

# HAYNES<sup>®</sup> 282<sup>®</sup> alloy

## Heat Treatment and Fabrication

### Heat Treatment

Wrought HAYNES<sup>®</sup> 282<sup>®</sup> alloy is furnished in the solution annealed condition unless otherwise specified. After component fabrication, the alloy would normally again be solution annealed at 2050 to 2100°F (1121 to 1149°C) for a time commensurate with section thickness and rapidly cooled or water-quenched for optimal properties. Following solution annealing, the alloy is given a two-step age-hardening treatment to optimize the microstructure and induce age-hardening. The first step is 1850°F (1010°C) for 2 hours followed by rapid or air cooling. The second step is 1450°F (788°C) for 8 hours followed by air cooling.

### Hot and Cold Working

HAYNES<sup>®</sup> 282<sup>®</sup> alloy has excellent forming characteristics. It may be hot-worked at temperatures in the range of about 1750-2150°F (955-1177°C) provided the entire piece is soaked for a time sufficient to bring it uniformly to temperature. Initial breakdown is normally performed at the higher end of the range, while finishing is usually done at the lower temperatures to afford grain refinement.

As a consequence of its good ductility, 282<sup>®</sup> alloy is also readily formed by cold-working. Intermediate annealing may be performed at 2050 to 2100°F (1121 to 1149°C) for a time commensurate with section thickness and rapidly cooled or water-quenched, to ensure maximum formability. All hot- or cold-worked parts should normally be annealed prior to age-hardening (as described in the "Heat Treatment" section) in order to develop the best balance of properties.

### Cold Forming Characteristics

Average Room-Temperature Hardness and Tensile Properties of Solution Annealed HAYNES<sup>®</sup> 282<sup>®</sup> alloy

Form	Hardness	0.2% Yield Strength		Ultimate Tensile Strength		Elongation	Reduction of Area
		ksi	MPa	ksi	MPa		
-	HRB					%	%
Sheet	90	56	384	122	839	59	-
Plate	93	56	384	120	830	60	61
Bar	86	51	348	118	816	62	69

Hardness vs. Cold Work (Sheet)

Alloy	0%	10%	20%	30%	40%	50%
<b>282<sup>®</sup></b>	<b>93 HRB</b>	<b>26 HRC</b>	<b>33 HRC</b>	<b>38 HRC</b>	<b>41 HRC</b>	<b>43 HRC</b>
<b>R-41</b>	96 HRB	30 HRC	36 HRC	39 HRC	41 HRC	42 HRC
<b>Waspaloy</b>	94 HRB	26 HRC	32 HRC	37 HRC	39 HRC	41 HRC
<b>263</b>	89 HRB	19 HRC	27 HRC	33 HRC	37 HRC	39 HRC
<b>625</b>	97 HRB	32 HRC	37 HRC	40 HRC	42 HRC	45 HRC

Effect of Cold Reduction on Room-Temperature Tensile Properties\*

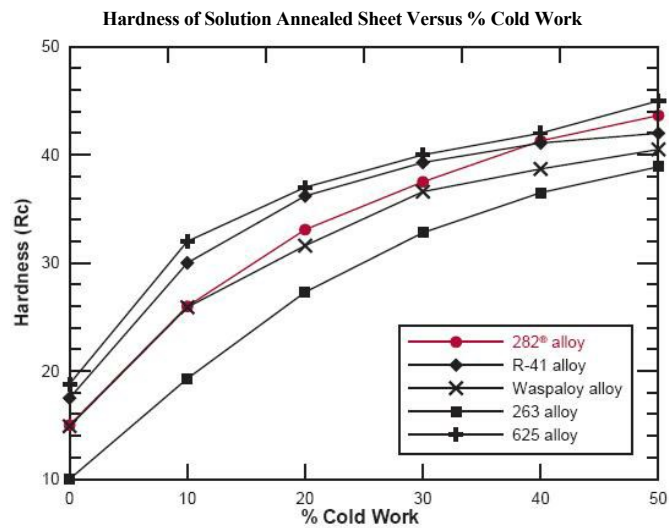
Cold Reduction	0.2% Yield Strength		Ultimate Tensile Strength		Elongation
	ksi	MPa	ksi	MPa	
%					%
0	55.5	383	121.0	834	58.0
10	87.8	605	131.8	909	46.7
20	114.5	790	144.9	999	31.5

30	139.7	963	165.4	1141	15.5
40	158.5	1093	184.2	1270	8.9
50	174.7	1204	200.4	1382	6.6
60	190.4	1312	215.4	1485	5.6

\*Based upon rolling reductions taken upon a solution annealed 0.125" (3.2 mm) thick sheet

HRB = Hardness Rockwell "B".

HRC = Hardness Rockwell "C".



## Machining

HAYNES<sup>®</sup> 282<sup>®</sup> alloy has similar machining characteristics to other nickel alloys used at high temperatures. Rough machining should be carried out prior to age-hardening. Final machining or finish grinding may be done after age-hardening. [Machining guidelines](#) can be found in the Welding and Fabrication section of this website. If further information is required, please contact the technical support group at Haynes International