

BSAA Salt Spray Failure Troubleshooting Guide

Check	Criteria	Notes	Check	Criteria	Notes	Check	Criteria	Notes
Anodize			Seal			Deoxidizer		
Chemistry			Chemistry			Chemistry		
H ₂ SO ₄	30.5-52.0 g/l	High end of spec. increases CW and allows greater conc. of Cl	Cr ⁺⁶	45 ppm min.		Cr ⁺⁶	4.5 - 13.5 g/l	Low side previously recommended
H ₃ BO ₃	5.2-10.7 g/l		pH	3.1 - 3.8	3.5 target	HNO ₃	75 - 150 g/l	
Temperature	80+/-4° F	higher temp yields higher CW and better corrosion protection but more SS variation	Immersion Time	23 - 28 minutes	Longer immersion time is better for SS resistance	Cr ⁺⁶ / Cr ⁺³	> 2:1	Higher ratio is likely to be better for SS resistance
Immersion Time	18-22 min. remove w/i 2 min.	after reaching 15+/-1 V after current stops Longer process times provide higher CW's and better corrosion protection. lessen time to achieve better PA	Temperature	195+/-5 deg. F		Immersion Time	6 min. max.	2 minutes better than 12 minutes
Contamination				192 - 194 deg. F	Low side has better PA results.		3 - 5 minutes	For parts that are non-stained and not heat treated.
Al	5.5 g/l max.	Much higher levels than allowed by specification can help remediate Cl pitting. Higher [Al] reduces oxide formation efficiency		195 -198 deg. F	High side has better SS resistance		10 - 20 minutes	For parts that are stained and heat treated.
Cl	0.1 g/l max.	as NaCl Use DI to reduce Cl concentration. In some conditions, failure can occur within specification.	Contamination		Erratic hydration values are an indication of excessive impurities as SiO ₂	Etch Rate	0.15 - 0.40 mils/side/hr	Lower etch rates to reduce potential for preferential etching.
Cr	500 ppm max.		silicates	10 ppm max.		Contamination		
Fe	50 ppm max.		TDS	250 ppm max.		sulfide	minimize	If [S] is too high from TEA drag-out, Deox. will be ineffective, causing low CW's and PA/SS failure.
NO ₃	100 ppm max.		phosphates	< 5 ppm	as PO ₄	Fe	minimize	Fe deposits can cause SS/PA failure.
Cu	237 ppm max.			3 - 15 ppm	Small amount of H ₃ PO ₄ can initiate sealing in hot DI PO ₄ at 3 ppm may reduce smut amount	Cu	< 0.2 g/l	Toner can reduce Cu concentration, maint. cleaning of bus bar can be cause
SO ₄	50 ppm max.	Lower levels better (for Cr anodize)	SO ₄	100 ppm max.	AESF course recommendation	Al	< 17.2 g/l	
Agitation	maintain moderate	Too high lowers current density and threatens SS performance	sludging	avoid	due to contaminated carbon filter Change carbon filter every 6 months.	Last Dump		If Deox. is too old, result can be staining and SS failure.
Last Dump		DI is recommended for charging.	sediment	avoid		Degreaser		
			Fe particles	avoid		Chemistry		
			fluorides	5 ppm max.	AESF course recommendation		maintain Na₂SiO₃ > 100 ppm	Set a panel in tank overnight and check next day for pitting.
			chlorides	50 ppm max.	AESF course recommendation		avoid silicated cleaners	Known problem for dilute Cr sealing.
			Cu,Fe,Zn	10 ppm max.	AESF course recommendation	Concentration	8 - 25%	typical
			Na	200 ppm max.	AESF course recommendation	pH	9.8-10.5	for typical silicated degreaser
			Mg	100 - 150 ppm	increases corrosion resistance			
			Al	100 ppm max	AESF course recommendation			

The BSAA process is covered by U.S. Patent No. 4,894,127 (method for Anodizing Aluminum), U.S. Patent No. 4,504,325 (Methods for Sealing on Aluminum Oxide film) and U.S. Patent No. 6,149,795 (Fungus Resistant Boric Acid - Sulfuric Acid Anodizing). Patent licenses are available.

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TEA Etch			Other Processes			Testing		
Contamination	avoid high sulfide levels	drag-out shortens Deox. life	Heat Treat	avoid contamination during forming	Alkaline clean may not be able to remove castor oil.	SS chamber	Supply water	ASTM D1193 Ty IV > Ty II
Etch rate	1.0 - 8.0 mils/side/hr		Vibratory Deburr	Use a plastic media for Deburring.	avoid use of Tide to prevent powdery coating		Panel position	Avoid areas where panels are subject to drips and splatter
Temperature	60 - 90 deg. F		Drying				Contamination	Inspect for rust
Chemistry			Temperature	160 deg. F max.	Too high may cause seal weeping	Panels	avoid old panels	12 months max for well protected (Mylar wrapped)
TEA	4 - 8 oz/gal		Time	Minimize transit times so that parts to dry between operations.	Too long may diminish CW			Examine defects via acid dissolution test to determine if defect is in the oxide or not (for processed panels)
NaOH	16-20 oz/gal		Equipment			Results		
Na ₂ S	1.5-3.5 oz/gal		Tanks		Avoid Fg construction for seal tank	Visual	Coating is free of:	
Al	2.5-10 oz/gal		Steam pipes		Use Carpenter 20 instead of 316L SS to avoid corrosion		- light gray color - burn marks - cracks & pits - powder	
Rinses			Racks	Al, Ti, Al w/Ti tips	Zn anode attached to racks just prior to seal prevents spotting	Coating Weight	200 mg/ft² min.	2024-T3, T4 Al
Anodize Rinse			Electrical Contacts	clean bus bars			700 m/ft² max.	7000 series Al
Immersion Time	3 - 15 min.	Long rinse times reduce the % hydration and may cause spotting.		good contact between bus bar, hoods, tank pads	Poor contacts can cause low or uneven CW's, dark depositions	Hydration	8-14%	per BSS 7325
	start w/i 3 min.	after power off	Power			Incoming Water Quality		
Chemistry			voltage ramp-up	1.5 V/min.	current on upon immersion	Chemistry		
pH	2.5 - 8.0		voltage	15+/-1 V	Voltage that is too low causes low coating density.	pH	5.5 - 8.0	
Temperature	95 deg. F max.		rectifier	low ripple	High ripple contributes to uneven CW distribution.	Contamination		
Contamination			current density	too low	Low CD contributes to low CW. Higher CD needed for BSAA vs CAA. CD is also load dependent.	Cl	500 ppm max.	total solids
1st rinse of two	5000 ppm max.		Anodes	avoid film	Red gelatinous film is Cu. Remove by scrubbing or plate out onto 1100 series Al	F	1.7 ppm max.	
final rinse	1000 ppm max.	Relatively high concentrations of acid contamin. does not affect SS				DI TDS	1 ppm max.	
TEA Rinse								
Contamination	< 750 ppm TDS	if parts are subject to further processing						
final rinse								
Amchem 6 Rinse								
Contamination	< 750 ppm TDS	TDS limit is for parts that are subject to further processing						
final rinse		Relatively high concentrations of acid contamin. does not affect SS.						

Criteria that appear in **Bold** reflect specification requirements.