HAYNES® 230® alloy

Creep and Stress-rupture Strength

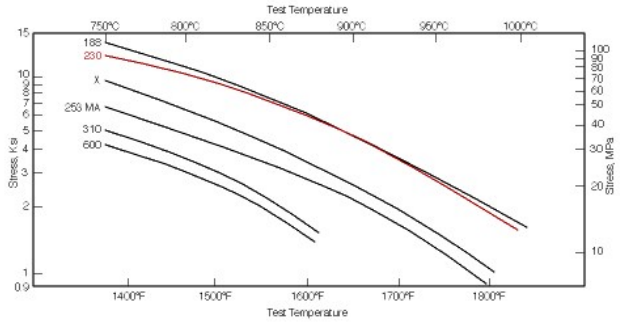
HAYNES® 230® alloy is a solid-solution-strengthened material which combines excellent high-temperature strength with good fabricability at room temperature. It is particularly effective for very long-term applications at temperatures of 1200°F (650°C) or more, and is capable of outlasting stainless steels and nickel alloys by as much as 100 to 1 depending upon the temperature. Alternatively, the higher strength of 230® alloy allows for the use of design section thicknesses as much as 75 percent thinner than lesser alloys with no loss in load-bearing capability.

Stress-Rupture Lives for Various Alloys at Fixed Test Conditions (Bar and Plate)*

Alloy	Hours to Rupture		
	1400°F (760°C)	1600°F (871°C)	1800°F (982°C)
-	15.0 ksi (103 MPa)	4.1 ksi (31 Mpa)	2.0 ksi (14 Mpa)
230®	8,200	65,000	5,000
625	19,000	14,000	2,400
X	900	5,000	2,100
800H	130	1,200	920
INCONEL® 601	50	1,200	1,000
253 MA®	140	900	720
600	15	280	580
316 SS	100	240	130
RA330®	30	230	130
304 SS	10	100	72

*Based upon Larson-Miller extrapolation

Comparison of Stress to Produce 1% Creep in 1000 Hours (Sheet)



230® Sheet, Solution Annealed

Temperature		Creep	Approximate Initial Stress to Produce Specified Creep in							
			10 Hours		100 Hours		1,000 Hours		10,000 Hours	
°F	°C	%	ksi	MPa	ksi	MPa	ksi	MPa	ksi	MPa
1200	649	0.5	-	-	31	214	-	-	-	--
		1	-	-	35	241	24*	165*	-	--
		R	-	-	51	352	36	248	28	193

1300†	704	0.5	29	200	21	145	14.5	100	-	--
		1	33	228	23	159	17	114	-	--
		R	47	324	34	234	26	179	20	134
1400	760	0.5	19.2	132	13.7	94	9.6	66	7.3	50
		1	21	145	15.5	107	11.5	79	8.6	59
		R	32	221	24.5	169	18.2	125	13.2*	91*
1500	816	0.5	14.2	98	10.3	71	7.5	52	5.4*	37*
		1	15	103	11.2	77	8.6	59	6.5*	45*
		R	23*	161*	17.5	121	12.5	86	8.4*	58*
1600	871	0.5	11.3	78	8.1	56	5.7	39	4.0	28
		1	11.7	81	9.0	62	6.2	43	4.3	30
		R	17.0	117	12.5	86	8.2	57	5.6*	39*
1700	927	0.5	7.7	53	5.5	38	3.8	26	2.4*	17*
		1	8.8*	61*	6.2	43	4.2	29	2.7*	19*
		R	12.0*	83*	8.0	55	5.1	35	3.2	22
1800	982	0.5	7.0	48	3.6	25	1.8	12	0.85	5.9
		1	8.0	55	4.1	28	2.0	14	1.0	6.9
		R	10.0	69	5.4	37	2.6	18	1.2*	8.3*
1900	1038	0.5	-	-	1.7	12	0.8	5.5	-	--
		1	-	-	2.0	14	0.9	6.2	-	--
		R	-	-	3.0*	21*	1.5	10	-	--
2000	1093	0.5	-	-	-	-	-	-	-	--
		1	-	-	0.9	6.2	-	-	-	--
		R	-	-	-	-	-	-	-	--

*Significant extrapolation

† Values obtained using Larson-Miller interpolation

230® Plate, Solution Annealed

Temperature		Creep	Approximate Initial Stress to Produce Specified Creep in							
			10 Hours		100 Hours		1,000 Hours		10,000 Hours	
°F	°C	%	ksi	MPa	ksi	MPa	ksi	MPa	ksi	MPa
1200	649	0.5	-	-	35	241	23	159	-	-
		1	-	-	39	269	26.5	183	17.5	121
		R	75	517	56	386	41	283	29	200
1300	704	0.5	35	241	21.5	148	14.5	100	-	-
		1	39	269	24.5	169	18	124	12.3*	85*
		R	59	407	42	290	30	207	21	145
1400	760	0.5	19	131	13.5	93	10.0	69	-	-
		1	23	159	15.9	110	11.5	79	9.0*	62*
		R	37	255	27	186	20	138	14.2	98
1500	816	0.5	14.0	97	10.4	72	8.2	57	6.1	42
		1	16.5	114	12.5	86	9.5	66	6.9	48

		R	26	179	20	138	14.0	97	9.8	68
1600	871	0.5	10.3	71	7.6	52	5.6	39	4.0	28
		1	11.7	81	9.0	62	6.2	43	4.3	30
		R	20	138	13.7	94	9.5	66	6.2	43
1700	927	0.5	7.8	54	5.7	39	3.9	27	2.5	17
		1	8.8	61	6.8	47	4.5	31	2.7	19
		R	15.0	103	10.0	69	6.0	41	3.6	25
1800	982	0.5	5.8	40	3.5	24	1.8	12	0.90	6.2
		1	6.3	43	4.0	28	2.1	14	1.1	7.6
		R	9.4	65	6.0	41	3.2	22	1.7	12
1900	1038	0.5	4.0	28	2.0	14	0.90	6.2	-	-
		1	4.4	30	2.2	15	1.0	6.9	0.50*	3.4*
		R	7.0	48	3.7	26	1.8	12	1.0	6.9
2000	1093	0.5	1.9	13	0.80	5.5	0.35	2.4	-	-
		1	2.3	16	1.0	6.9	0.47	3.2	0.20*	1.4*
		R	4.2	29	2.1	14	1.0	6.9	0.55	3.8
2100	1149	0.5	0.80	5.5	0.03*	2.1*	-	-	-	-
		1	1.0	6.9	0.43	3.0	-	-	-	-
		R	2.3	16	1.2	8.3	0.60	4.1	-	-

*Significant extrapolation