350 ppm)				X	
High [Al] (>11000ppm)				X	(with long immersion times)
High [Cu] (>50ppm)				X	
High [Zn]				X	
High [Fe]				X	
Low Sulfate(<1000ppm)	X				
Too many adds				X	(dump when adds equal tank volume)
Use of sulfuric based deoxidizers				X	(nitric based recommended)
High mineral content in Make-up water				X	
Green color				X	(for Cr-based deoxidizers)
Stray current				X	
Etch rate (too high)				X	
Conversion Coating					
pH					
low		X			
high	X			X	
Agitation					
low	X				
high		X			(can also cause surface roughness)
Fluoride concentration					
low	X			X	
high	X*	X			*(when [Al] is low)
Solution concentration					
low				X	
high		X			
Cr(VI)/Cr(III) ratio is low (<1.0)	X		X	X*	*(better if 3:1)
Ion contamination					
High [Fe^{+2}]			X	X	
Chloride concentration					
below 12ppm				X	
above 43ppm (for new solutions)				X	
above 100ppm				X	
above 400ppm			X		
Aluminum concentration					
low	X				(when [F] is high)
high (>250ppm)				X	[Al] can be much higher (2.5g/L) for K3(FeCN)6 conversion coatings
Combined [Cl] + [SO_4] is high (>400ppm)				X	

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Cause	Condition (Defect)				
	Selective Coating	Loose Coating (Powdery)	Dull Brown Color	Salt Spray Failure	Comments
Sulfate concentration is high (>400ppm)				X	
Nitrate concentration is high (>200ppm)				X	
Copper concentration is high (>30ppm)				X	
Zinc concentration is high (>10ppm)				X	
Calcium concentration is high (>25ppm)				X	
Phosphate is high (>25ppm)				X	[PO4] can be much higher (2000ppm) for K3(FeCN)6 conversion coatings
Use of DI water for solution make-up	X				
New bath was not “seeded”				X	
Immersion Time					
Low	X			X	
High		X			
Temperature					
Low	X			X	
High		X			
Excessive transfer times		X			
Rinses					
Alkaline Clean Rinse					
Transfer time too slow	X				
Long immersion time in first rinse				X	
TDS too high				X	
Contamination (that causes micro-pitting)				X	
Deoxidizer Rinse					
Less than 60ppm TDS (avoid DI)	X			X	
Contaminated final rinse		X		X	
Long immersion time				X	(especially if preceded by long deox time)
Conversion Coating Rinse					
Misaligned spray nozzles	X				
Clogged spray nozzles	X				
High ambient temperature	X				
Low pH in first rinse (<4.0)		X			
Excessive spray velocities	X			X	
TDS too high (>1000ppm)				X	
Dryer					
Temperature					
High (>130F)				X	
Low (< 90F)				X	
Dirty (FOD blows onto wet part)	X			X	
Racking					
Contact of parallel surfaces	X				
Entrapped solution draining down part	X				
Dirty Hooks	X				
Testing					
Panels					
Mylar residue not fully removed	X				
Unseen micro-pitting (storage issue)				X	
Ungloved hands				X	
Roll code not fully removed				X	
Cleaning with acetone				X	
Storage in desiccator				X	
Wet panels placed on brown Kraft paper				X	
Short age times (<48 hours)				X	
Operator variation				X	
Rust in salt spray chamber				X	
Rough handling during transport				X	
Spray impingement				X	
Condensate splatter during lid opening				X	
Part Condition					
Work hardened (uneven Zn at surface)	X				
Inclusions				X	
Part geometry that is susceptible to coating fracture				X	(A600 best for tubing)
Heavy surface oxide	X				
Use of soap as media for Vibra Debur		X			