RADATA SHEET

RA321 stainless

FEATURES

- Oxidization resistance to 1600°F (870°C)
- Stabilized against weld heat affected zone (HAZ) intergranular corrosion
- Resists polythionic acid stress corrosion cracking

APPLICATIONS

- Thermal oxidizers
- Aircraft piston engine manifolds
- Expansion joints
- Refinery equipment
- High temperature chemical process equipment
- LBGT exhaust ducting

SPECIFICATIONS

UNS S32100
ASTM A 240, A 167, ASME SA-240, Plate, Sheet & Strip
AMS 5510 QQ - S - 766 d
DIN X8CrNiTi 18-10 No. 1.4541

MACHINING

Austenitic steels such as RA321 machine with a tough and stringy chip. Machine tools should be rigid and used to no more than 75% of their rated capacity. Make deep cuts to get under the work-hardened zone of the previous cut. Suggested drilling speeds, 1/4 - 3/4" (6-20mm) dia HSS drills, 49-59 SFPM (15-18 m/min). Single point turning, HSS tools, is done at 55 - 85 SFPM (17-26 m/min).

GENERAL

RA321 stainless is a titanium stabilized grade commonly used for a service in the 1000-1600°F (540-870°C) temperature range. For service temperatures up to about 1600°F (870°C), a stabilizing treatment at 1550-1650°F (840-900°C), air cool, may be used to provide optimum resistance to intergranular corrosion and to polythionic acid stress corrosion cracking. RA321 is readily welded by all common methods including submerged arc. Appropriate weld fillers are AWS ER347 bare wire and E347 covered electrodes.

Specified Chemistry Range

Cr	Ni	Si	Mn	P	S	C	Ti	Fe
17.00	9.00	0.25	2.00	0.040	0.030	0.08	5X(C+N)	bal
19.00	12.00	1.00	max	max	max	max	.70	

Physical Properties

Density 0.286 lb/cu.in
Melting Range2550-2600°F (1399-1427°C)
Magnetic Permeability, Annealed

μ = 1.02 at H = 200 Oersted
(cold work may increase permeability)

Specific Heat, 32-212°F (0-100°C)
0.12 Btu/lb°F (502 J/Kg•K)

Thermal Expansion

Temp °F	Temp °C	Mean Coefficient of Thermal Expansion[a] in/in °F x 10^{-6}	m/m•K x 10^{-6}
200	93	9.3	16.7
400	204	9.4	16.9
800	427	10.0	18.0
1000	538	10.3	18.5
1200	649	10.6	19.1
1400	760	10.9	19.6
1600	871	11.1	20.0
1800	982	11.4	20.5

Temp °F	Temp °C	Thermal Cond Btu•ft/ft²•hr°F	W/m•K	Modulus of Elasticity Dynamic psi x 10^6	GN/mm²
200	93	8.8	15.2	28.0	193
400	204	9.7	16.8	26.5	183
800	427	11.4	19.7	23.8	164
1000	538	12.1	20.9	22.5	155
1200	649	-	-	21.2	146
1400	760	-	-	19.7	136

[a]70°F (21°C) to indicated temperature

Electrical Resistivity

°F	°C	ohm circ mil/ft	microhm•m
68	20	430	0.715
212	100	470	0.781
392	200	515	0.856
752	400	600	0.997
1112	600	670	1.11
1472	800	725	1.21
1652	900	760	1.26

Minimum Specified Mechanical Properties, Room Temperature

Ultimate Tensile Strength, psi (N/mm²)	0.2% Yield Strength, psi (N/mm²)	Elong. %	Hardness, BHN max
75,000 (517)	30,000 (207)	40	217

Average Elevated Temperature Tensile Properties

Test Temp.		Ultimate Tensile Strength		0.2% Yield Strength	
°F	°C	psi	N/mm²	psi	N/mm²
RT	20	84,000	579	38,000	262
400	204	62,000	427	20,500	141
600	316	62,000	427	18,000	124
800	427	62,000	427	17,000	117
1000	538	59,500	410	16,500	114
1200	649	45,500	314	16,000	110
1400	760	27,500	190	14,000	97

Note: Above 1000°F (538°C), tensile properties should not be used in design. Creep-rupture behavior governs here.

Fatigue Strength

The room temperature fatigue strength of RA321 is approximately 35-40% of the tensile strength. Corrosive conditions, surface finish and mean stress affect these values.

Average stress for secondary (minimum) creep rate of *:

Temperature		1% in 10,000 hrs		1% in 100,000 hrs	
°F	°C	psi	N/mm²	psi	N/mm²
1050	566	30,000	207	13,600	93.8
1100	593	20,000	138	9,200	63.4
1150	621	13,100	90.3	5,900	40.7
1200	649	8,800	60.7	3,900	26.9
1250	677	5,800	40	2,550	17.6
1300	704	3,850	26.5	1,700	11.7
1350	732	2,550	17.6	1,100	7.6
1400	760	1,700	11.7	740	5.1
1450	788	1,130	7.8	480	3.3
1500	816	750	5.2	320	2.2

Average Stress for Rupture in * :

Temperature		10,000 hrs		100,000 hrs	
°F	°C	psi	N/mm²	psi	N/mm²
1050	566	31,000	214	23,000	159
1100	593	23,500	162	16,500	114
1150	621	17,300	119	12,000	82.7
1200	649	12,900	88.9	8,700	60
1250	677	9,700	66.9	6,300	43.4
1300	704	7,200	49.6	4,600	31.7
1350	732	5,400	37.2	3,300	22.8
1400	760	4,000	27.6	2,450	16.9
1450	788	3,050	21.0	1,750	12.1
1500	816	2,280	15.7	1,270	8.8

*G.V. Smith, An Evaluation of the Yield, Tensile, Creep and Rupture Strengths of Wrought 304, 316, 321 and 347 Stainless Steels at Elevated Temperatures, ASTM Data Series DS 5S2