

CarTech® 882 Alloy

Identification

UNS Number

• T20811

AISI Number

• Type 610

Type Analysis

Single figures are nominal except where noted.

Carbon	0.40 %	Silicon	1.00 %
Chromium	5.00 %	Molybdenum	1.50 %
Vanadium	0.40 %	Iron	Balance

General Information

Description

CarTech 882 alloy is a 5% chromium high temperature alloy possessing extremely high strength at temperatures up to about 1000°F (538°C).

This alloy has been used in critical structural components which require strength in excess of 260 ksi (1793 MPa) at ambient temperatures or high creep and rupture strength in the 800/1200°F (427/649°C) temperature range.

CarTech 882 alloy has also been used in a wide variety of hot working tools.

Applications

CarTech 882 alloy has been used for structural components in missiles and aircraft.

It has also been used in numerous hot working applications such as forging dies, heavy-duty compression tools, bulldozer dies, hot forging tools with deep recesses or sharp corners, die-casting dies, aluminum extrusion dies, bolt dies, hot piercing and forming punches, and vastoning dies.

Properties

Physical Properties

Specific Gravity	7.77
Density	0.2810 lb/in ³
Mean CTE	
80 to 200°F	6.10 x 10 ⁻⁶ in/in/°F
80 to 400°F	6.40 x 10 ⁻⁶ in/in/°F
80 to 800°F	6.80 x 10 ⁻⁶ in/in/°F
80 to 1000°F	6.90 x 10 ⁻⁶ in/in/°F
80 to 1200°F	7.30 x 10 ⁻⁶ in/in/°F
80 to 1450°F	7.50 x 10 ⁻⁶ in/in/°F
500 to 1200°F	7.80 x 10 ⁻⁶ in/in/°F
500 to 1450°F	8.00 x 10 ⁻⁶ in/in/°F
800 to 1200°F	8.10 x 10 ⁻⁶ in/in/°F
800 to 1450°F	8.20 x 10 ⁻⁶ in/in/°F

CarTech® 882 Alloy

Mean coefficient of thermal expansion

Temperature		Coefficient	
°F	°C	10 ⁻⁶ /°F	10 ⁻⁶ /°C
80- 200	27- 93	6.1	11.0
80- 400	27-204	6.4	11.5
80- 800	27-427	6.8	12.2
80-1000	27-538	6.9	12.4
80-1200	27-649	7.3	13.1
80-1450	27-788	7.5	13.5
500-1200	260-649	7.8	14.0
500-1450	260-788	8.0	14.4
800-1200	427-649	8.1	14.6
800-1450	427-788	8.2	14.8

Thermal Conductivity

420°F	198.0	BTU-in/hr/ft ² /°F
660°F	197.0	BTU-in/hr/ft ² /°F
890°F	196.0	BTU-in/hr/ft ² /°F
1120°F	199.0	BTU-in/hr/ft ² /°F

Thermal conductivity

Temperature		Conductivity	
°F	°C	Btu-in/ft ² • hr • °F	W/m • K
420	216	198	29
660	349	197	28
890	477	196	28
1120	604	199	29

Modulus of Elasticity (E)

70°F	30.5	x 10 ³ ksi
300°F	27.8	x 10 ³ ksi
500°F	26.1	x 10 ³ ksi
649°F	27.7	x 10 ³ ksi
801°F	27.3	x 10 ³ ksi
900°F	27.0	x 10 ³ ksi
1000°F	22.7	x 10 ³ ksi
1099°F	21.0	x 10 ³ ksi
1200°F	16.5	x 10 ³ ksi

Modulus of elasticity

Temperature		Modulus	
°F	°C	ksi x 10 ³	MPa x 10 ³
70	21.1	30.5	210
300	149	27.8	192
500	260	26.1	180
650	343	27.7	191
800	427	27.3	188
900	482	27.0	186
1000	538	22.7	157
1100	593	21.0	145
1200	649	16.5	114

Critical Temperature (AC1)

1505 °F

Typical Mechanical Properties

Creep Properties (Total Plastic Strain) — Pyromet Alloy 882

Testing Temperature		Stress		Time in Hours for Total Plastic Section		
°F	°C	ksi	MPa	0.2%	0.5%	1.0%
Air Treated 1850°F (1010°C), Tempered 1 Hour at 1050°F (566°C)						
800	427	200	1379	—	1.2	308.0
800	427	195	1344	0.1	5.0	757.0
800	427	130	896	302.0	—	—
900	482	200	1379	—	—	—
900	482	170	1172	0.5	9.0	97.0
900	482	125	862	24.0	263.0	—
900	482	100	689	172.0	—	—
1000	538	155	1069	—	0.5	4.5
1000	538	110	758	—	7.0	27.0
1000	538	75	517	7.0	43.0	116.0
1000	538	70	483	9.8	52.0	134.0
1000	538	50	345	24.0	113.0	—
Air Treated 1850°F (1010°C), Tempered 1200°F (649°C), 1 Hour at Heat						
1000	538	95	655	—	0.2	0.7
1000	538	70	483	0.2	0.8	2.6
1000	538	40	276	11.0	80.0	158.0
1100	593	60	414	0.1	0.3	0.6
1100	593	40	276	2.5	10.0	18.0
1100	593	20	138	6.7	22.0	46.0
1200	649	15	103	0.7	2.2	4.9
1200	649	10	69	1.6	5.8	16.0

Elevated Temperature Hardness Properties — Pyromet Alloy 882

Air treated from 1850°F (1010°C) 1 hour, double tempered 2 hours at heat per temper. Tested as indicated. Hardness given in Rockwell C.

Tempering Temperature		Test Temperature											
°F	°C	300°F (149°C)	500°F (260°C)	600°F (316°C)	650°F (343°C)	700°F (371°C)	800°F (427°C)	900°F (482°C)	1000°F (538°C)	1050°F (566°C)	1100°F (593°C)	1150°F (621°C)	1200°F (649°C)
950	510	—	54	53.5	—	—	52.5	—	47	—	—	—	—
1050	566	50	49	49	49	47	46	43	41.5	37	34	30	20
1100	593	41	38	—	—	35	—	32	—	—	28	—	15
1150	621	33	30	—	—	28	—	22	—	—	20	—	15

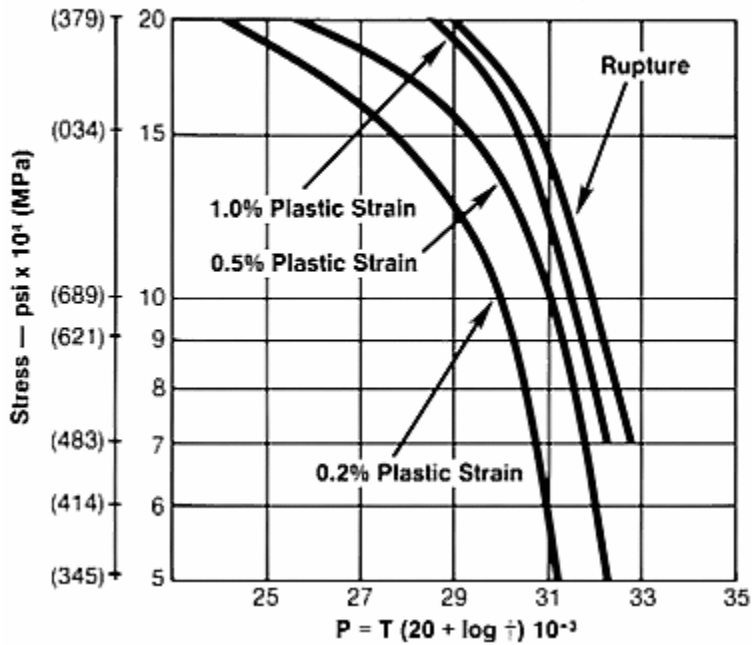
Fatigue Strength Properties — Pyromet Alloy 882

Air treated 1850°F (1010°C) 1 hour, double tempered 1050°F (566°C) 2 hours per temper. Data obtained on unnotched specimens on a rotating beam type testing machine with a mean stress amplitude of 0 ksi.

Maximum Stress		Mean Fatigue Life Cycles
ksi	MPa	
205	1413	10,000
170	1172	50,000
155	1069	100,000
135	931	1,000,000
130	896	55,000,000

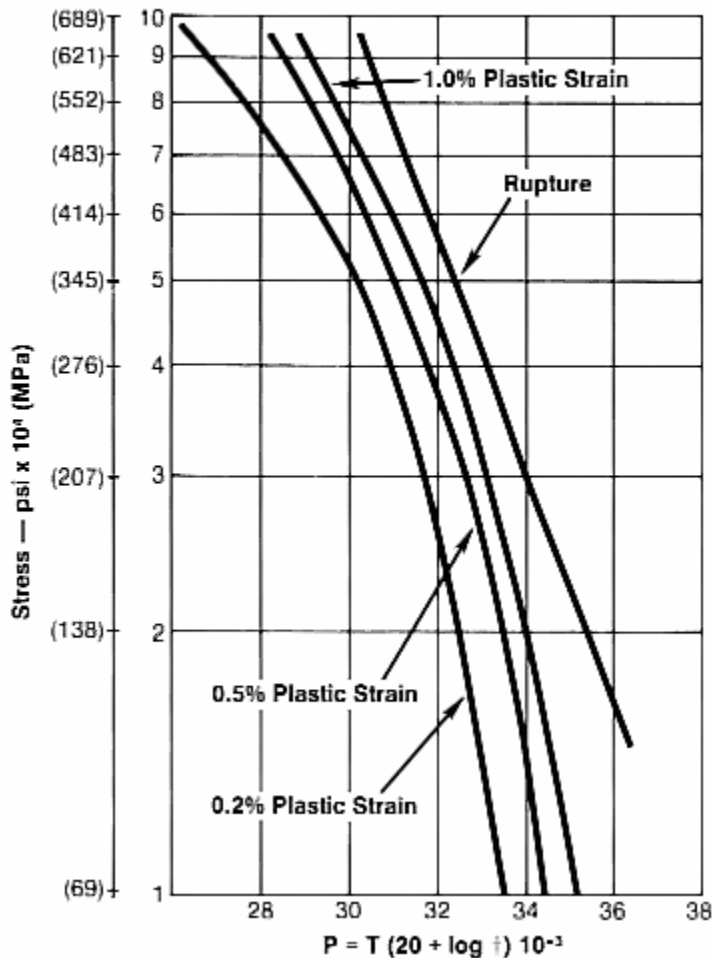
Creep Rupture Properties (Total Plastic Strain) — Pyromet Alloy 882

Air treated 1850°F (1010°C) 1 hour, tempered 1050°F (566°C) 1 hour and tested at 800°F (427°C), 900°F (482°C) and 1000°F (538°C).



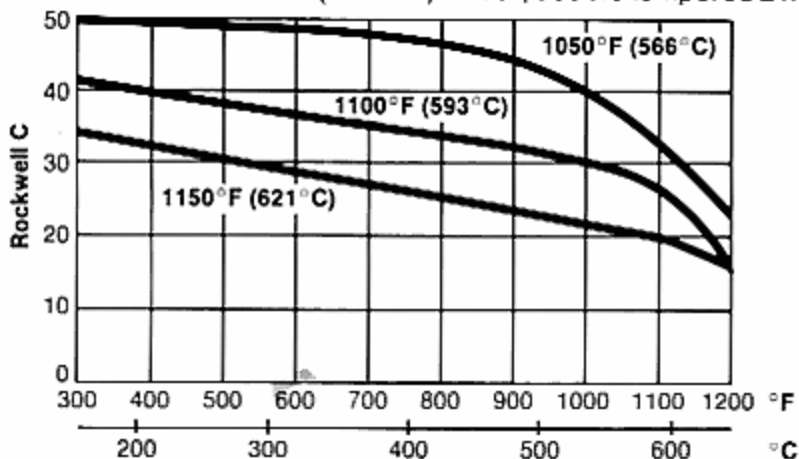
Creep Rupture Properties (Total Plastic Strain) — Pyromet Alloy 882

Air treated 1850°F (1010°C) 1 hour, tempered 1200°F (649°C) 1 hour and tested at 1000°F (538°C), 1100°F (593°C) and 1200°F (649°C).

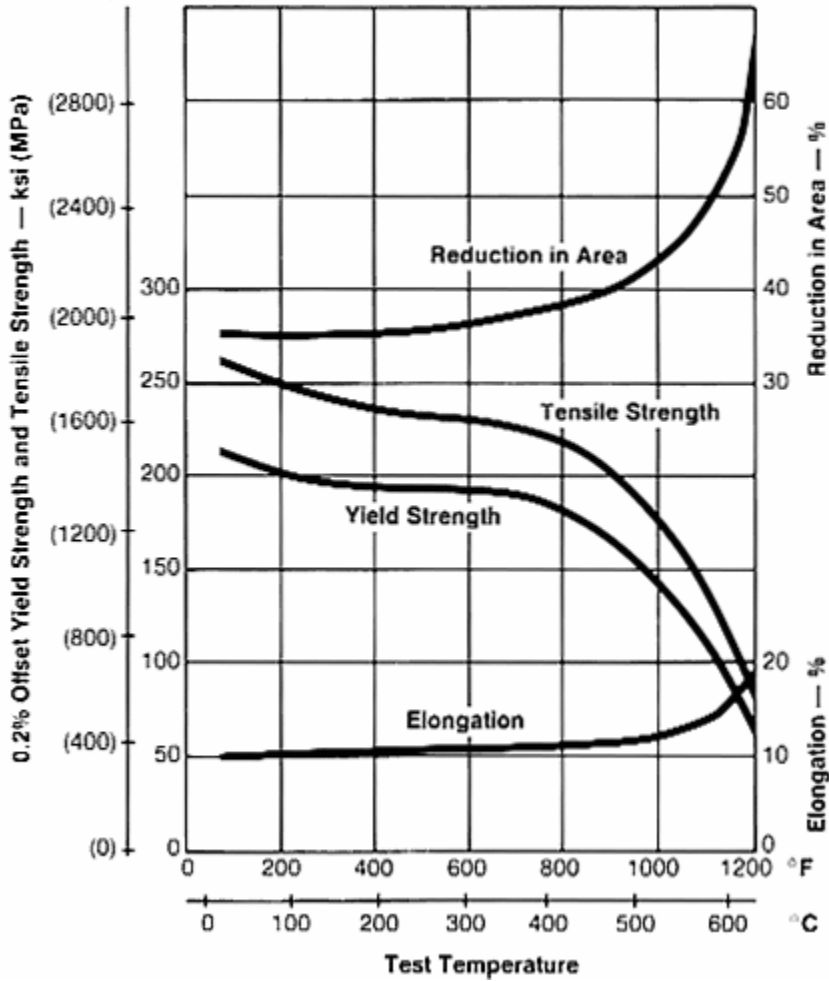


Elevated Temperature Hardness Properties — Pyromet Alloy 882

Air treated from 1850°F (1010°C) 1 hour, double tempered 2 hours at heat per temper.

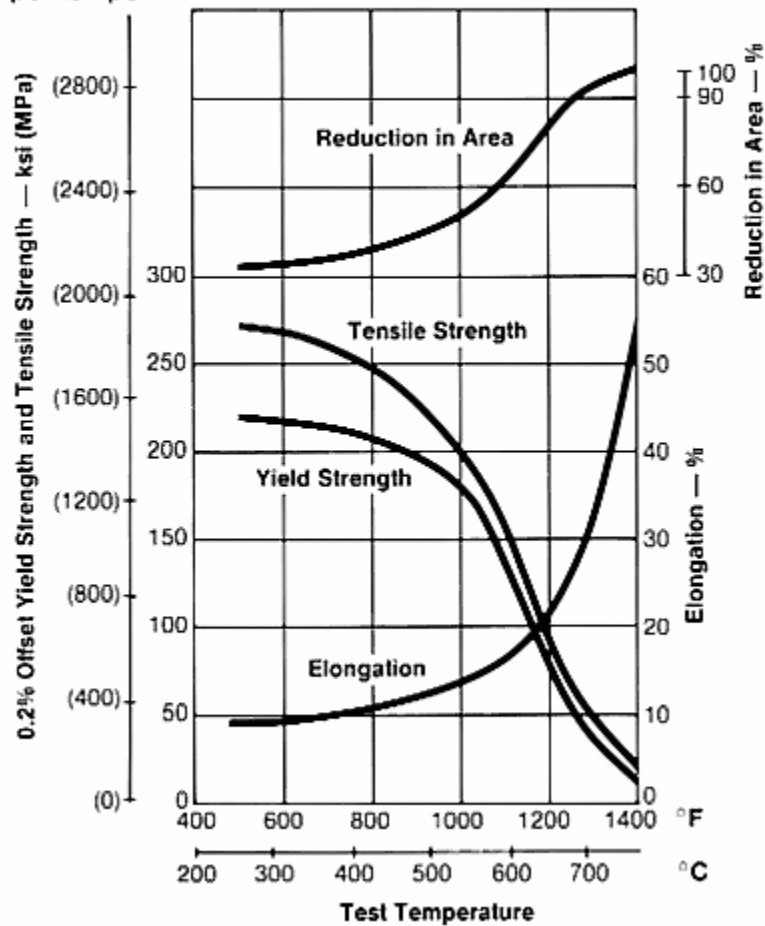


Longitudinal Elevated Temperature Tensile Properties — Pyromet Alloy 882
Air treated 1850°F (1010°C) 1 hour, double tempered 1000°F (538°C) 2 hours at heat per temper.



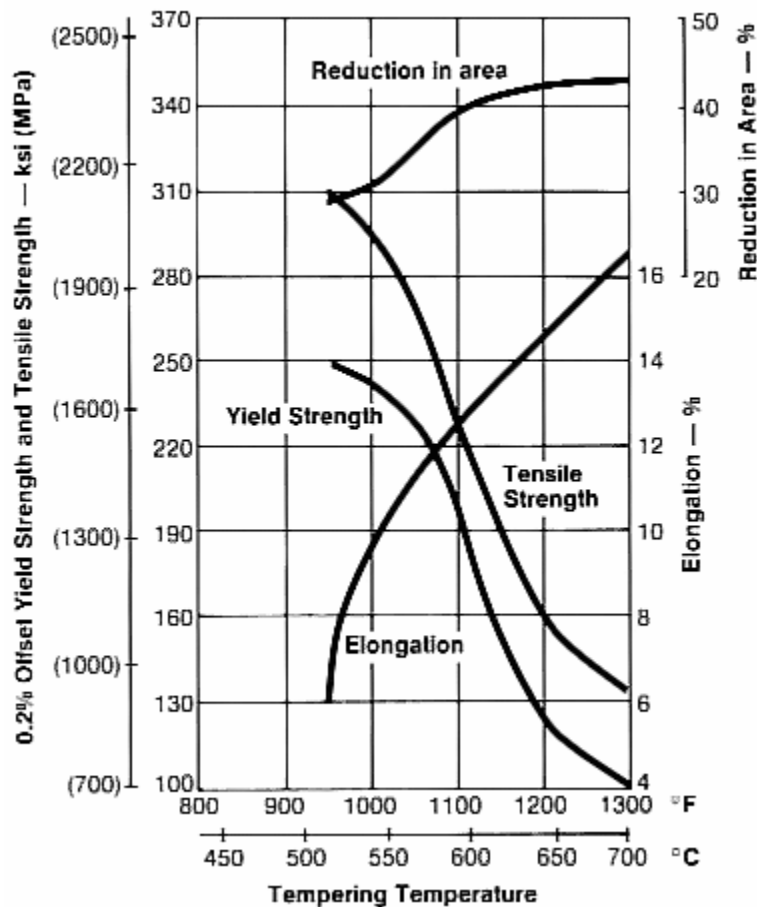
Longitudinal Elevated Temperature Tensile Properties — Pyromet Alloy 882

Air treated 1850°F (1010°C) 1 hour, double tempered 1050°F (566°C) 2 hours at heat per temper.



Longitudinal Room Temperature Tensile Properties — Pyromet Alloy 882

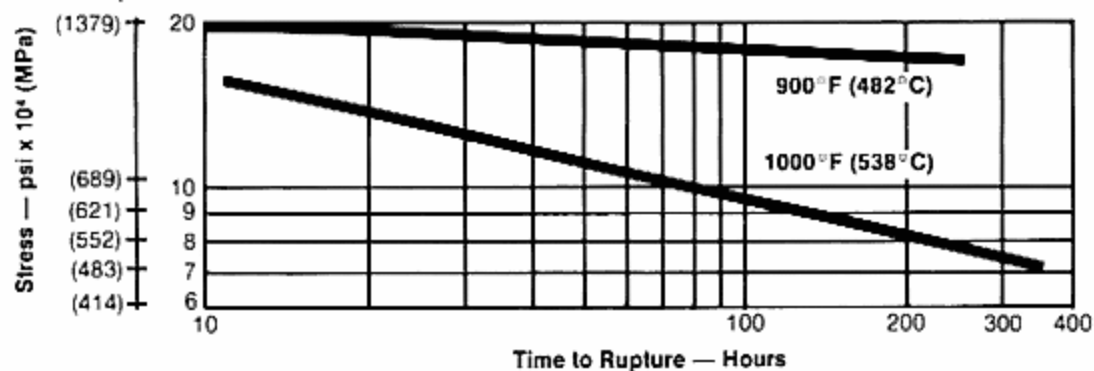
Air treated 1850°F (1010°C) 1 hour, double tempered 2 hours per temper.



Stress Rupture Properties — Pyromet Alloy 882

Air treated from 1850°F (1010°C), tempered 1 hour at 1050°F (566°C).

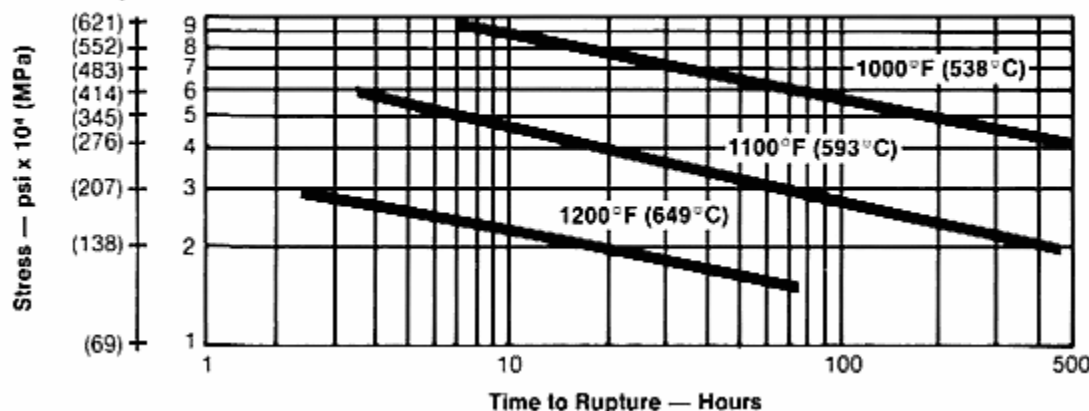
Test temperatures are as indicated in chart.



Stress Rupture Properties — Pyromet Alloy 882

Air treated from 1850°F (1010°C), tempered 1 hour at 1200°F (649°C).

Test temperatures are as indicated in chart.



Longitudinal Elevated Temperature Tensile Properties — Pyromet Alloy 882

Testing Temperature		Ultimate Strength		Yield Strength 0.2% Offset		% Elongation in 2" (50.8 mm)	% Reduction in Area
°F	°C	ksi	MPa	ksi	MPa		
Air Treated From 1850°F (1010°C), 1 Hour							
Double Tempered (2+2 hours) at 1000°F (538°C)							
500	260	270	1862	220	1517	9.9	33.2
600	316	267.5	1844	216	1489	10.3	34.5
800	427	242	1669	209	1441	12.0	42.6
900	482	229	1579	198	1365	12.3	46.1
1000	538	215	1482	182	1255	13.7	48.2
1200	649	88	607	84.5	583	24.8	83.5
1300	704	46.5	321	36	248	32.9	95.2
1400	760	20.5	141	15	103	56.0	98.2
Air Treated From 1850°F (1010°C), 1 Hour							
Double Tempered (2+2 Hours) at 1050°F (566°C)							
70	21	262	1806	215	1482	9.8	35.4
300	149	246	1696	198	1365	10.1	36.1
500	260	233	1606	195	1344	10.2	35.8
600	316	231.5	1596	193	1331	10.3	36.0
650	343	229	1579	191	1317	10.5	36.9
800	427	217	1496	184	1269	11.4	38.8
900	482	206	1420	166	1145	12.2	39.3
1000	538	180	1241	141	972	12.2	41.3
1100	593	142	979	105	724	12.8	46.8
1200	649	85	586	64	441	19.0	66.6
Air Treated From 1850°F (1010°C), 1 Hour							
Double Tempered (2+2 Hours) at 1100°F (593°C)							
500	260	195	1344	164	1131	10.0	45.0
600	316	190	1310	160	1103	10.9	48.1
800	427	178	1227	146	1007	12.4	52.2
900	482	164	1131	131	903	13.5	56.0
1000	538	142	979	115	793	15.5	62.0

Longitudinal Room Temperature Tensile Properties — Pyromet Alloy 882

Air treated from 1850°F (1010°C) 1 hour, double tempered (2+2 hours) at indicated temperature.

Tempering Temperature		Ultimate Strength		Yield Strength 0.2% Offset		% Elongation in 2" (50.8 mm)	% Reduction in Area	Rockwell C Hardness
°F	°C	ksi	MPa	ksi	MPa			
950	510	308	2124	248	1710	5.9	29.5	56.5
1000	538	291	2006	243	1675	9.6	30.6	56.0
1050	566	269	1855	227	1565	11.0	34.5	52.0
1100	593	223	1538	192	1324	13.1	39.3	45.0
1200	649	154	1062	124	855	14.1	41.2	33.0
1300	704	136	938	101	696	16.4	42.2	29.0

Longitudinal Room Temperature Tensile Properties — Pyromet Alloy 882

As annealed

Ultimate Strength		Yield Strength 0.2% Offset		% Elongation in 2" (50.8 mm)	% Reduction in Area	Rockwell B Hardness	BHN
ksi	MPa	ksi	MPa				
102	703	66	455	28.3	58.8	93.0	197

Longitudinal Room Temperature Tensile Properties After Exposure to Elevated Temperature — Pyromet Alloy 882

Air treated from 1850°F (1010°C) 1 hour, double tempered (2+2 hours) at indicated temperature.

Tempering Temperature		Exposure			Ultimate Strength		Yield Strength 0.2% Offset		% Elongation in 2" (50.8 mm)	% Reduction in Area
		Temperature		Time Hours						
°F	°C	°F	°C		ksi	MPa	ksi	MPa		
1000	538	950	510	100	260	1793	255	1758	11.5	42.8
1050	566	1000	538	10	239	1648	204	1407	12.4	49.9
1050	566	1000	538	100	210	1448	188	1296	13.7	52.9
1050	566	{ 1000 1100	{ 538 593	{ 100 + 10 }	181	1248	149	1027	15.9	57.5
1100	593	1000	538	10	201	1386	173	1193	14.1	52.4
1100	593	1000	538	100	189	1303	160	1103	15.2	58.2
1100	593	{ 1000 1100	{ 538 593	{ 100 + 10 }	167	1151	133	917	18.5	60.1

Longitudinal V-Notch Charpy Impact Properties — Pyromet Alloy 882

Air treated 1850°F (1010°C) 1 hour, double tempered 2 hours per temper.

Test performed at room temperature.

Tempering Temperature		Impact Energy	
°F	°C	ft-lb	J
950	510	10.0	14
1000	538	15.5	21
1050	566	19.5	26
1100	593	23.0	31
1200	649	29.5	40
1300	704	66.8	91

Longitudinal V-Notch Charpy Impact Properties at Elevated Temperatures — Pyromet Alloy 882

Air treated 1850°F (1010°C) 1 hour, double tempered (2+2 hours) and tested at indicated temperatures.

Tempering Temperature		Testing Temperature																					
		-100°F (-73°C)		300°F (149°C)		400°F (204°C)		500°F (260°C)		600°F (316°C)		650°F (343°C)		800°F (427°C)		900°F (482°C)		1000°F (538°C)		1100°F (593°C)		1200°F (649°C)	
°F	°C	R-lb	J	R-lb	J	R-lb	J	R-lb	J	R-lb	J	R-lb	J	R-lb	J	R-lb	J	R-lb	J	R-lb	J	R-lb	J
1050	566	15.0	20	21.7	29	24.0	33	30.4	41	31.5	43	32.0	43	29.5	40	29.3	40	30.5	41	33.2	45	59.0	80
1100	593	—	—	25.0	34	—	—	33	45	—	—	—	—	30	41	—	—	—	—	—	—	—	—
1150	621	—	—	41	56	—	—	48	65	—	—	—	—	53	72	—	—	—	—	—	—	—	—
1200	649	—	—	49	66	—	—	56	76	—	—	—	—	60	81	—	—	—	—	—	—	—	—

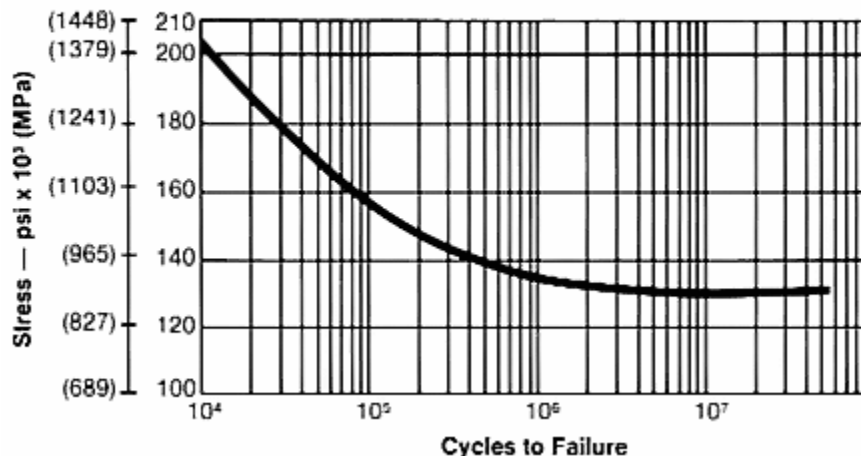
Room Temperature Notch Tensile Properties — Pyromet Alloy 882

Air treated from 1850°F (1010°C) 1 hour, double tempered (2+2 hours) at indicated temperature. Data obtained with a 60°, 50% type notch with a 0.010" (0.25 mm) root radius.

Sample Size		Position	Tempering Temperature		Notch Strength		Notch/Ultimate Strength Ratio
in. sq.	mm sq.		°F	°C	ksi	MPa	
5	127	Midradius	1050	566	358	2468	1.30
5	127	Center	1050	566	308	2124	1.15

S-N Curve — Pyromet Alloy 882

Air treated from 1850°F (1010°C) 1 hour, double tempered 1050°F (566°C) 2 hours at heat per temper.



Stress Rupture Properties — Pyromet Alloy 882

Testing Temperature		Stress		% Elongation	% Reduction of Area	Rupture Life Hours
°F	°C	ksi	MPa			
Air Treated 1850°F (1010°C), Tempered 1 Hour at 1050°F (566°C)						
900	482	200	1379	9.9	33.7	10.4
900	482	170	1172	5.7	33.7	257.3
1000	538	155	1069	9.9	20.9	11.1
1000	538	110	758	12.4	24.9	58.0
1000	538	75	517	13.3	30.3	254.0
1000	538	70	483	17.3	35.4	318.0
Air Treated 1850°F (1010°C), Tempered 1 Hour at 1200°F (649°C)						
1000	538	95	655	24.5	32.3	6.9
1000	538	70	483	25.4	46.7	31.4
1000	538	40	276	31.3	68.7	435.4
1100	593	60	414	25.7	60.4	3.3
1100	593	30	207	49.3	64.6	73.1
1100	593	20	138	55.2	71.3	444.3
1200	649	30	207	28.1	75.0	2.3
1200	649	15	103	69.9	84.8	70.5

Transverse V-Notch Charpy Impact Properties — Pyromet Alloy 882

Air treated from 1850°F (1010°C) 1 hour, double tempered (2+2 hours) at 1050°F (566°C). Test performed at 70°F (21°C).

Position	Impact Energy	
	ft-lb	J
Midradius	9.5	13
Center	6.9	9

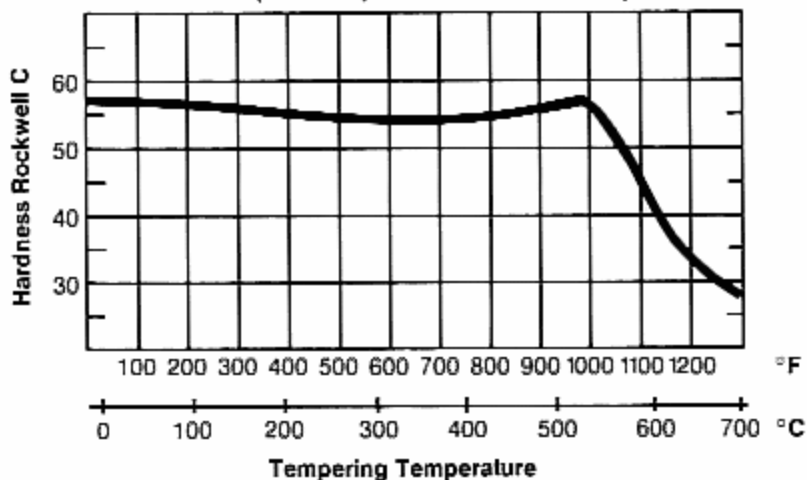
Heat Treatment

Tempering Characteristics — Pyromet Alloy 882

Austenitizing Temperature (1 Hour at Heat)		Tempering Temperature (2 + 2 Hours at Heat)		Rockwell C Hardness
°F	°C	°F	°C	
1800	982	700	371	55.5
1800	982	1000	538	56.0
1800	982	1025	552	54.0
1800	982	1050	566	52.5
1850	1010	As hardened		57
1850	1010	300	149	56
1850	1010	400	204	55.5
1850	1010	500	260	55
1850	1010	600	316	54.5
1850	1010	700	371	54.5
1850	1010	800	427	55
1850	1010	900	482	56
1850	1010	950	510	56.5
1850	1010	975	524	57
1850	1010	1000	538	56.0
1850	1010	1025	552	54.5
1850	1010	1050	566	52.0
1850	1010	1100	593	45.0
1850	1010	1200	649	33.0
1850	1010	1300	704	29.0
1900	1038	700	371	52.0
1900	1038	1000	538	56.0
1900	1038	1025	552	53.0
1900	1038	1050	566	51.5

Tempering Temperature vs. Hardness — Pyromet Alloy 882

Air treated 1850°F (1010°C) 1 hour, double tempered 2 hours per temper.



Other Information

Applicable Specifications

- AMS 6437 (Strip)
- AMS 6487
- ASTM A681
- AMS 6485
- AMS 6488

Forms Manufactured

- | | |
|--------------|----------|
| • Bar-Rounds | • Billet |
| • Strip | • Wire |
-

Technical Articles

- [Alloy Selection for Cold Forming \(Part I\)](#)
 - [Alloy Selection for Cold Forming \(Part II\)](#)
 - [New Stainless for Fasteners Combines Corrosion Resistance, High Hardness and Cold Formability](#)
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