HAYNES® HR-160® alloy

Welding

HAYNES® HR-160® alloy is readily weldable by Gas Tungsten Arc (TIG) and Gas Metal Arc (MIG) welding processes. Many of the alloy's welding characteristics are similar to those for the HASTELLOY® alloys and the same precautions apply. Submerged arc welding is not recommended as this process is characterized by high heat input which could result in distortion and hot cracking. HR-160® filler metal is prone to start/stop cracking. The filler metal may be prone to hot cracking when welding heavy plate (e.g. greater than 1/2 inch thick) under highly restrained conditions. Any localized cracking should be removed by grinding prior to further welding. Do not attempt to remelt or "wash-out" welding cracks.

Base Metal Preperation

The joint surface and adjacent area should be thoroughly cleaned before welding. All grease, oil, crayon marks, sulfur compounds and other foreign matter should be removed. It is preferable, but not mandatory, that the alloy be in the solution-annealed condition when welded.

Filler Metal Selection

Matching composition filler metal is recommended for joining HR-160® alloy. When dissimilar base metals are to be jointed, such as HR-160® alloy to a stainless steel, HAYNES 556® filler metal is recommended. Please click here or see the Haynes Welding SmartGuide for more information.

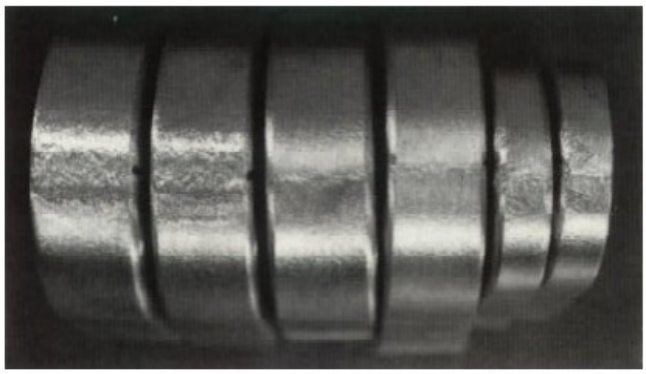
Preheating, Interpass Temperatures and Postweld Heat Treatment

Preheat should not be used so 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, as needed, providing that such methods do not introduce contaminants. Postweld heat treatment is not normally required for HR-160® alloy.

Nominal Welding Parameters

Nominal welding parameters are provided as a guide for performing typical operations. These are based on welding conditions used in our laboratory and should be considered only as a guideline. For further information, please click here.

Large Welded retort fabricated from 0.375 inch (9.5 mm) HR-160® plate



Typical face, root and side bends for HR-160 alloy. The plate thickness was 0.5 inch (12.7 mm) and the bend radius 1.0 inch (25 mm) (2T radius)

AWM Tensile

Type	Test Temperature		Ultimate Tensile Strength		0.2% Yield Strength		Elongation
	°F	°C	ksi	MPa	ksi	MPa	%
GMAW	RT	RT	94.1	649	58.0	400	26.4
	500	260	81.9	565	45.8	316	25.2
	1000	538	71.3	492	42.8	295	32.4
	1400	760	43.2	298	33.7	232	29.6
	1600	871	22.7	157	17.6	121	33.3
GTAW	RT	RT	101.3	698	68.5	472	26.4
	500	260	81.7	563	47.2	325	32.1
	1000	538	70.4	485	42.8	295	43.7
	1400	760	46.3	319	34.4	237	30.0
	1600	871	22.6	156	18.1	125	72.2

All-Weld Metal samples
RT= Room Temperature

Welded Transverse Tensile

Condition	Test Temperature		Ultimate Tensile Strength		0.2% Yield Strength		Elongation
	°F	°C	ksi	MPa	ksi	MPa	%
As-Welded	RT	RT	102.3	705	60.1	414	30.6
	500	260	82.9	572	49.5	341	32.0
	1000	538	75.3	519	47.1	325	39.5
	1400	760	45.4	313	31.3	216	26.3
	1600	871	23.6	163	18.6	128	33.9
Aged*	RT	RT	98.7	680	52.8	364	18.1

GTAW welded transverse tensile samples

*Samples aged at 1600°F (871°C) for 1000 hours

RT= Room Temperature

Welded Creep Rupture

Test Temperature		Stress		1% Creep Life	5% Creep Life	Rupture Life	Elongation
°F	°C	ksi	MPa	h	h	h	%
1200	649	30.0	207	12.9	67.0	110.7	13.7
1400	760	18.0	124	5.0	13.1	29.2	22.0
1600	871	11.5	79	49.0	67.5	114.6	26.9
1700	927	6.0	41	61.0	94.0	152.4	33.9