HAYNES® 282® alloy

Welding

As a result of its high resistance to strain-age cracking, HAYNES® 282® alloy is much more weldable than other alloys of similar strength. The preferred welding processes are gas tungsten arc (GTAW or TIG) and gas metal arc (GMAW or MIG), using 282 alloy bare filler wire. If shielded metal arc welding (SMAW) of HAYNES® 282® alloy is necessary, please contact the technical support group at Haynes International for information on the most appropriate coated electrode. Submerged arc welding (SAW) of HAYNES® 282® alloy is not recommended due to the high heat input and increased weld restraint associated with this process.

Filler Metal Selection

It is recommended that bare, filler metal of a matching composition be used to join HAYNES 282 alloy to itself, using either the GTAW or GMAW process. HAYNES® 282® alloy filler metal can also be used for dissimilar joining, and/or repair welding, of other age-hardenable, nickel superalloys. Please click here or see the Haynes Welding SmartGuide for more information.

Base Metal Preparation

HAYNES® 282® alloy should be welded in the solution-annealed condition, before it is subjected to the age-hardening treatment. The joint surface and adjacent areas should be thoroughly cleaned, to reveal bright, metallic surfaces, before welding. All grease, oil, crayon marks, sulfur compounds, and other foreign matter should be removed.

Preheating, Interpass Temperatures, and Postweld Heat Treatment

Preheating of HAYNES® 282® alloy is not required, as long as the base metal to be welded is above 32°F (0°C). Interpass temperatures should be less than 200°F (93°C). Auxiliary cooling methods may be used between weld passes, provided that these do not introduce contaminants.

After welding, HAYNES® 282® alloy will normally be subjected to its age-hardening treatment, which comprises 2 hours at 1850°F (1010°C), air cool + 8 hours at 1450°F (788°C), air cool. The heat up rate to 1850°F should be as fast as possible, within the capability of the furnace being used.

The use of a full solution anneal (typically at 2075°F/1135°C) after welding and prior to the two step age-hardening treatment is neither required nor prohibited. For heavy section weldments, or complex weldments with high residual stress, a full solution anneal prior to the age-hardening treatment may be advisable.

NOTE: For information regarding ASME Advanced – Ultra Super Critical (A-USC) applications, please contact Vinay Deodeshmukh (765-456-6212; VDeodeshmukh@haynesintl.com).

Nominal Welding Parameters* (Sheet)

These are provided as a guide for performing typical operations and are based upon the welding conditions used in the laboratories of Haynes International. For further information, please contact the technical support group.

Manual Gas Tungsten Arc Welding V-Groove or U-Groove – All thicknesses 0.125” (3.2 mm) or greater	
Technique	Stringer Bead

Current (DCEN), amperes	150-250
Voltage, volts	11-14
Filler Metal	0.125” (3.2 mm) diameter 282®alloy
Travel Speed, in/min (mm/min	4-6 (102-152)
Electrode Size – EWTH-2, in (mm)	0.125” (3.2 mm) diameter
Electrode Shape	30° included
Cup Size	#8 or larger
Gas Type	Argon
Shielding Gas Flow, CFH (l/min)	30-35 (14.2-16.5)
Backing Gas Flow, CFH (l/min)	10 (4.7) for root pass
Preheat	Ambient
Maximum Interpass Temperature, °F (°C)	200 (93)

Automatic Gas Tungsten Arc Welding Square Butt Joint – No filler metal added – Material thickness 0.125” (3.2 mm)	
Current (DCEN), amperes	275
Voltage, volts	9.5
Travel Speed, in/min (mm/min)	12 (305)
Electrode Size – EWTH-2, in (mm)	0.125 (3.2) diameter
Electrode Shape	45° included
Cup Size	#8
Shielding Gas Flow, CFH (l/min)	30 (14.2)
Shielding Gas Type	Argon
Backing Gas Flow, CFH (l/min)	10 (4.7)
Backing Gas Type	Argon

Gas Metal Arc Welding Synergic Mode – All thicknesses 0.09” (2.3 mm) or greater	
Wire Type	HAYNES®282®alloy
Wire Diameter, in (mm)	0.045 (1.1)
Feed Speed, ipm (m/min)	170-190 (4.3-4.8)
Current (DCEP), amperes	175
Voltage, volts	28-32
Stickout, in (mm)	0.5-0.75 (12.7-19.1)
Travel Speed, ipm (mm/min)	9-13 (230-330)
Torch Gas Flow, CFH (l/min)	40 (18.9)
Gas Type	75% Argon + 25% Helium

Mechanical Properties of HAYNES® 282® Welds

Welded Transverse Tensile Data* For 0.125" (3.2 mm) Sheet
0.125" (3.2 mm) Sheet Autogenously Welded, then with one Cover Pass
Cover Pass - .125" (3.2 mm) Diameter Wire

Condition	**Temperature**		**0.2% Yield Strength**		**Ultimate Tensile Strength**		**Fracture Location**	
-	**°F**	**°C**	**ksi**	**MPa**	**ksi**	**MPa**	**-**	
As Welded	RT	RT	64.7	446	125.4	865	Weld	Weld

As Welded/Aged**	RT	RT	106.3	733	168.2	1160	Base	Weld
As Welded/Solution Annealed**	RT	RT	66.9	461	126.8	874	Base	Base
As Welded/Solution Annealed**/Aged***	RT	RT	98.5	679	152.1	1049	Base	Base
	1000	538	83.7	577	132.0	910	Base	Base
	1200	649	86.1	594	135.1	932	Base	Weld
	1400	760	83.7	577	120.3	829	Base	Base
	1600	871	70.9	489	77.1	532	Base	Base
	1800	982	19.1	132	24.7	170	Base	Weld

RT = Room Temperature

GTAW Welded Transverse Tensile Data* For .5" (12.7 mm) Plate
0.5" (12.7 mm) Plate GTAW Welded
with .125" (3.2 mm) Diameter Wire

Condition	Temperature		0.2% Yield Strength		Ultimate Tensile Strength		Fracture Location	
-	°F	°C	ksi	MPa	ksi	MPa	-	
As Welded	RT	RT	75.9	523	130.8	902	Weld	Base
As Welded/Aged**	RT	RT	120.5	831	165.8	1143	Weld	Weld
As Welded/Solution Annealed**	RT	RT	77.2	532	139.5	962	Weld	Weld
As Welded/Solution Annealed**/Aged***	RT	RT	94.3	650	146.1	1007	Weld	Weld
	1000	538	85.4	589	134.3	926	Weld	Weld
	1200	649	86.6	597	137.0	945	Base	Base
	1400	760	85.3	588	125.7	867	Base	Base
	1600	871	71.9	496	83.4	575	Weld	Weld
	1800	982	20.1	139	26.3	181	Weld	Weld

GMAW Welded Transverse Tensile Data* For .5" (12.7 mm) Plate
0.5" (12.7 mm) Plate GMAW Welded
with 0.045" (1.1 mm) Diameter Wire

Condition	Temperature		0.2% Yield Strength		Ultimate Tensile Strength		Fracture Location	
-	°F	°C	ksi	MPa	ksi	MPa	-	
As Welded	RT	RT	77.9	537	130.4	899	Base	Base
As Welded/Aged**	RT	RT	117.5	810	162.4	1120	Weld	Weld
As Welded/Solution Annealed**	RT	RT	78.6	542	141.7	977	Base	Base
As Welded/Solution Annealed**/Aged***	RT	RT	94.4	651	155.8	1074	Base	Base
	1000	538	83.8	578	132.0	910	Weld	Weld
	1200	649	85.2	587	137.3	947	Weld	Weld
	1400	760	83.7	577	123.6	852	Base	Base
	1600	871	71.0	490	82.0	565	Weld	Weld
	1800	982	19.8	137	26.8	185	Weld	Weld

All Weld Metal Tensile Data*
0.5" (12.7 mm) Cruciform GMAW Welded
with 0.045" (1.1 mm) Diameter Wire

Condition	Temperature		0.2% Yield Strength		Ultimate Tensile Strength		Elongation	Reduction of Area
-	°F	°C	ksi	MPa	ksi	MPa	%	%
As Welded	RT	RT	85.0	586	124.7	860	40.0	43.8
As Welded/Aged**	RT	RT	105.4	727	151.6	1045	20.3	22.4
As Welded/Solution Annealed**	RT	RT	81.2	560	132.4	913	40.1	45.5
As Welded/Solution Annealed**/Aged***	RT	RT	100.9	696	149.3	1029	22.7	20.0

*Average of two tests

** 2075°F (1135°C)/30 min/AC

***1850°F (1010°C)/2 h/AC + 1450°F (788°C)/8 h/AC

Comparative Creep-Rupture Properties of Weld Metal to Base Metal

Temperature		Stress		Material	Time to 1% Creep	Time to Rupture
°F	°C	ksi	MPa	-	h	h
1400	760	50	345	Base Metal*	96.8	237.5
				All Weld Metal**	197.0	364.8
1700	927	7	48	Base Metal*	335.6	792.3
				All Weld Metal**	648.0	950.5

*Annealed + Age-Hardened **GMAW Welded + Annealed + Age-Hardened