

HAVAR[®] Corrosion Test Data

Samples from heat 305992, coil 2654 at 0.045" thick in strand annealed condition
 Evaluation showed strip to be HRB 91, ASTM grain size 6
 Weld beads placed on annealed strip via EB welding at International Beam Welding Corp.

Environment	Temperature	Test duration, hr	Sample Condition	Corrosion Rate		Comparative Data	
				mils/year	mm/year	316L mils/year	C-276 mils/year
10% H ₂ SO ₄	150°F	96	Unwelded	1.01	0.03	850-2400	20-30
		96	Welded	0.99	0.03		
	boiling	96	Unwelded	9.79	0.25		
		96	Welded	10.28	0.26		
96% H ₂ SO ₄	150°F	96	Unwelded	29.91	0.76	560	>200
		96	Welded	33.04	0.84		
	boiling	96	Unwelded	273.76	6.96		
		96	Welded	267.16	6.79		
86% H ₃ PO ₄	150°F	96	Unwelded	1.02	0.03	1000	20
		96	Welded	1.02	0.03		
10% H ₃ PO ₄	boiling	96	Unwelded	2.15	0.05		
		96	Welded	1.60	0.04		
1% HCl	boiling	96	Unwelded	237.79	6.05		0.2-2
		96	Welded	248.69	6.32		
5% HCl	68°F	96	Unwelded	4.42	0.11		
		96	Welded	4.65	0.12		
50% NaOH	boiling	96	Unwelded	7.49	0.19		2-4
		96	Welded	7.55	0.19		
65% HNO ₃	boiling	240	Unwelded	336.30	8.55	11	450
		240	Welded	296.39	7.54		

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Evaluation	Temperature, °F	Test duration, hr	Sample Condition	Corrosion Behavior
Pitting in Mixed Acid-Chloride (1)	122	24	Unwelded and Welded	No Pitting; Uniform Attack with corrosion rate of 17 mils/year
FeCl ₃ Pitting by ASTM G-48 Method A	68	72	Unwelded	Resistant to pitting ↓
	104	72	Welded	
	140	72	Unwelded	
140	72	Welded		
FeCl ₃ Crevice Corrosion by ASTM G-48 Method B	68	72	Unwelded	Severe Crevice Attack ↓
	104	72	Welded	
	140	72	Unwelded	
140	72	Welded		
Seawater	86	720	Unwelded	No Pitting or General Attack No Pitting or General Attack
			Welded	
Seawater Crevice Corrosion	86	720	Unwelded	Perforation at Crevice Site Perforation at Crevice Site
			Welded	
Sulfide Stress Cracking by NACE MR0175	---	---	35 HRC max.	Acceptable for use in Sour Environments
Pitting or Crevice Corrosion of Surgical Implants by ASTM F-746 (2)	98.6	---	600 grit polish + passivation	Critical Crevice Potential greater than +0.8 V (SCE)

notes (1) - Mixed acid-chloride
 11.5% H₂SO₄ + 1.2% HCl + 1% CuCl₂ + 1% FeCl₃
 (2) - Electrolyte
 0.9% NaCl in distilled water, pH = 7.0